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# *An empirical study on behavioural intention to reuse e-learning systems in rural China*

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**Abstract**
The learner's acceptance of e-learning systems has received extensive attention in prior studies, but how their experience of using e-learning systems impacts on their behavioural intention to reuse those systems has attracted limited research. As the applications of e-learning are still gaining momentum in developing countries, such as China, it is necessary to examine the relationships between e-learners' experience and perceptions and their behavioural intention to reuse, because it is argued that system reuse is an important indicator of the system's success. Therefore, a better understanding of the multiple factors affecting the e-learner's intention to reuse could help e-learning system researchers and providers to develop more effective and acceptable e-learning systems. Underpinned by the information system success model, technology acceptance model and self-efficacy theory, a theoretical framework was developed to investigate the learner's behavioural intention to reuse e-learning systems. A total of 280 e-learners were surveyed to validate the measurements and proposed research model. The results demonstrated that e-learning service quality, course quality, perceived usefulness, perceived ease of use and self-efficacy had direct effects on users' behavioural intention to reuse. System functionality and system response have an indirect effect, but system interactivity had no significant effect. Furthermore, self-efficacy affected perceived ease of use that positively influenced perceived usefulness.

## Introduction

The development of information and communication technologies (ICTs) has provided significant opportunities for education suppliers to explore and develop new ways of delivering educational programmes. As a result, e-learning has become an emerging phenomenon in revolutionising processes and environments in which teaching and learning can take place. Compared with classroom-based teaching and learning, e-learning has received considerable attention because of its flexibility, low cost and convenience. These characteristics make it a potentially attractive option for rural users. According to the National Bureau of Statistics of China (NBS), the rural population accounted for 54% of the total population in 2008. Because of the backwardness of rural economic development and inadequate financial resources, the improvement of rural education has been seriously restricted (NBS, 2008). The statistical data showed that 9.5% of rural labourers were illiterate; 86.2% are educated up to the junior high school level, which is the end

**Practitioner Notes**

What is already known about this topic

- Internet has provided great opportunities for continuous education through e-learning in rural areas of China.
- Many factors affect initial e-learning adoption.
- Limited attentions have been paid to examine the relationships between e-learners' experience and perceptions and their behavioural intention to reuse e-learning systems, which is an important indicator of the system's success.

What this paper adds

- A first attempt to study how e-learners' experience and perceptions affect their intention to reuse e-learning systems in the context of rural education in China.
- Proposed and validated a hybrid model underpinned by information systems success model, technology acceptance model and self-efficacy theory.
- An effective model to explain the relationships between contributing factors and their effect on behavioural intention of users to reuse an e-learning system.
- Identified key factors and the extent of their impact on e-learning system reuse that will enable e-learning providers to be more focused with their effort and work more effectively on future improvement.

Implications for practice and/or policy

- It is essential for system designers to use appropriate system features and functions that can effectively facilitate the teaching and learning processes and outcomes.
- As the course quality significantly affects the learner's intention to reuse an e-learning system, pedagogical principles, including principles of developing and structuring the course content, should be employed in the development and evaluation of relevant curriculum. E-learning content developed for learners in rural areas of China must be practical and relevant to learners' personal development goals and work requirements, so the learners can benefit from the learning outcomes and improve their work performance eventually.
- A perfectly designed e-learning system will only work well with appropriate e-learning service. Human interaction as an important part of services must not be underestimated and eliminated.
- As perceived ease of use has a strong impact on e-learning success, e-learning providers in China must consider the low education level of people living in rural areas and take effective measures to improve the ease of use.

of the 9-year compulsory education in China; and only 4.3% received an education at high school level or above (NBS, 2008). The low education level of the rural population seriously hinders the development of the rural economy. Therefore, continuous education plays an important role in improving the knowledge and skills of people living in rural areas. The rapid development of Internet technologies has provided opportunities for people to participate in adult continuous study through e-learning, because e-learning offers affordable, new educational opportunities that were not available before.

With continuous public investment in Internet infrastructure in China, the Internet coverage has been extended to many rural areas, especially in more developed regions. The China Internet Network Information Center (CNNIC, 2009) reported that rural Internet users had increased to

84.6 million at a rate of 60% in 2008. E-learning has been considered as an efficient solution for expanding adult education and vocational training in rural areas (Ministry of Agriculture, 2005). Although the applications of e-learning have been enhanced by the government promotion programs and the rapid penetration of the Internet into the rural regions, only 1.6% of a 700-million strong rural population registered in e-learning programs in 2009, despite the fact that many higher education institutions offer e-learning curriculum and training course in rural areas (CNNIC, 2010).

According to a survey of 150 e-learning courses by Guo and Yuan (2009), there was a lack of andragogy in developing e-learning materials. Lang (2006) and Guo (2006) indicated that system service and system design were factors that could impact system usage and student motivation. This limited research on e-learning implementation in China has shed light on some of the potential problems and challenges. To overcome these challenges and promote wider applications of e-learning systems, it is imperative to understand the factors affecting e-learning success. Although e-learning research has attracted much attention over the last decade, it can be characterised by a diversity of studies in a wide range of contexts using a variety of variables and models (McGill & Klobas, 2009). As e-learning system success is a multifaceted outcome and can be highly contextual, it is difficult to decide what findings and outcomes reported in the literature are applicable in helping to understand the e-learning system success in our context of rural areas of China.

It is argued in this paper that the behavioural "intention to reuse" can be an appropriate indicator for understanding the success of the e-learning system. Therefore, this study aims to examine how e-learners' experience and perceptions in using existing e-learning systems in the rural areas of China affect their behavioural intention to reuse by developing and empirically validating an integrated theoretical framework based on the technology acceptance model (TAM), information system (IS) success model and self-efficacy theory.

## Theoretical background and research model

e-learning system research has been well reported in the literature. McGill and Klobas (2009) provide a comprehensive analysis on e-learning success research and acknowledge that one of the major foci has been the adoption and continuance of use. Many factors may contribute to e-learning system adoption, use and behavioural intention to reuse, so a number of theories have been used or adapted to examine the main factors affecting e-learning system success. TAM is one of the most popular models used. In addition to TAM, the IS success model and self-efficacy theory have also been used or adapted in research on information technology (IT) acceptance, usage and success; each of these approaches has its own strengths and limitations as discussed in the following section. Limited attempts have been reported in developing and validating modified or extended theoretical models in the context of e-learning in China, but the explanatory power of the models tested are low (eg, Duan, Feng & Fu, 2010; van Raaij & Schepers, 2008). It is argued that intention to reuse e-learning systems, which is regarded as an effective measure for system success, can be affected by multiple key factors pertinent to the technology, users and application context. Therefore, a comprehensive framework can be developed to provide a holistic view of factors affecting the intention to reuse. Based on TAM, IS success model and self-efficacy theory, an integrated hybrid research model was proposed and its related constructs were established. This research model was used to inform the development of research hypotheses and the survey design. The following sections explain the relevant theories incorporated in the proposed hybrid model.

### *IS success model*

Based on a thorough and systematic analysis of research publications, DeLone and McLean (2003) developed an IS success model as shown in Figure 1. The model identified six interrelated

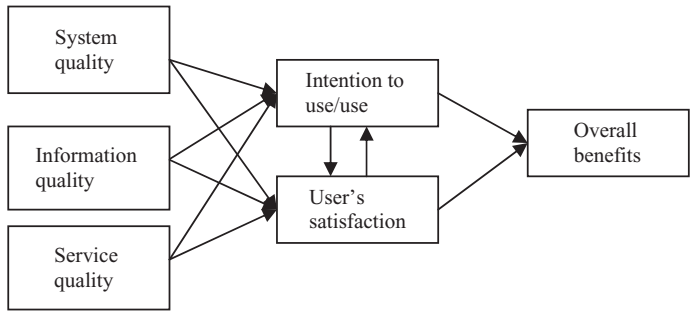


*Figure 1: Information system success model (DeLone and McLean, 2003)*

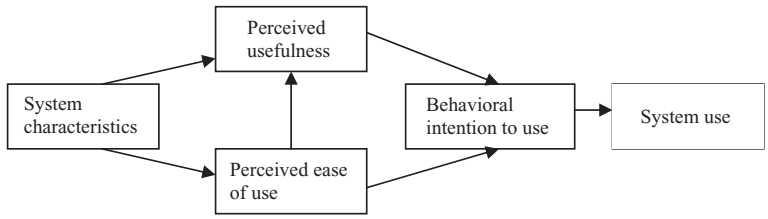


*Figure 2: Technology acceptance model (Davis & Venkatesh, 1996)*

dimensions of IS success that can be measured by system quality, information quality, service quality, intention to system use/re-use, user's satisfaction and net benefits. System quality is defined as the desirable characteristics of an IS, and information quality is defined as the desirable characteristics of the system output. Service quality is the quality of the support that system users receive from the IS department and IT support personnel. System use is defined as the degree of utilisation; intention to use is how likely it is the users intend to use the system; and net benefit is the extent to which the IS is contributing to the success of individuals, groups, organisations, industries and nations. According to DeLone and McLean, net benefits are the most important success measures as they capture the overall impact of the system in use. The six dimensions were proved to have temporal and causal interdependencies.

A number of research papers attempted to validate or apply the modified IS success model in various fields of IS studies (eg, Heo & Han, 2003; Wang, Wang & Shee, 2007). Although an e-learning system is the application of IS, limited attempts have been made to apply the IS success model in e-learning system research. For instance, only a few publications reported on the application of the IS success model in e-learning (eg, Lee & Lee, 2008; Wang *et al*, 2007).

*TAM*

Developed by Davis, Bagozzi and Warshaw (1989), TAM is generally referred to as the most influential and commonly employed theory in IS (Lau & Woods, 2008; Lee, Kozar & Larsen, 2003). According to TAM, perceived usefulness and perceived ease of use affect the user's intention to use and their actual use. In TAM, perceived usefulness is defined as the degree to which a person believes that using a particular system would enhance his/her job performance and perceived ease of use is the degree to which a person believes that using a particular system would be free of physical and mental effort. In 1996, Davis and Venkatesh modified the TAM and suggested that perceived usefulness and perceived ease of use had direct effects on the individual's intention to use the system (Figure 2). Intention to use was defined as the degree to which users intend to adopt the technology or to increase their usage. Meanwhile, the system characteristics

only have a mediating effect on the intention through perceived usefulness and perceived ease of use. Additionally, perceived ease of use directly impacts on the perceived usefulness.

A number of studies have applied TAM to examine the acceptance and effectiveness of e-learning system use (eg, Lau & Woods, 2008; Liao & Lu, 2008; Ong & Lai, 2006). In spite of its popularity and considerable empirical support, TAM has been criticised for parsimony (Hu, Hu, Clark & Ma, 2003). Attempts have been made to extend and integrate TAM with other models and theories, such as the hybrid models based on TAM and self-determined theory (Roca & Gagne, 2008), TAM and unified theory of acceptance and usage of technology model (van Raaij & Schepers, 2008), and TAM and theory of planned behaviour model (Liaw, Huang & Chen, 2007).

Although TAM is generally referred to as the most influential and commonly used theory in IS, it has also received criticisms and concern for its dominance in IS research. Benbasat and Barki (2007) point out that the intense focus on TAM has led to several problems, one of them is the diversion of researchers' attention away from other important phenomena. For example, TAM-based research paid limited attention to the system design and evaluation. Thus, Benbasat and Barki (2007) call for more innovative and comprehensive approaches to fully understand the factors affecting IS adoption and use.

*Self-efficacy theory*

With the rapid development and applications of ICTs, e-learning systems have evolved rapidly from simply delivering teaching materials to facilitating teaching and learning in a complex virtual environment. An increasing number of studies begin to examine the learner's cognition in an e-learning environment (eg, Hu *et al*, 2003; Ong & Lai, 2006). In fact, cognition theory has been adopted in many education studies. Developed by psychologist Bandura (1977), social cognition theory (SCT) is one of the main directions in examining the motivation of learning. Standing at the very core of SCT, self-efficacy is based on the belief in one's effectiveness in performing specific tasks. It was further elaborated that people may passively tend to avoid a difficult task if they find that the task exceeds their coping skills, but may actively engage in a task if they find themselves capable of performing the task.

In the e-learning context, self-efficacy is defined as "confidence in one's ability to perform certain learning tasks using an e-learning system" (Pituch & Lee, 2006). Self-efficacy has become commonly used by researchers for investigating the individual's e-learning behaviour. For instance, prior studies have identified that self-efficacy influenced both the intention to engage in e-learning and the subsequent performance (eg, Hu *et al*, 2003; Ong & Lai, 2006). In Lim's (2000) research, self-efficacy was found to be a good predictor of adult e-learner's satisfaction.

*The research model*

Having reviewed various influential theories and critique about limitations of TAM in capturing the full picture of multidimensional factors affecting a system adoption and use (eg, Benbasat & Barki, 2007), an integrated hybrid research model is proposed and shown in Figure 3. As intention to use is a common dimension in the TAM and IS success model, the proposed research model is developed to categorise the various factors influencing intention to use. Based on the related empirical study by Pituch and Lee (2006), this study measures the system characteristics with three constructs: system functionality, system response and system interactivity. As the system characteristics and system quality have similar measures, only the other three core dimensions in the IS success model, which are service quality, course quality and intention to use, were adopted in the research model. Self-efficacy was posited to have a direct influence on the behavioural intention to system reuse.

Based on the research model, 12 hypotheses were postulated for empirical validation. Table 1 shows the statements of 12 research hypotheses.

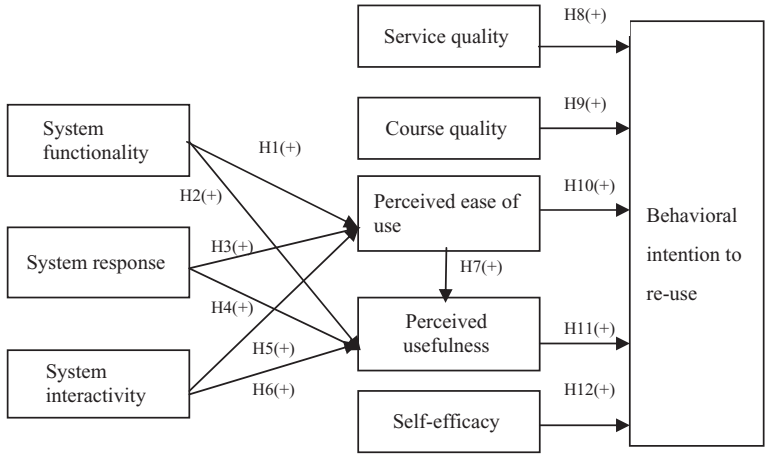


*Figure 3: Research model*

*Table 1: Research hypotheses*

| *Hypotheses* | *Statements* |
|---|---|
| H1(+) | System functionality (SF) will have a positive effect on perceived usefulness (PU). |
| H2(+) | SF will have a positive effect on perceived ease of use (PEOU). |
| H3(+) | System response (SR) will have a positive effect on PU. |
| H4(+) | SR will have a positive effect on PEOU. |
| H5(+) | System interactivity (SI) will have a positive effect on PU. |
| H6(+) | SI will have a positive effect on PEOU. |
| H7(+) | PEOU will have a positive effect on PU. |
| H8(+) | System service quality will have a positive effect on behavioural intention of reuse (BI). |
| H9(+) | System course quality will have a positive effect on BI. |
| H10(+) | PU will have a positive effect on BI. |
| H11(+) | PEOU will have a positive effect on BI. |
| H12(+) | Self-efficacy will have a positive effect on BI. |

## Research methodology

*Measurement instruments*

To measure the latent variables of the model, items were mainly adapted from validated instruments reported in the relevant studies. All items were reviewed by e-learning experts and researchers in the field. Items related to independent variables were modified and reviewed by experts to ensure their relevance to the e-learning system context of the present study.

As shown in Table 2, the survey instruments consisted of 32 items to evaluate nine constructs of the proposed model combining IS success model, TAM and self-efficacy theory. Systems service quality refers to the quality of the support that e-learning system users receive from the teaching staff and IT support personnel and was measured with four items adapted from DeLone and McLean (2003), Webster and Hackley (2003) and Thurmond *et al* (2002). Course quality refers to the quality of e-learning system outputs of learning resources. Three items for measuring course quality were adapted from prior studies by Saarinen (1996), Arbaugh (2000) and DeLone and McLean (2003). Self-efficacy is defined as the confidence in one's ability to perform certain learning tasks using an e-learning system by Pituch and Lee (2006). Three items for assessing self-efficacy were adapted from research by Joo, Bong and Choi (2000) and Liaw *et al* (2007).

*Table 2: Research constructs and related survey items*

| *Construct* | *Items* | *Statement* | *References* |
|---|---|---|---|
| System functionality | SF1 | The system can clearly present the course information in a readable format. | Pituch & Lee (2006); self-developed |
| | SF2 | The system provides multimedia types of course content. | |
| | SF3 | The system can provide the function use accurately. | |
| | SF4 | The system interface and design are complete and consistent. | |
| | SF5 | The linking among all the system Webs is efficient. | |
| System response | SR1 | The system response is fast. | Pituch & Lee (2006); self-developed |
| | SR2 | The speed of download and upload is consistent. | |
| | SR3 | In general, the system operation is stable. | |
| System interactivity | SI1 | The e-learning system enables communication among students. | Pituch & Lee (2006); self-developed |
| | SI2 | The e-learning system enables communication between students and teachers. | |
| | SI3 | The communication tools in the e-learning system are effective. | |
| System service quality | SS1 | The instruction and manuals have enhanced the learning efficiency. | DeLone & McLean (2003), Webster & Hackley (2003), Thurmond *et al* (2002) |
| | SS2 | I believe the staff in charge of e-learning are aware of my concerns. | |
| | SS3 | I find the communication and tutorials good between tutors and students. | |
| | SS4 | Tutors show a sincere interest in solving my problems. | |
| E-learning course quality | EC1 | e-Learning content provides abundant information and problem-solving techniques. | Saarinen (1996), Arbaugh (2000), DeLone & McLean (2003) |
| | EC2 | The lecture content is communicated with few errors. | |
| | EC3 | The methods of evaluation and assessment of the course are appropriate. | |
| Self-efficacy | SE1 | I could complete the learning if the computer and Internet facilities are provided. | Joo *et al* (2000), Liaw *et al* (2007) |
| | SE2 | I would feel confident to use the e-learning system even if I had never used it before. | |
| | SE3 | I feel confident to complete my learning activities using the e-learning system with the instruction and manuals for reference. | |
| Perceived ease of use | PEOU1 | I find it is easy to get the e-learning system to do what I want it to do. | Davis & Venkatesh (1996), Ngai *et al* (2007) |
| | PEOU2 | Learning to operate the e-learning system is easy for me. | |
| | PEOU3 | I believe the e-learning system is easy to use. | |
| Perceived usefulness | PU1 | Using the e-learning system allows me to accomplish learning tasks more quickly. | Davis & Venkatesh (1996), Ngai *et al* (2007) |
| | PU2 | Using the e-learning system enhances my effectiveness in learning. | |
| | PU3 | Using the e-learning system makes it easier to learn course content. | |
| | PU4 | Using the e-learning system increases my learning productivity. | |
| | PU5 | I believe the e-learning system to be useful in my learning. | |
| Behavioural intention to use | BI1 | Assuming that I had access to the e-learning system, I intend to reuse it. | Davis & Venkatesh (1996), Ngai *et al* (2007) |
| | BI2 | Given that I had access to the e-learning system, I predict that I would reuse it. | |
| | BI3 | I would reuse the e-learning system to assist my self-study. | |

System functionality, system interactivity and system response are variables associated with system characteristics in TAM, which may have indirect effects on behavioural intention to use. System functionality refers to "the perceived ability of an e-learning system to provide flexible access to instructional and assessment media" (Pituch & Lee, 2006, p. 225). According to the guidelines by Pituch and Lee (2006), it was measured by five items in our study, with one item removed in relation to the study context. Systems interactivity refers to "the interactions among students themselves, the interactions between faculty and students, and the collaboration in learning that results from these interactions" (Palloff & Pratt, (1999, p. 5). System response is defined by Pituch and Lee (2006, p. 225) as "the degree to which a learner perceives that the response from the e-learning system is fast, consistent, and reasonable." Following the recommendation of Pituch and Lee (2006), three items were adapted and modified to assess system interactivity and system response respectively.

Perceived usefulness, perceived ease of use and behavioural intention to system use are three main TAM variables developed by Davis and Venkatesh (1996). Perceived usefulness measures the reuser's perceptions on the e-learning system effectiveness of improving academic and job performance. Perceived ease of use in the e-learning context refers to the user's perception on ease of use of the system related to accomplishing the e-learning tasks. Behavioural intention to reuse is the dependent variable and is defined as the degree to which users intend to reuse the e-learning system or increase their use of it in the future. Five items for perceived usefulness, three items for perceived ease of use and three items for intention to system use were adopted from prior work by Davis and Venkatesh (1996) and Ngai, Poon and Chan (2007).

All items were measured by the respondent's level of agreements or disagreements with the statements on a 5-point Likert scale (from 1—*strongly disagree* to 5—*strongly agree*). Survey participants need to indicate their level of agreement or disagreement with the statements on the 5-point Likert scale. In addition to the model measurement items, the survey also collects information on the respondents' demographics.

*Sampling and survey procedures*

The sample for this study was part-time e-learning students at the undergraduate level who were working in rural areas. The students were registered in the Network Education College, which is one of the colleges in the top Chinese Agricultural University. The college offers 16 courses related to agricultural areas and has over 10 000 students. The majority of students are from the local county. The participants were randomly selected from the groups of students who are working on their final stage of studies. The survey questionnaire was in Chinese because all respondents were native Chinese speakers. The questionnaire was reviewed and tested with 45 students from another e-learning programme and was refined and revised based on the feedback of pilot tests. With the assistance of course managers, 350 questionnaires were distributed, and 280 validated responses were collected by course managers. To ensure a high response rate, the survey was conducted in the local study centres when students came to their classes or took their exams. In addition to the user-friendly questionnaire design, the university's course managers' assistance was a key factor in ensuring the high response rate in the study. Table 3 shows the demographic profile of the respondents.

## Data analysis

The measurement and research models were tested using the structural equation modelling (SEM) technique, which has been used in measuring user's acceptance of IT. The computer software program linear structural relation (LISREL) 8.80 was used. According to the recommendation by Anderson and Gerbing (1988), the minimum sample size for the SEM approach is 200. One rule of thumb found in the literature is that the sample size should be more than eight times

*Table 3: Respondent profile*

| *Profile* | *Frequency* | *Percentage (%)* |
|---|---|---|
| Gender | | |
| Male | 148 | 52.9 |
| Female | 132 | 47.1 |
| Age | | |
| 18–30 | 167 | 59.6 |
| 31–40 | 97 | 34.6 |
| 41–50 | 12 | 4.3 |
| Over 50 | 4 | 1.4 |
| Years of study | | |
| 1 | 115 | 41.1 |
| 2 | 97 | 34.6 |
| 3 | 43 | 15.4 |
| 4 | 20 | 7.1 |
| Above 4 | 5 | 1.8 |
| Computer skills at the start of the course | | |
| Novice | 53 | 18.9 |
| Intermediate | 194 | 69.3 |
| Expert | 33 | 11.8 |
| Computer owner | | |
| Yes | 268 | 95.7 |
| No | 12 | 4.3 |

the number of variables in the model (Garson, 2010). Therefore, 280 questionnaires for this study were considered as acceptable for the SEM analysis involving 32 variables (see Table 2). Using LISREL for SEM analysis consists of measurement model validation and structural equation model testing. The measurement model should be assessed before the structural equation model is examined.

*Analysis of measurement model*

The adequacy of the measurement model was evaluated by confirmatory factor analysis, which is proposed to verify the reliability and validity of the measures. Eleven assessments of fit measures were used to evaluate the validity of the hypothetical model constructs. Multiple criteria measures were used to measure the model fit, which are absolute fit measures, incremental fit measures and parsimonious fit measures. Following the LISREL data analysis practice, seven problematic items of the 32 items were deleted, and the measurement model was reassessed. The results in Table 4 show that all indices of the revised measurement model either exceeded (70%) or were close to (30%) the recommended level. Therefore, it was judged that the full hypothetical model fits the observed data adequately and the component fit measure can then be assessed.

In this study, all estimates of parameters were calculated by LISREL with the system maximum likelihood estimation approach. To assess the reliability, the composite reliability was computed. As shown in Table 5, composite reliability values vary from 0.691 to 0.895, which are all above the minimum value of 0.60 suggested by Bagozzi and Yi (1988). Convergent validity was evaluated by using factor loading and average variance extracted (AVE). To assess the convergent validity of the instrument, Fornell and Larcker (1981) suggested that construct reliabilities should be above 0.7, and the AVE by each construct must exceed the variance because of measurement error for that construct (ie, AVE should exceed 0.5). For a satisfactory degree of the discriminant validity, the AVE can be used to assess discriminant validity (Pituch & Lee, 2006). Fornell and Larcker (1981) recommended that AVE for each construct should exceed the squared

*Table 4: Results of revised measurement model fit statistics*

| *Assessment of fit measures* | | *Recommended value* | *Result* |
|---|---|---|---|
| Absolute fit measures | $\chi^2$/df | 0–3 | 525/421 = 1.25 |
| | GFI | >0.90 | 0.878 |
| | RMR | <0.05 | 0.045 |
| | RMSEA | ≤0.05 | 0.03 |
| Incremental fit measures | AGFI | >0.90 | 0.855 |
| | NFI | >0.90 | 0.878 |
| | NNFI | >0.90 | 0.957 |
| | IFI | >0.90 | 0.963 |
| Parsimonious fit measures | PNFI | >0.50 | 0.578 |
| | PGFI | >0.50 | 0.744 |

GFI, goodness of fit index; RMR, root mean square residual; RMSEA, root mean square error of approximation; AGFI, adjusted goodness of fit index; NFI, normed fit index; NNFI, non-normed fit index; IFI, incremental fit index; PNFI, parsimony normed fit index; PGFI, parsimony goodness of fit index; df, degrees of freedom.

*Table 5: Results of estimations of construct measurements*

| *Factor* | *Item* | *Unstandardised factor loading* | T-*value* | *Standardised factor loading* | *Composite reliability* | *Average variance extracted* |
|---|---|---|---|---|---|---|
| System functionality | SF1 | 1.000 | | 0.805 | 0.895 | 0.632 |
| | SF2 | 1.046 | 15.457 | 0.859 | | |
| | SF3 | 0.930 | 14.773 | 0.831 | | |
| | SF4 | 0.903 | 14.474 | 0.819 | | |
| System response | SR1 | 1.000 | | 0.700 | 0.828 | 0.620 |
| | SR2 | 1.281 | 11.891 | 0.896 | | |
| | SR3 | 1.002 | 10.617 | 0.752 | | |
| System interactivity | SI1 | 1.000 | | 0.891 | 0.862 | 0.678 |
| | SI2 | 0.983 | 16.498 | 0.891 | | |
| | SI3 | 0.654 | 11.625 | 0.769 | | |
| System service quality | SS1 | 1.000 | | 0.887 | 0.734 | 0.534 |
| | SS2 | 0.676 | 10.360 | 0.788 | | |
| Self-efficacy | SE1 | 1.000 | | 0.814 | 0.691 | 0.531 |
| | SE2 | 0.637 | 7.151 | 0.799 | | |
| E-learning course quality | EC1 | 1.000 | | 0.715 | 0.722 | 0.500 |
| | EC2 | 1.091 | 5.902 | 0.712 | | |
| Perceived ease of use | PEOU1 | 1.000 | | 0.704 | 0.762 | 0.518 |
| | PEOU2 | 0.941 | 9.052 | 0.785 | | |
| | PEOU3 | 1.094 | 9.808 | 0.767 | | |
| Perceived usefulness | PU1 | 1.000 | | 0.709 | 0.872 | 0.586 |
| | PU2 | 1.262 | 13.861 | 0.952 | | |
| | PU3 | 1.125 | 12.227 | 0.815 | | |
| | PU4 | 1.035 | 11.310 | 0.753 | | |
| Behavioural intention to use | BI1 | 1.000 | | 0.783 | 0.695 | 0.532 |
| | BI2 | 0.936 | 7.740 | 0.770 | | |

factor correlations between that construct and other constructs. Table 6 shows AVE square roots and intercorrelations of the revised measurement model. As seen in Table 6, the correlations between factors are smaller than the corresponding square root of AVE. Therefore, all corresponding results of estimations in Tables 5 and 6 indicate that the revised measurement model fit criteria of factor loading and AVE exceeded the suggested threshold level. In the meanwhile, *t*-values are all above 1.96 with the significant level of 0.05.

*Table 6: AVE square roots and intercorrelations*

| | *SF* | *SR* | *SI* | *SS* | *SE* | *EC* | *PEOU* | *PU* | *BI* |
|---|---|---|---|---|---|---|---|---|---|
| SF | 0.795 | | | | | | | | |
| SR | 0.746** | 0.787 | | | | | | | |
| SI | 0.528** | 0.279** | 0.823 | | | | | | |
| SS | 0.618** | 0.684** | -0.036 | 0.730 | | | | | |
| SE | 0.153* | 0.269** | 0.444** | -0.026 | 0.729 | | | | |
| EC | 0.667** | 0.464** | 0.435** | 0.561** | -0.029 | 0.707 | | | |
| PEOU | 0.713** | 0.679** | 0.177** | 0.715** | 0.131* | 0.442** | 0.720 | | |
| PU | 0.523** | 0.389** | 0.672** | 0.225** | 0.538** | 0.462** | 0.268** | 0.766 | |
| BI | 0.173* | 0.068 | 0.405** | 0.038 | 0.181** | 0.317** | -0.013 | 0.453** | 0.729 |

*$p < 0.05$.
**$p < 0.01$.
SF, system functionality; SR, system response; SI, system interactivity; SS, system service quality; SE, self-efficacy; EC, e-learning course quality; PEOU, perceived ease of use; PU, perceived usefulness; BI, behavioural intention to use; AVE, average variance extracted.

*Table 7: Results of model testing using SEM*

| *Latent variables* | *Independent variables* | *Standardised estimation* | | |
|---|---|---|---|---|
| | | *Direct effects* | *Indirect effects* | *Total effects* |
| PEOU ($R^2 = 0.589$) | SF | 0.475 | | 0.475* |
| | SR | 0.342 | | 0.342* |
| | SI | 0.298 | | 0.298* |
| | SE | 0.316 | | 0.316* |
| PU ($R^2 = 0.522$) | SF | 0.329 | 0.222 | 0.551* |
| | SR | 0.020 | 0.188 | 0.208* |
| | SI | 0.096 | 0.005 | 0.101 |
| | PEOU | 0.408 | | 0.408* |
| BI ($R^2 = 0.609$) | SS | 0.611 | | 0.611* |
| | EC | 0.608 | | 0.608* |
| | PEOU | 0.277 | 0.432 | 0.709* |
| | PU | 0.735 | | 0.735* |
| | SE | 0.102 | 0.151 | 0.253* |

*$p < 0.05$.
SF, system functionality; SR, system response; SI, system interactivity; SS, system service quality; SE, self-efficacy; EC, e-learning course quality; PEOU, perceived ease of use; PU, perceived usefulness; BI, behavioural intention to use; SEM, structural equation modelling.

*Structural model testing results*

The significance of the structural model test and individual direct effects, indirect effects and the total effects are summarised in Table 7 and shown in Figure 4. Overall, 11 of the 12 hypotheses are supported with statistical significance.

System functionality, system response and system interactivity had a significant positive direct effect on perceived ease of use (0.475, 0.342, 0.289). The result also shows that self-efficacy has a direct effect on perceived ease of use (0.316). These determinants account for 58.9% of the variance in perceived ease of use. The total effect of perceived ease of use on behavioural intention is 0.709.

As there is no significant effect of system interactivity on perceived usefulness (0.101, $p > 0.05$), hypothesis 6 is not supported. For the positive relationship between perceived ease of use and

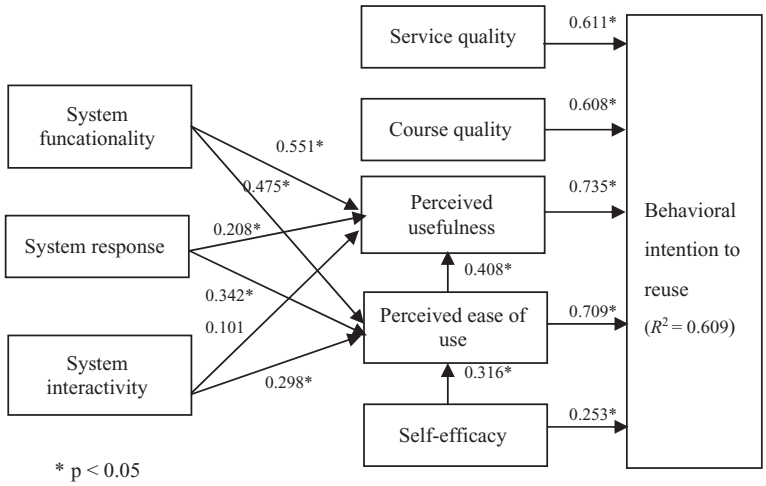


*Figure 4: Model testing results*

perceived usefulness, the direct effect is 0.408. The total effects of system functionality and system response on perceived usefulness are 0.551 and 0.208 respectively. The variables explained 52.2% of the variance in perceived usefulness. The total effect of perceived usefulness on behavioural intention is 0.735.

System service quality, course quality and self-efficacy have a significant positive direct effect on behavioural intention to reuse (0.611, 0.608, 0.102). The result also shows the total effect of self-efficacy on behavioural intention to reuse (0.253). These determinants account for 60.9% of the variance in behavioural intention.

## Discussion

The results of the data analysis demonstrate that the proposed research model is effective in explaining contributing factors affecting the behavioural intention of e-learning system reuse. Most of the causal relationships between the constructs postulated by the research model are well supported.

The findings reveal that perceived usefulness has the strongest direct effect on the e-learner's intention to reuse the e-learning system ($\beta = 0.735$). It seems that people living in rural areas are more concerned about the usefulness of e-learning because it is important for them to be able to improve their personal qualifications and enhance their career prospective through the use of e-learning systems. Coping with the rapid economic development in rural areas in China, people pay more attention to continuous education. Thus, the advantages of e-learning can provide the opportunities to meet the educational demand.

Perceived ease of use is also found to have significant influence on behavioural intention ($\beta = 0.709$). This suggests that it is important to develop easy to use and user-friendly e-learning systems. Our findings reveal that the perceived ease of use positively affects the perceived usefulness, although there are still different views and debates on examining the relationship between the perceived ease of use and the perceived usefulness in the literature (eg, Mathieson, 1991; Roca & Gagne, 2008; Venkatesh & Davis, 2000).

Service quality ($\beta = 0.611$) and course quality ($\beta = 0.608$) appear to be the significant determinants of e-learners' behavioural intention to reuse. The results suggest that staff support and interaction between students and teachers strongly affect e-learners' intention to reuse. Because

of students' limited access to the learning facilities and education centres in rural China, teachers' support of learning through regular communications, interactions and tutoring is essential. Also, the course quality, as in the course content and assessment, affects the learner's intention to reuse.

E-learners' computer self-efficacy appears to have a significant effect on behavioural intention ($\beta = 0.253$). The study identifies that computer self-efficacy is also related to the perceived ease of use ($\beta = 0.316$). This finding is consistent with prior e-learning studies. For example, computer-efficacy is examined with a significant positive effect on perceived ease of use of e-learning (Venkatesh & Davis, 1996) and with significant positive effects on perceived usefulness, ease of use and negative effects on perceived credibility of e-learning (Wang, 2003).

Compared with system response and system interactivity, system functionality has the higher effect on perceived ease of use ($\beta = 0.475$) and perceived usefulness ($\beta = 0.551$). System functionality and system response indirectly influence the learners' intention to reuse the system. It is found that system interactivity has no significant effect on perceived usefulness. This result is not unexpected because the multiple communication tools provided by the Internet, such as email, MSN, QQ (similar to MSN) and telephone, are easy to use and popular in China, so learners and teachers may choose to use one of those tools instead of interacting through the e-learning system. However, system interactivity positively affects the behavioural intention of reuse, mediated by the perceived ease of use.

Through the development and empirical validation of the hybrid research model, a number of interesting implications are generated, which will help e-learning providers in rural areas of China to improve the e-learning success. First, it is essential for system designers to use appropriate system features and functions that can effectively facilitate the teaching and learning process and outcomes. Active users' (both teachers and students) involvement in e-learning system design would help to identify the most suitable functionalities and features that meet their needs. Second, as the course quality significantly affects the learner's intention to reuse, an e-learning system, pedagogical principles, including principles of developing and structuring the course content, should be employed in the development and evaluation of relevant curriculum. E-learning content developed for learners in rural areas of China must be practical and relevant to learners' personal development goals and work requirements, so that the learners can benefit from the learning outcomes and improve their work performance eventually. Third, a perfectly designed e-learning system will only work well with appropriate e-learning service quality. Therefore, human interaction as an important part of services must not be underestimated and eliminated. Finally, as perceived ease of use has a strong impact on e-learning success, e-learning providers in China must consider the low education level of people living in rural areas and take effective measures to improve the ease of use. For example, in addition to designing an easy to use system, user instructions and manuals may be necessary to provide useful guidelines and improve the ease of use.

## Conclusion

In conclusion, this study proposed and empirically validated a hybrid research model based on TAM, IS success model and self-efficacy theory. This integrated hybrid model aims to examine the factors that affect a user's behavioural intention to reuse an e-learning system. The validated model shows a good fit with data collected and demonstrates satisfactory power in explaining the behaviour of e-learners in rural China. The model identifies the relationships between the e-learning system reuse and system characteristics, perceived ease of use, perceived usefulness, service quality, course quality and self-efficacy respectively. An empirical study was conducted to test and validate the research model and investigate the degree of the impact of specific variables.

The results provide valuable insights that may help practitioners and researchers to better understand how e-learners' experience and perceptions impact on their intention to reuse, which is arguably an effective overall indicator for measuring e-learning system success. This better understanding from multidimensional perspectives can offer a holistic view on the ways to improve e-learning system development and use.

A number of important contributions have been made in this study. First, the literature reveals that limited attempts in adopting or developing research models to examine Chinese e-learners' behaviour have achieved less than satisfactory results in predicting e-learning system adoption/intention in the past. This research has attempted to address the challenge by proposing and validating a hybrid model underpinned by a number of relevant theories. Based on our belief that intention to reuse is a key success indicator, the model incorporated the IS success constructs to examine the factors affecting e-learning system success.

Second, the hybrid model is effective in explaining the relationships between contributing factors and their effect on behavioural intention of users to reuse a system. As a result, the model can better inform research on identifying multiple factors affecting not only e-learning system success but also other types of systems success, such as information and knowledge management systems.

Third, empirical evidence is provided to support the notion that intention to reuse is affected by multiple key factors pertinent to the technology, users and application context.

Fourth, this is a first attempt to study how e-learners' experience and perceptions affect their intention to reuse a system in the context of rural education in China. The findings are significant in terms of the practical implications for improving education and reducing knowledge gaps between modern cities and vast underdeveloped rural regions in China.

Fifth, validation of the theories in the context of e-learning systems in rural China is significant as it proves that, despite the cultural, political and economical differences, the integration of relevant theories developed in Western countries worked well in this context.

Finally, the model helps to identify the key factors and the extent of their impact that enables e-learning providers to be more focused with their effort and work more effectively on future improvement.

Although the study followed a rigorous validation procedure to develop and test the model constructs and the findings may contribute to the better development and use of e-learning systems in rural China, it also has limitations. The data used were collected from a sample of e-learners engaged in a specific e-learning system for people to study for an undergraduate degree in rural areas of China. Caution should be made when applying the model and findings in different contexts. For example, e-learners' behaviour intention in urban China can be different because of their higher level of IT competence and educational qualifications. E-learners in rural area of other Asian countries may also exhibit different behaviour intention because of significant differences in political and social systems and cultural environment between China and other Asian regions. However, the research model and its associated measures provide scope for developing future research, such as to study e-learners behaviour intention with samples from different age groups, in different geographic locations or using specific design elements of e-learning. Also, the level of similarities of the effects among certain constructs may cause concern because of the potential effect of common method variance, which refers to the amount of spurious covariance shared among variables because of the common method used in collecting data (Buckley *et al*, 1990, cited by Malhotra, Kim & Patil, 2006). However, it can be argued that although the effect of common method variance might contribute to the high level of similarities, this does not invalidate the findings. Malhotra *et al* (2006) conducted

a comprehensive and systematic analysis of past IS research and suggested that common method biases in the IS domain are not as serious as those found in other disciplines, as the inflated correlation resulting from common method variance is smaller than that reported in other disciplines.

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