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ADVANCED E-LEARNING QUALITY IMPROVEMENT METHODS IN GOVERNMENT ORGANIZATIONS

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Abstract:
Being equipped with advanced information and communication technologies, e-learning systems have gained dramatic demands in recent years. Especially, to government organizations, e-learning plays a critical role to sustainable competitiveness through facilitating staff and authorities' continuing professional and training development. Consequently, e-learning quality management is perceived to significantly promote users' learning effects, satisfaction, and use intention. However, despite the increasing growth rate worldwide, failures in e-leaning still exist and little is known about why many users stop using e-learning after early-stage experience. In spite of previous studies' attempt in pointing out key factors influencing e-learning success, missing from the extant literature is the investigation of e-learning quality failure gaps and appropriate recovery solutions. Therefore, this paper aims to target government organizations to develop an innovative methodology which can solve these research missing gaps of (1) identifying the key failure factors significantly influencing users' overall satisfaction and use behaviour and (2) seek the optimal improvement solutions. Accordingly, the recovery capability ranking of achieved determinant factors is firstly established; then, Quality Function Deployment (QFD) method is employed to seek optimal recovery solutions. The results prove five top improvement solutions, namely "creation of e-learning support management team", "creation of e-learning agency", "instructors' professionalism enhancement", "reward system for proactive participation", and "information security certification". The results hope to provide academicians and organizations with innovative reference method and helpful guidelines for advancing e-learning quality in a shorter and more effective manner.

Keywords: e-learning quality improvement, Quality Function Deployment, recovery capability ranking, government organizations

1. INTRODUCTION

Being equipped with currently advanced information and communication technologies, e-learning systems has gained dramatic recognition and increasing demands from schools, businesses, institutes of higher education, and government organizations and become one of the top-concerned topics globally (Sun et al., 2008; Little, 2010; Chen, 2012). Unlike the traditional learning, e-learning systems effectively provide a revolutionary form of learning and training through web-based/computerized learning and digital cooperation that allows effective information accessibility, unlimited time and space flexibility, better content delivery, self-paced learning, interactivity, and more efficient knowledge reuse and sharing (Cheng et al., 2012; Huang et al., 2012; Chen and Tseng, 2012; Chen, 2014). To any organization, investments in e-learning systems in the workplace stimulate their international competitiveness through assisting employees' professionalism development and improving organizational lifelong learning (Gronlund and Islam, 2010), improving employees' operating skills and self-learning attitude, enhancing employees' adaptation capabilities that help them become real members that function well in the organizations, promoting training efficiency, and cutting off training cost (Gulati, 2008; Payne et al., 2009; Luor et al., 2009; Iris and Vikas, 2011). For these benefits, e-learning is perceived to play a critical role to government organizations' success and sustainable competitiveness. As such, it is believed that e-learning quality enhancement has a significant impact on users' learning effects, satisfaction, and use behaviour (Liaw et al., 2007). However, e-learning is surprisingly still in its infancy in developing countries and has been reported to have a higher drop-out rate than traditional face-to-face instructions (Gronlund and Islam, 2010; Bhuasiri et al., 2012). Despite the increasing growth rate worldwide, failures in e-leaning still exist and little is known about why users stop using e-learning after early-stage experience (Sun et al., 2008). Therefore, how to improve e-learning quality has become a critical issue and challenge on a global scale (Cheng et al., 2012).

Previous studies have attempted to point out the key factors toward e-learning success; however, there has been no research investigating the e-learning quality failure gaps and search appropriate recovery solutions (Payne et al., 2009). It has been suggested that sufficient evaluation of e-learning systems success is an essential basis for managing and developing these systems in organizations that have adopted these applications (Alsabawy et al., 2013). Taking this point, this paper aims to take government organizations as a case to develop an innovative methodology which can solve these research missing gaps of (1) identifying the key failure factors which significantly influence users' overall satisfaction, use behaviour, and learning effect and (2) seek the most effective improvement solutions. As such, the calculation of factors' recovery capability ranking and the Quality Function Deployment (QFD) method were utilized to find out the most capable recovery solutions. This paper hopes to provide useful reference method and survey items for future e-learning-related researches, additionally offers helpful guidelines for promoting e-learning quality, which in turn is beneficial to the learning, development, and competitiveness of government organizations as well as making the implementation of improvement process for e-learning quality shorter and more effectively.

2. LITERATURE REVIEW: THE EMPIRICAL CASE STUDY OF E-LEARNING IN TAIWAN GOVERNMENT ORGANIZATIONS AND INFLUENTIAL FACTORS

In this IT era, through stimulating collaborative learning, knowledge sharing, communication flexibility, work effectiveness, and relationship building in the organizations (So and Bonk, 2010; Lin and Wang, 2012), providing the most cost-effective learning and training tool for employees' continuing education, facilitating employees' self-improving learning attitude and learning efficiency (Payne et al., 2009; Chen and Tseng, 2012; Chen, 2014), e-learning platform has been perceived to play a critical role to the success and competitiveness of government organizations as well as beneficial to employees' continuous learning and professional development (Cheng et al., 2012; Jan et al., 2012; Chen, 2014). However, concerning the Taiwan context, it has been argued that the current development of e-learning mainly focuses on technical design issues and most e-learning applications may not perform well in motivating learners (Chen and Kao, 2012). A wide range of barriers to the success of e-learning initiatives in workplace has been consequently indicated (Cheng et al., 2012). Therefore, based on these crucial considerations and the beneficial impact of e-learning on government organizations' sustainability and competitiveness, this study aims to take Taiwan government organizations as a case to investigate the key factors to e-learning quality failures and seek the most feasible improvement solutions. The achieved findings hope to provide government organizations with helpful guidelines for promoting e-learning quality and use satisfaction.

With the prospect of cost-effective investments, many enterprises have adopted e-learning systems for employee training to assist in their human capital management in recent decades (Chen, 2010; Chen and Kao, 2012). However, e-learning in workplaces still remains a fragmented, complex, and challenging issue (Wang, 2011) since it is still confronted with a highly complex set of factors such as learners, activities, outcomes, etc. (Chen, 2012; Wang et al., 2010). Specifically, since e-learning system is the web-based platform, IT infrastructure services and quality factors (e.g., ease of access, internet speed, state-of-the-art equipment, sufficient hardware and software, good digital bandwidth, etc.) have been perceived to play a critical role to users' satisfaction and continuous use (Bhuasiri et al., 2012). Noteworthy, the success of e-learning platform is also affected by users' system perceived usefulness and perceived ease of use (Chou et al., 2012; Alsabawya et al., 2013).

In the extant literature, motivations which include intrinsic motivations and extrinsic motivations are additional factors examined for learners and instructors using e-learning systems (Law et al., 2010). In order to facilitate learning, it is helpful for e-learning system managers to provide learners with appropriate assistances in applying what they have learned to new problems (Bhuasiri et al., 2012), for instance, simulation courses for employee training or courses introducing general rules or specific knowledge for employees to learn (Chen and Kao, 2012), personal assistant services to help learners use, manage, and interact with the learning system (Wang et al., 2011), institution and faculty support (Ozkan & Koseler, 2009). Moreover, strong pedagogical foundations, especially content-related issues (e.g., content quality, content correctness), and course flexibility teaching assistant support, computer training, and program flexibility are essential for the success of e-learning implementation and learners' satisfaction with e-learning courses (Lee, 2008; Teo, 2010). Furthermore, in e-learning environments, instructors and peers are important resources for learners (Wan et al., 2008). Among which, instructors' characteristics (e.g., attitude toward students, teaching style, technical competence, interaction) exert considerable effects on learners' cognition and learning motivation and effectiveness (Bhuasiri et al., 2012). Hence, educators should strongly focus on shaping their core knowledge to meet learners' needs (Gamalel-Din, 2010). Furthermore, learning is believed to be more effective when students are able to have effective interactions with course content, peers, and instructors (Lin and Wang, 2012). Hence, interactivity is perceived to be of great importance.

In sum, based on the above studies, this research proposes a set of 37 factors which potentially affect learning effectiveness, satisfaction, and continuous use of the e-learning system, as shown in Table 1. Specifically, 31 factors were extracted from e-learning provider perspectives and 6 factors were derived from e-learning learner perspectives. From these potential factors, key determinants to e-learning satisfaction and effectiveness would be identified, which served as a basis for seeking the most effective improvement methods for e-learning quality.

3. METHODOLOGY - THE PROCEDURE OF THE SFI-QFD MODEL

3.1. The procedure of the SFI-QFD model

This study aims to establish an innovative method for identifying key factors toward e-learning satisfaction and learning effectiveness in government organizations and exploring the most viable improvement methods. Accordingly, this study proposes the 2-stage methodology SFI-QFD as follows:

Phase 1 (SFI - Key service failure identification & improvement opportunity priority calculation)

This phase consists of 5 steps. In step 1 (Identifying the critical service quality factors of e-learning), the qualitative approach (e.g., literature review and expert interview) were employed to identify the key e-learning service quality factors perceived by relevant researches for establishing reliable data. In step 2 (Evaluating customers' satisfaction toward expected services), customers' satisfaction toward expected services (i.e., E1, E2... Ek) as well as perceived services (i.e., P1, P2… Pk) were evaluated for all obtained service quality factors. The overall customer satisfaction (CS) toward the whole service system of e-learning was additionally assessed. In step 3 (Clarifying failure gaps and the degree of severity (SVi) among the factors), paired t-test was used to explore the failure gaps. Subsequently, degree of severity was calculated as in the formula (1). Noteworthy, $\overline{P}_i$ was the average of ith perceived service factor toward e-learning perceived services, $\overline{E}_i$ was the average of ith expected service toward e-learning expected services.

(1)

$$SV_i = \begin{cases} \dfrac{(\overline{P}_i - \overline{E}_i) - \min_i(\overline{P}_i - \overline{E}_i)}{\max_i(\overline{P}_i - \overline{E}_i) - \min_i(\overline{P}_i - \overline{E}_i)} & \text{, if ith factor exists negative gap} \\ 0 & \text{, if ith factor does not exists negative gap} \end{cases}$$

In step 4 (Key failure factor identification), if SVi was greater than 0.5, the i^{th} factor would be considered as the key failure factor. Finally, in step 5 (Severity transformation and improvement opportunity priority calculation), multivariable regression analysis was employed to calculate the improvement opportunity (SIi) for the failure factors on the basis of the obtained overall customer satisfaction values (CS). Through the multiple regression, the achieved results for standardized regressor coefficients were viewed as the improvement opportunity for the factors. Opportunity priority was then determined. As such, improvement rates (IR) were calculated through considering the combination of the obtained degree of severity (SVi) and regressor coefficients (SIi) of the factors, being shown in the formula (2) that IRi = SVi * SIi. As results, the factors with higher improvement rate were identified as the e-learning key factors toward overall customer satisfaction and learning effectiveness, which serve as the basis for the identification of viable improvement solutions.

Phase 2 (QFD - Recovery solution identification)

After identifying the key factors, it is essential to develop a set of effective e-learning quality improvement solutions. In order to seek the best solutions which can efficiently solve all relevant key factors, it is extremely important to recognize the priority of factors in addition to their failure gaps and severity. Hence, the quality function deployment (QFD) method was utilized, being shown in three steps. Specifically, in step 1 (Seek possible improvement solution), experts were initially asked to contribute possible solutions to the above failure factors through utilizing the brainstorming and group meeting approaches. In step 2 (Severity recovery capability identification and Recovery matrix construction), in order to seek for effective recovery solutions, expert discussions were conducted for calculating proposed solutions' recovery capabilities and then the House of Quality-QFD method was utilized for determining their severity recovery capabilities. In the HoQ matrix, in order to effectively solve the key failure factors perceived from e-learning providers and learners that critically influence e-learning use satisfaction, this study transformed these factors into adequate technical solutions (TSj), also considered as severity recovery capability. Based on the factors' severity degree, severity recovery capability (TSi) of the j^{th} solution was calculated using the formula (3) that $TS_j = \sum_{i=1}^{m} Q_{ij} * IR_i$, in which IRi represented the improvement rate of the i^{th} factor, Qij was the recovery capability of the j^{th} solution that can solve the i^{th} service failure, and m is the number of service failure items. Finally, in step 3 (Effective recovery solution and Decision making), based on the achieved severity recovery capabilities TSj of proposed solutions, the best solutions were determined. As such, the solutions with higher severity recovery capabilities would be considered as the most effective solutions.

3.2. Data collection and questionnaire design

For data collection, in accordance with the research purposes, for the first step of key failure factor identification, government staff with e-learning use experience was selected to be research sample for identifying key e-learning failure factors. Chosen government organizations included the Directorate-General of Personnel Administrative, Executive Yuan and five various Ministries of Transportation, Finance, Interior, Economic Affairs, and Education. Through convenience sampling method, 750 respondents were requested to fill out the questionnaires, resulting in 599 valid answers (79.9%). The demographic analysis results showed that the major of participants were female (60.8%), from the 31-40 year-old group (34.9%), possessing university degree (65.3%), and having working experience of more than 12 years (43.9%). In the second phase, in response to the urgent need for seeking solutions, 5 experts were first requested to contribute possible solutions to the above failure factors; then, discussions were conducted with 15 experts and scholars who were academics and practitioners engaged in the implementation of e-learning systems to seek the most viable improvement solutions (i.e., 4 scholars, 4 senior managers in businesses with e-learning implementation, 2 experts participating in establishing e-learning platform, and 2 government staff relevant to e-learning system).

In accordance with the main research objectives, the survey questionnaire was divided into two parts, namely (1) e-learning service quality failure factor questionnaire (2) QFD questionnaire for e-learning

improvement solutions. Specifically, Part 1 (E-learning service quality factor questionnaire) aims to explore key failure factors through understanding the current development and the impacts of e-learning on learners' learning effectiveness and satisfaction. Accordingly, the identification of e-learning quality key failure factors were accessed through 37 factors achieved from two perspective angles of e-leaning providers and learners (as shown in Table 1). The Likert 5-point scale was used to assess these 37 factors for degree of importance (IMP) (from 1="significantly unimportant" to 5="significantly important") and overall satisfaction (SAT) (from 1="totally dissatisfied" to 5="totally satisfied"). Simultaneously, overall satisfaction (CS) was evaluated. Finally, part 2 (QFD questionnaire for e-learning improvement solutions) is conducted on response to the urgent needs for superior e-learning quality improvements for government organizations. Prior to expert discussions, references of e-learning practices in public sectors in advanced countries were included in the initial proposal for more feasible solutions. The above obtained e-learning quality failures were then discussed with experts and scholars to find out the most effective solutions. Accordingly, the questionnaire items were evaluated regarding solution capability using 0="no improvement" to 5="strong improvement".

4. RESULTS

4.1. Reliability and validity

In order to assess the scale appropriateness and to identify the critical factors among the above 37 factors, this study employed exploratory analysis (EFA), using the principle component analysis extraction method with varimax rotation with Kaiser normalization. As a result, regarding e-learning provider dimension, 6 major factors were extracted from the original 31 factors, namely "hardware/software sufficiency, security and ease of use" (D1), "e-leaning course topics and instructions' professionalism" (D2), "assistance capability and e-learning support system management" (D3), "e-learning course curriculum and managers' support for e-learning use" (D4), "incentives mechanism" (D5), and "promotion and punishment mechanism" (D6). Concerning the e-learning learner dimension, 2 major factors were extracted from original 6 factors, namely "learners' professional background and operational skills" (D7) and "learning motivation" (D8). The obtained 8 multiple-item factors were then tested for construct reliability. The results showed that the achieved Cronbach's α coefficients of all dimensions for degree of satisfaction (SAT) (e.g., ranged from 0.75 to 0.90) and degree of importance (IMP) (e.g., ranged from 0.70 to 0.91) were greater than the threshold 0.6 (Nunnally, 1978; Bagozzi and Yi, 1988), indicating high internal consistency and thus reliability for all measurement indicators. In addition, the obtained results for construct reliability ranged from 0.77 to 0.91 (SAT) and from 0.72 to 0.91 (IMP), which were all greater than the threshold 0.6 (Bagozzi and Yi, 1988), confirming construct reliability.

In the next step, confirmatory factor analysis (CFA) was employed to examine construct validity of all dimensions. The CFA analysis results showed the standardized factor loading values for IMP and SAT of all dimensions were greater than the threshold 0.4 (Bagozzi and Yi, 1988). Overall, the convergent validity of all measurement indicators was validated (Hair et al., 2006). Finally, discriminant validity test was performed to establish the distinction among the proposed constructs. Following Hair et al. (2006), this study paired the latent constructs and subjecting them to two CFA models. The results showed the first model allowed the correlation between two constructs to be estimated (unconstrained) while the correlation between two constructs was set to 1 (constrained) in the other model. The chi-square difference test was employed to compare these two models, indicating all chi-square difference values were statistically significant at $p<0.05$, thus confirming discriminant validity.

4.2. Phase 1: Service failure identification and improvement opportunity priority

In this step, the paired t-test was employed to clarify the failure gaps among the factors. Based on formula (1), pairs with negative gaps were then determined for the degree of severity SVi (Table 1). Based on the premise that the i^{th} factor would be considered the key failure factor if its SVi value was greater than 0.5, 20 factors of G1, G2, G3, G4, G5, G6, G7, G8, G9, G10, G11, G12, G13, G14, G17, G19, G21, G24, G25, and G31 were the key failure factors toward e-learning in this case.

Multivariable regression analysis was then utilized to calculate the improvement opportunity (SIi) for the achieved key failure factors. As shown in Table 1, only factors G2, G3, G7, G9, G14, G19, G24 , and G25 with positive values were considered improvable key failure factors that would stimulate the overall satisfaction, among which G14 "supplementary operation examples & teaching resources"

(0.077) ranked first, followed by G2 “have sufficient hardware” (0.072) and G24 “new technology adoption in e-learning system” (0.06). It was noted that the factors with higher SIi values could better enhance overall satisfaction when being improved. Finally, the opportunity priority for each factor was determined. Based on the formula (2), improvement rates (IR) were calculated by multiplying the obtained degree of severity (SVi) and regressor coefficients (SIi). Higher improvement rate indicated the e-learning key factors that could better enhance customer satisfaction and learning effectiveness, which serve as the basis for the identification of viable improvement solutions in the second phase. As in Table 1, the factor G2 (0.056) ranked first, followed by G24 (0.042) and G14 (0.038).

Table 1: Service failure identification and improvement opportunity priority

Dimensions / Items		Pair	Mean	t-value	SVi	SIi	IRi
E-learning provider perspectives							
D1	**G1 -** Have state-of-the-art equipment	gi1-gp1	-0.596	12.673***	***0.7268***	-0.059	--
	G2 - Have sufficient hardware	gi2-gp2	-0.628	15.261***	***0.7744***	0.072	**0.05576**
	G3 - Have sufficient software	gi3-gp3	-0.664	16.081***	***0.8296***	0.026	**0.02157**
	G4 - Have sufficient digital bandwidth	gi4-gp4	-0.778	16.742***	***1.0000***	-0.088	--
	G5 - System’s PEOU	gi5-gp5	-0.726	18.156***	***0.9223***	-0.060	--
D2	**G6 -** Instructors’ professionalism	gi6-gp6	-0.731	17.330***	***0.9298***	-0.096	--
	G7 - Course topics	gi7-gp7	-0.638	16.419***	***0.7895***	0.002	**0.00158**
	G8 - Easy teaching contents	gi8-gp8	-0.568	16.140***	***0.6842***	-0.062	--
	G9 - Correct contents	gi9-gp9	-0.538	15.253***	***0.6391***	0.059	**0.03771**
	G10 - Useful contents	gi10-gp10	-0.604	17.458***	***0.7394***	-0.052	--
	G11 - Instructors’ assistance capability	gi11-gp11	-0.604	17.623***	***0.7394***	-0.133	--
D3	**G12 -** Content diversity	gi12-gp12	-0.526	13.099***	***0.6216***	-0.037	--
	G13 - Instructive/inspiring contents	gi13-gp13	-0.514	13.994***	***0.6040***	-0.003	--
	G14 - Supplementary operation examples/teaching resources	gi14-gp14	-0.444	12.340***	***0.4988***	0.077	**0.03840**
	G15 - Alternative teaching materials	gi15-gp15	-0.419	12.480***	0.4612		
	G16 - Learning assessment mechanism	gi16-gp16	-0.242	6.506***	0.1955		
	G17 - E-learning support system	gi17-gp17	-0.621	15.264***	***0.7644***	-0.132	--
D4	**G18 -** Organizations’ support in providing guidelines/ registrations	gi18-gp18	-0.439	11.420***	0.4912		
	G19 - Available guidance & assistance	gi19-gp19	-0.494	12.262***	***0.5739***	0.014	**0.00804**
	G20 - Course curriculum & self-learning experience building	gi20-gp20	-0.396	10.684***	0.4261		
	G21 - Organizations’ support for e-learning	gi21-gp21	-0.531	12.016***	***0.6291***	-.172	--
	G22 - E-learning inspiring environment	gi22-gp22	-0.396	9.073***	0.4261		
	G23 - Course benefits/advantages	gi23-gp23	-0.404	9.396***	0.4386		
D5	**G24 -** Adoption in e-learning system	gi24-gp24	-0.583	11.018***	***0.7068***	0.060	**0.04241**
	G25 - Reward system	gi25-gp25	-0.508	8.858***	***0.5940***	0.007	**0.00416**
	G26 - Award recognition	gi26-gp26	-0.316	6.175***	0.3058		
	G27 - Certificate achievement	gi27-gp27	-0.412	7.863***	0.4511		
D6	**G28 -** Learning outcomes to job promotion	gi28-gp28	-0.349	7.771***	0.3559		
	G29 - Sense of honor for participation	gi29-gp29	-0.339	8.539***	0.3409		
	G30 - Punishment mechanism	gi30-gp30	-0.018	-.394			
	G31 - Perceived relationships between e-learning use & job performance	gi31-gp31	-0.514	12.245***	***0.6040***	-0.008	--
E-learning learner perspectives							
D7	**P1 -** Learners’ operating skills	pi1-pp1	-0.363	10.863***	0.3760		
	P2 - Learners’ professional background	pi2-pp2	-0.346	10.970***	0.3509		
	P3 - Motivation of obtaining new knowledge	pi3-pp3	-0.372	12.266***	0.3910		
	P5 - Learning motivation from peer pressures	pi5-pp5	-0.215	7.125***	0.1554		
D8	**P4 -** Learning motivation from work demands	pi4-pp4	-0.111	3.410***	4.6E-06		
	P6 - Interactivity	pi6-pp6	-0.165	5.407***	0.0802		

4.3. Phase 2: Recovery solution identification

The main aim of this phase was to seek the best solutions which can efficiently solve all relevant key factors. As such, with the above top-concerned failure factors, 5 experts were first requested to initially develop a set of possible e e-learning quality improvement programs, resulting in 12 solutions, namely A1 (Establishment of e-learning software use), A2 (Information security certification), A3 (Provision of software operating guide), A4 (Plans for learning passport), A5 (E-learning curriculum establishment),

A6 (Creation of e-learning support management team), A7 (Creation of e-learning agency), A8 (Instructors' professionalism enhancement), A9 (Plans of learning outcomes appraisal), A10 (Reward system for proactive participation), A11 (Course design in accordance with learning needs), and A12 (Organize after-course seminars for sharing learning experience). Then, to provide the most feasible improvement solutions for simultaneously solving numerous key failure factors, the House of Quality-QFD method was employed. Based on the total score of the improvement programs (IRi) achieved in Table 1, the recovery solutions are put in priority ranking through calculating their technical solutions (TSj) using the above formula (3). As such, the analysis results (Table 2) showed that the top improvement solution was "Creation of e-learning support management team" (A6) (0.8468), followed by "Creation of e-learning agency" (A7) (0.8381), "Instructors' professionalism enhancement" (A8) (0.7356), "Reward system for proactive participation" (A10) (0.7168), and "Information security certification" (A2) (0.6531).

Table 2: House of Quality-QFD analysis results

Solutions / Factors	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	SVi	SIi	IRi
G2	2.0	3.2	2.1	1.4	2.2	3.9	3.8	2.2	3.0	3.2	1.8	2.0	0.77444	0.072	**0.05576**
G3	2.4	3.5	3.6	1.8	2.2	3.7	3.6	2.8	3.4	3.2	2.2	2.0	0.82958	0.026	**0.02157**
G7	2.6	4.6	2.6	3.0	3.0	3.4	3.6	4.8	4.0	3.4	3.6	3.2	0.78948	0.002	**0.00158**
G9	3.8	3.2	4.2	3.0	3.4	3.4	3.6	4.4	4.0	3.2	4.6	3.4	0.63910	0.059	**0.03771**
G14	3.4	2.4	3.2	3.0	3.2	4.4	3.8	4.6	2.3	3.8	3.8	3.6	0.49875	0.077	**0.03840**
G19	3.6	3.2	3.4	3.0	3.8	4.8	4.8	4.0	2.5	3.5	2.8	2.4	0.57390	0.014	**0.00804**
G24	3.2	3.4	3.0	3.0	3.3	4.6	4.8	3.8	2.4	3.6	3.0	2.2	0.70677	0.060	**0.04241**
G25	1.2	2.2	1.2	3.2	4.0	3.2	4.6	2.2	4.6	4.0	2.8	3.8	0.59390	0.007	**0.00416**
Improvement score	**0.6109**	**0.6531**	**0.6396**	**0.5146**	**0.6131**	**0.8468**	**0.8381**	**0.7356**	**0.6271**	**0.7168**	**0.6343**	**0.5545**			
Rank		**V**				**I**	**II**	**III**		**IV**					

5. CONCLUSION

In current era of advanced information and communication technologies, due to dramatically increasing demands toward e-learning systems government organizations, it is of great importance for government authorities to identify the key e-learning failure factors which significantly influence users' overall satisfaction, use behaviour, and learning effect and seek the most effective improvement solutions once attempting to enhance their life-long competitiveness, which are also the main purposes of this research. Concerning service failure identification, this study has provided 20 actual key factors influencing e-learning users' satisfaction and continual use behaviour. Noteworthy, all obtained key failure factors indentified for improvement belong to e-learning provider perspectives. These results in turn have implied that the role of e-learning providers and managers in the organizations in sufficiently evaluating e-learning systems success and implementing suitable improvement strategies is crucial and needs to be appropriately and emphatically invested. Then, the results from the SFI-QFD model and expert interviews have provided the top improvement solutions to the above main service failure factors, namely "Creation of e-learning support management team" "Creation of e-learning agency", "Instructors' professionalism enhancement", "Reward system for proactive participation", and "Information security certification". The achieved findings have beneficially suggested e-learning system providers in government organizations the service items and effective solutions that should be taken into deeper consideration to enhance e-learning system quality.

With the utilized analytical method and the achieved findings, this study has provided several useful academic and managerial contributions. First, this research is the first of its kind to integrate evaluation perspectives of e-learning providers and users in order to sufficiently explore the actual key service failure factors influencing e-learning users' satisfaction and use behaviour. As such, this study has effectively set a solid foundation in understanding the determinants of e-learning system quality and learning satisfaction and outcomes. Second, this study has efficiently offered useful service quality scale references for future research. Finally, the achieved improvement solutions have provided e-learning system-related providers as well as government authorities with effective guidelines and active focuses for e-learning service quality evaluation and improvement strategies.

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