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Abstract

In recent years, many universities and educational institutions have made considerable investments in e-learning systems. These are systems that deliver educational services via electronic channels. Service quality has been studied in previous research as a critical factor for measuring systems success. Modest attention has been paid to factors affecting the service delivery quality in the e-learning arena. The objective of this study is to identify the factors considered to impact the e-learning systems service delivery quality through a survey of stakeholders. The sample was 720 students enrolled in online courses at the University of Southern Queensland (USQ).The main finding of this study is that IT infrastructure, system quality, and information quality significantly affect service delivery quality in the e-learning systems field. IT infrastructure services were found to play a critical role in improving system quality and information quality, and this construct can be considered as a foundation of delivering high quality educational services.

Keywords

E-learning Systems, Service Delivery Quality, IT Infrastructure Services, System Quality, Information Quality.

INTRODUCTION

Considerable investments are allocated yearly in educational institutions to adopt and develop information technology (IT) for e-learning. Learning Management Systems (LMSs) have been adopted by 95 percent of all higher education institutions in the United Kingdom (McGill et al. 2009). It is worth mentioning that transnational courses are delivered by most Australian universities through educational software (Shurville et al. 2008). E-learning systems deliver educational services to users via electronic channels. E-learning systems services should be delivered to the users should be performed with high quality since these are core business applications. Service quality is an essential issue in the information systems literature, and this issue is even more complicated in electronic learning systems. According to Santos (2003), in 2001, the world lost £8 billion due to inadequate e-services. Accordingly, this study aims to investigate the factors affecting the sub-dimensions of service delivery quality (SDQ) in the e-learning systems arena.

Research Problem

A review the literature of information systems and e-learning systems shows that the majority of studies to date considered SDQ as an exogenous factor that impacts the success indicators (e.g. Ozkan and Koseler 2009). The factors affecting service delivery quality, in particular in the e-learning system field have received scant attention. The issue of SDQ is considered to be more complicated in e-learning systems because the relationship between the services provider and recipient is organised through an electronic channel, and that may lead to difficulties in adequately understanding the customers' needs.

The research problems that this study aims to address are:

- Do the factors that have been selected in this study (IT infrastructure services, systems quality, and information quality) affect the sub-dimensions SDQ? And if so;
- Which sub-dimensions of SDQ, as endogenous factors, are the most affected by these factors?

Significance of Research

In spite of the critical impact of IT infrastructure services in achieving organizational activities, goals, and competitive advantage, there remains ambiguity about its role in service delivery quality. In this study, IT infrastructure services will be considered as the foundation to achieve system quality and information quality. Systems quality will be an essential determinate of information quality. The significance of this study comes from investigating the impacts of IT infrastructure services, systems quality, and information quality on sub-dimensions of SDQ.

Study Objectives

The objectives of the study are

- to study the effects of exogenous factors on each sub-dimension of SDQ to identify which sub-dimensions of SDQ are the most affected by these factors; and
- to test the reliability and validity of the SDQ construct in the e-learning systems field. The reliability and validity of systems quality and information quality in measuring the success of e-learning systems have been tested in previous studies. According to our experiences, however, there are scant studies dealing with the role of IT infrastructure services in the e-learning system field (e.g. Selim (2007) and Ahmed (2010)).

LITERATURE REVIEW

IT Infrastructure Services

The study of Davenport and Linder (1994) is believed to be among the earliest to investigate the role of long-term investment in IT infrastructure in gaining competitive advantage. The findings of the study concluded five components as indispensable aspects of IT infrastructure to boost organizational efforts in achieving competitive advantage: core technologies; technical functionality; business applications; business information and business process support. Broadbent and Weill (1999) proposed three elements of IT infrastructure services necessary to enhance business processes: shared IT services; human IT infrastructure; and IT components. The results identified 23 services which were classified across eight groups based on the nature of the services: application management; communication management; data management; IT R&D; services management; security management; standards management; and IT management. Weill and Vitale (2002) submitted a new initiative which dealt with IT infrastructure services for e-business. The results identified 70 IT infrastructure services for e-business clustered into nine groups: application management (13 services); communication management (7); data management (6); IT management (9); security (4); architecture and standards (20); channel management (7); IT R&D (2) and education (2). Some researchers dealing with IT infrastructure services issues adopted another direction: the flexibility of IT infrastructure, for instance Duncan (1995) and Bhatt et al. (2010).

Soong et al. (2001) studied the critical factors of IT infrastructure services in online courses. The measures of IT infrastructure focused on the software used in implementing the online courses. The measure is limited and insufficient because there are different aspects that should be considered in measuring this construct such as IT education, IT security and risk management, channel management, data management, and application management. Selim (2007) studied critical success factors affecting acceptance of e-learning systems. The results concluded that IT infrastructure was a significant factor affecting e-learning system acceptance. However, the study used a narrow range of measures to gauge this construct (computer access and computer network reliability). A study by Ahmed (2010) concluded that IT infrastructure significantly affected acceptance of hybrid e-learning courses by learners. However, the measure of IT infrastructure used in the study was limited to computer access.

Information System Quality

Considerable work has been done to measure the quality of information systems. Bailey and Pearson (1983) employed four indicators to measure information system quality: convenience of access; flexibility of systems; integration of systems; and response time. Salmela (1997) proposed a model to evaluate the business value of information systems quality. The model was based on four constructs: information system quality; information system user quality; business integration; and business quality. The model can be used in two directions: saving costs and reducing the resources needed in information process to increase the value of information systems; and to enhance the relationship between information systems work quality, user quality and information systems benefits.

Systems quality of electronic systems is deemed to be the key concern encountered by stakeholders. In this regard, Zhang (2005) claimed that "this might cause the 'web-based information systems crisis' like the 'software crisis' forty years ago"(p. 33). Many studies have investigated the quality of e-learning systems and sought to identify the indicators that can gauge this construct effectively. Volery and Lord (2000) investigated critical success factors in online education. Their empirical study concluded that system quality was a key factor in measuring online education. System quality of online education has been measured by two indictors: ease of access in navigation; and interface. Holsapple and Lee-Post (2006) measured e-learning system quality with six indicators: ease of use; user friendliness; stability; security; speed; and responsiveness.

Information Quality

Considerable attention has been paid to information quality. This construct has been included in most of the studies which dealt with information system success. Wang and Strong (1996) developed a framework to measure data quality important to data consumers. From an analysis of the results, it was concluded that there were three categories of data quality: (1) intrinsic: accuracy; objectivity; believability; and reputation; (2) contextual: value added; relevance; timeliness; completeness; and appropriate amount of data; and (3) representational: interpretability; ease of understanding; representational consistency; and concise representation. To measure the Enterprise System Success (ESS) Sedera and Gable (2004) conducted a study. In regard to information quality, they identified six valid dimensions to measure this construct: availability; utility; understandability; relevance; format; and conciseness.

Most of the studies which dealt with e-learning system success have considered information quality as an important construct in measuring success. In the framework of e-learning system design, Holsapple and Lee-Post (2006) argued that information quality is considered a fundamental factor in system design. The subscales which are used to measure information quality were supposed to be the characteristics of the course content such as whether it was: well organized; effectively presented; of the right length; clearly written; useful and up-to-date. Information quality has been used as a necessary factor by Wang et al. (2007) to evaluate enterprise e-learning system success. The results demonstrated that information quality is a valid and reliable construct in measuring success in the context of enterprise e-learning systems.

Service Delivery Quality

Service quality has received substantial attention not just in the marketing field, but also in the information system literature as well. Rockart (1982) is believed to be the earliest researcher who pointed out the role of service quality in information as a Critical Success Factor (CSF).

At the start of the 21st century a new direction in service quality appeared. The focus of this trend is online service quality. Considerable attention is given to the issue of evaluating online service quality. Parasuraman et al. define electronic service quality as "The extent to which a web site facilitates efficient and effective shopping, purchasing, and delivery" (2005, p.5). The first initiative to address this issue in electronic applications was taken by Zeithaml et al. (2000). The main contribution of this study is a scale called E-SERVQUAL. Eleven dimensions have been identified as criteria to evaluate features of web sites. The dimensions were: reliability; responsiveness; access; flexibility; ease of navigation; efficiency; assurance/trust; security/privacy; price knowledge; site aesthetics and customization/personalization.

Service quality delivery in e-learning systems is considered to be a crucial issue because it is an important component in information system success. Holsapple and Lee-Post (2006) considered service quality, besides system quality and information quality, as a critical element in designing e-learning systems successfully. Five indicators used to measure service quality were: promptness; responsiveness; fairness; knowledgeability; and availability. Ozkan and Koseler (2009) employed four subscales to measure service quality: student tracking; course/instruction authorisation; course management; and knowledgeability. Adeyinka and Mutula (2010) suggested a model to evaluate WebCT course content management system success. Service quality was specified as an important construct. The focus of service quality concerned evaluating the support delivered by the course content management team to students. Teaching and learning quality, as well as the quality of tutors' interaction with students, were the main concerns of this variable.

SDQ is considered to be an indispensable challenge encountered by organizations. Shortfalls in SDQ will lead to undesired results with respect to organizational activities, performance and customer satisfaction.

RESEARCH METHODOLOGY

Study Model and Hypotheses

The main use of the causality approach is to discover the nature (positive or negative) and the power (significant or insignificant) of the relationships and effects between the constructs. This approach also can provide results about the indirect effect among the factors (Nishida et al. 2003). Thus, the causality approach has been employed in designing the study model. The model is used to test the effect of each exogenous factor on each sub-dimension of SDQ. Figure 1 depicts the model.

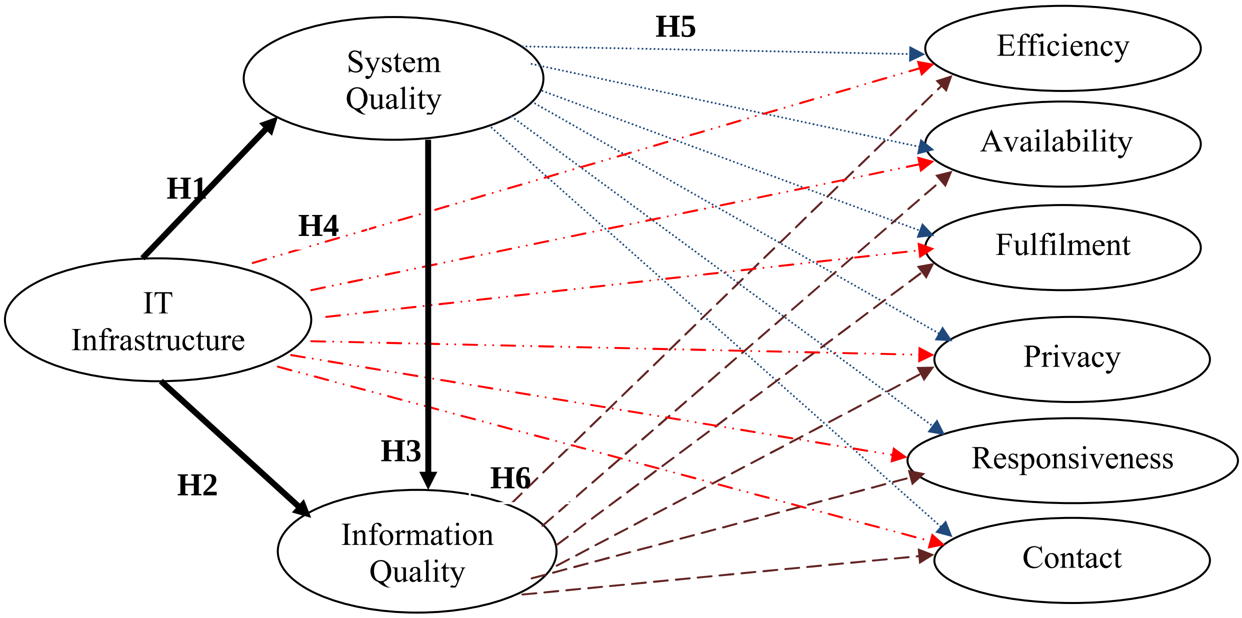

Figure 1: Study Model

The model has been suggested by the researchers to study the effect of IT infrastructure services, system quality, and information quality on the six sub-dimensions of SDQ the e-learning systems arena: efficiency; availability; fulfilment; privacy; responsiveness; and contact. The main justification to select system quality and information quality is that these two constructs are widely used by researchers to measure the success of information systems and e-learning systems. According to the Authors' experience, the impact of IT infrastructure services on sub-dimensions of SDQ has not been examined as yet and this paper aims to investigate this relationship. To test these effects, six hypotheses have been formulated:

H1: IT infrastructure services significantly affect system quality.
H2: IT infrastructure services significantly affect information quality.
H3: System quality significantly affects information quality.
H4: Each sub-dimensions of SDQ is affected by IT infrastructure services.
H5: Each sub-dimensions of SDQ is affected by system quality.
H6: Each sub-dimensions of SDQ is affected by information quality.

Measurement Instrument

A questionnaire was developed to gather the data from the study sample. The items of IT infrastructure services were adopted from Fink and Neumann (2007) who based this instrument on earlier studies (Broadbent et al. 1999; Weill et al. 2002). These items measured six IT infrastructure services: channels management; security; advice and consultancy; communication infrastructure; application infrastructure; and support services. The measures prepared in the study of Sedera and Gable (2004) have been adopted in this study to gauge systems quality and information quality. The reliability and validity of these measures were tested and exploratory factor analysis and confirmatory factors analysis used in preparing those measures (Sedera & Gable, 2004). Eight items are selected to gauge system quality: ease of use; ease to learn; user requirements; system features; system accuracy; flexibility; sophistication; and integration. Five items are used to measure information quality: importance; availability; usability; understandability; conciseness.

The items of SDQ were adopted from Parasuraman et al. (2005). This instrument has two scales: E-S-QUAL which includes efficiency; fulfilment; system availability; and privacy, and E-RecS-QUAL which includes responsiveness; compensation; and contact. The second scale was used by Parasuraman et al. (2005) for the customers who had non-routine encounters with the sites. In this study, the two scales will be used together as one scale, because the students are using the e-learning systems frequently to achieve their educational activities. In addition, contact and responsiveness are considered to be the main elements in providing services in e-learning systems. Students use different electronic channels to keep in touch with academic staff to perform educational activities, receive comments, feedback, and share information with other students. For those reasons, the E-RecS-QUAL has been included in the E-S-QUAL. However, compensation is not included in this measurement model because it is not applicable in the context of e-learning systems. The items used in this study to measure SDQ are distributed as follows: efficiency (4 items); availability (3); fulfilment (4); privacy (3); responsiveness (3); and contact (4). It is worth mentioning that two items to measure the contact dimension were adopted from the study of Ong and Lai (2007), and the two others from Parasuraman et al.'s (2005) instrument.

A pilot test was conducted on the instrument to overcome the problems in the items. The pilot study was undertaken with interviews of three students who studied online. Each student has been interviewed separately twice. The first interview focused on delivering the questionnaire, providing the students with details about the study, explaining the purpose of the interview, asking the students to identify the ambiguous questions, double barrelled questions, repeated questions, and determining the questions not understandable or questions that do not sound right. The second interview was allocated to collect the questionnaire from the students and discuss the problems in the instrument and the suggested solutions to solve these problems.

The relationships between the constructs and their indicators are reflective because these indicators effect and cause the latent construct. Thus, reflective measurement models were adopted in this study.

Research Sample and Data Collection

Students are deemed to be essential stakeholders who have constant touch with this system, and use it frequently. The research was conducted with students who use the e-learning system at USQ, and their opinions will provide a picture of the user experience about e-learning systems. One of the most important reasons to select USQ for conducting the study is that USQ has a large share of the International Distance Education market in Australia. For example, in 2009, USQ held in excess of 45 percent of the Queensland market (University of Southern Queensland 2010). The survey was developed using Survey Monkey and the link sent to 5903 students who were enrolled in online courses via the StudyDesk. The returned questionnaires totalled 732. However, 12 questionnaires were unusable and eliminated from the analysis, yielding 720 useable questionnaires, and the response rate was 12.40%.

THE EMPIRICAL STUDY

Structural Equation Modeling (SEM) was employed in this study to achieve the study purposes. Via SEM researchers can formulate constructs as latent variables, and that provides the ability to extract the measurement error (Stephenson et al. 2006). Four steps are taken to analyse the data.

Step One: One-factor Congeneric Measurement Model

The one-factor congeneric measurement was employed to test the model fit of each construct separately. Confirmatory Factor Analysis is undertaken in this step. This technique is used to identify the items which have a high error variance, the parameters that have a low squared multiple correlation, and to determine items with high modification indices. This stage was conducted until the model fitted. Table 1 shows the results of these analyses. It worth mentioning that the first-order confirmatory factor analysis was conducted on SDQ to examine the model fit. The model fit indices highlighted that all the constructs achieved a good fit.

Table 1. CFA goodness-of-fit indicators of the model constructs

Construct	Input items	Output items	Model Fit indices at the last iteration				
			CMIN/DF	GFI	AGFI	RMR	RMSEA
IT infrastructure services	6	4	13.718	0.947	0.877	0.027	0.133
System Quality	8	4	2.262	0.997	0.984	0.011	0.042
Information Quality	5	4	1.034	0.999	0.993	0.006	0.007
SDQ	20	12	1.971	0.983	0.966	0.016	0.037

Step Two: Exogenous and Endogenous Factors First-order CFA

In the second step, confirmatory factor analysis (CFA) was conducted with all exogenous factors separately, and then same procedure was undertaken with endogenous factors as well. This stage is limited to exogenous constructs because there is only one endogenous construct (SDQ), and the first-order confirmatory factor analysis was conducted on this construct. The results of conducting the first iteration were: CMIN/DF 5.088; GFI 0.942; AGFI 0.912; RMR 0.032; RMSEA 0.075. The modification indices showed that an item of information quality (IQ3) has a high cross loading with other items, and elimination of this item may assist in improving the model fit. The indictors of model fit, after deleting IQ3, were: CMIN/DF 2.739; GFI 0.974; AGFI 0.958; RMR 0.022; RMSEA 0.049. These results confirmed that the model has been improved, and the cross-loading across constructs has been reduced.

Step Three: Testing the Validity and Reliability

After conducting CFA, the reliability and validity of the constructs were tested. The reliability was tested using Squared Multiple Correlation (SMC), Cronbach Alpha, and Coefficient H. The validity was examined by using convergent validity and construct validity. Table 2 shows these indicators.

Table 2. Indicators of the reliability and validity of model constructs

Constructs	Items	SMC	FL	CA	H	Constructs	Items	SMC	FL	CA	H
Efficiency	EFFI1	.708	.789	.822	.843	IT Infrastructure Services	ITIS1	.425	.652	.774	.807
	EFFI2	.687	.878				ITIS3	.464	.681		
Availability	AVA2	.763	.875	.825	.836		ITIS4	.678	.823		
	AVA3	.646	.803				ITIS6	.322	.567		
Fulfilment	FULF1	.658	.787	.745	.739	System Quality	SQ1	.501	.708	.783	.841
	FULF2	.536	.740				SQ3	.633	.796		
Privacy	PRIV2	.550	.745	.720	.720		SQ5	.660	.812		
	PRIV3	.576	.755				SQ8	.382	.618		
Responsiveness	RESP2	.871	.547	.71	.877	Information Quality	IQ2	.531	.729	.817	.829
	RESP3	.301	.933				IQ4	.708	.841		
Contact	CONT3	.687	.831	.822	.822		IQ5	.567	.753		
	CONT4	.708	.839								
(SMC) Squared Multiple Correlation; (FL) Factor Loading; (CA) Cronbach Alpha; (H) Coefficient H											

As the recommended level of SMC is > 0.50 (Kline 2011) a SMC value of 0.30 indicates an acceptable item (Holmes-Smith 2011). Most of the indicators exceed 0.50, and were between 0.501 and 0.871. Five items were between 0.301 and 0.425, still within the acceptable range.

Cronbach Alpha values indicated the reliability of the measurement model, and the values for this indicator were between 0.71 and 0.825. Coefficient H, proposed by (Hancock et al. 2001) has been used as a measure of the construct reliability. The recommended level of Coefficient H is 0.70. The values of this measure were between 0.72 and 0.877, and these values confirm that the constructs achieved a good level of reliability.

The convergent validity is "a measure of the magnitude of the direct structural relationship between an observed variable and latent construct" (Holmes-Smith 2011, p. 9-24). As the recommended value to achieve convergent validity is ≥ 0.70, the result of 0.50 is an acceptable level (Shook et al. 2004). The values of factor loading were between 0.567 and 0.933, and confirm the convergent validity. The indices of goodness of fit measures indicate construct validity. The four constructs in this study have achieved a good fit and the indices provide evidence of the validity of those constructs.

Step Four: Testing the Study Models

The study model, including six hypotheses, has been proposed to achieve an essential objective of the study: to identify factors affecting the sub-dimensions SDQ. Figure 2 shows the result of conducting SEM to test the model. The model has examined the effects of each exogenous factor on each sub-dimension of the SDQ. The indicators of goodness-of-fit model were: CMIN/DF 2.492; GFI 0.9426; AGFI 0.923; RMR 0.024; RMSEA 0.046. Table 3 shows the results of regression analysis of the exogenous factors on SDQ sub-dimensions. The results highlight that IT infrastructure significantly impacted the systems quality and information quality constructs, and systems quality significantly affected information quality. According to these results, hypotheses 1, 2, and 3 are not rejected. IT infrastructure services significantly affected four sub-dimensions of SDQ: fulfilment; privacy; responsiveness; and contact. However, the effect of IT infrastructure services was insignificant with two sub-dimensions of SDQ: efficiency and availability. Four sub-dimensions of service quality were significantly influenced by systems quality: efficiency; privacy; fulfilment; and contact. On the other hand, two sub-dimensions are insignificantly impacted by system quality: privacy and responsiveness. All the sub-dimensions of SDQ, except fulfilment, were significantly affected by the information quality construct.

Based on these results, hypothesis 4 is supported regarding the sub-dimensions of fulfilment, privacy, responsiveness, and contact, and rejected with two sub-dimensions: efficiency and availability. Hypothesis 5 is supported in respect to efficiency, availability, fulfilment, and contact, and rejected with two sub-dimensions: privacy and responsiveness. Hypothesis 6 accepted with all sub-dimensions of SDQ except fulfilment.

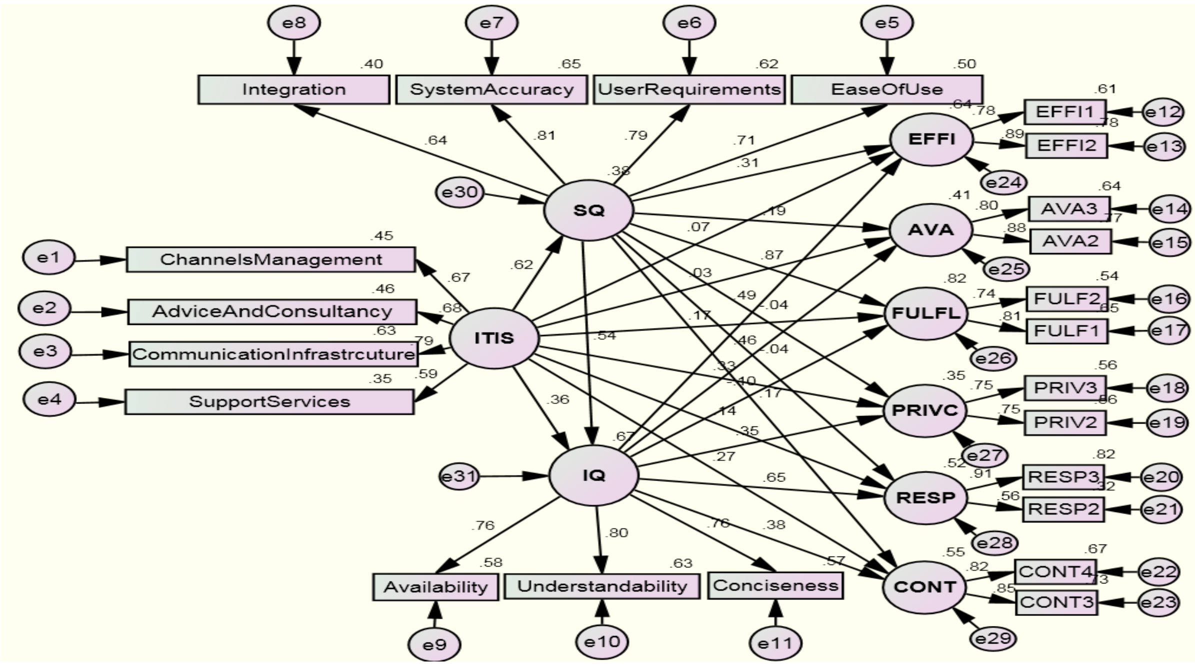

Figure 2: Results from Testing the Study Model

Table 3. Regression analysis results of exogenous factors effects on each sub-dimension of SDQ

Endogenous Factors		Exogenous Factors	Estimate	S.E.	C.R.	P	Effect
System Quality	←	IT infrastructure services	.825	.074	11.152	***	Significant
Information Quality	←	System Quality	.564	.057	9.868	***	Significant
Information Quality	←	IT infrastructure services	.498	.071	7.062	***	Significant
Efficiency	←	IT infrastructure services	.106	.087	1.221	.222	Insignificant
Availability	←	IT infrastructure services	.043	.092	.470	.638	Insignificant
Fulfilment	←	IT infrastructure services	.235	.079	2.984	.003	Significant
Privacy	←	IT infrastructure services	.401	.090	4.432	***	Significant
Responsiveness	←	IT infrastructure services	.236	.100	2.359	.018	Significant
Contact	←	IT infrastructure services	.380	.084	4.555	***	Significant
Efficiency	←	System Quality	.375	.074	5.068	***	Significant
Availability	←	System Quality	.211	.076	2.772	.006	Significant
Fulfilment	←	System Quality	.917	.086	10.687	***	Significant
Privacy	←	System Quality	-.034	.072	-.468	.640	Insignificant
Responsiveness	←	System Quality	-.055	.083	-.665	.506	Insignificant
Contact	←	System Quality	.183	.068	2.706	.007	Significant
Efficiency	←	Information Quality	.572	.084	6.819	***	Significant
Availability	←	Information Quality	.488	.088	5.573	***	Significant
Fulfilment	←	Information Quality	-.099	.075	-1.320	.187	Significant
Privacy	←	Information Quality	.309	.081	3.797	***	Significant
Responsiveness	←	Information Quality	.779	.097	8.033	***	Significant
Contact	←	Information Quality	.393	.076	5.166	***	Significant

***Significant at level 0.001

RESULTS AND DISCUSSION

One of the most important findings is that the critical role IT infrastructure services in enhancing system quality, information quality, and SDQ has been supported. The main role of IT infrastructure services, according to these findings, is to support the e-learning systems in generating information with high quality, and delivering educational services to students effectively. According to the study results, there are four critical services of IT infrastructure affecting e-learning systems: channel management; advice and consultancy; communication and infrastructure; and support services related to e-learning systems.

Availability, understandability, and conciseness were essential aspect to measure information quality of e-learning systems. These aspects are deemed to be important for students to achieve the required educational tasks via electronic channels. For instance, students need to receive some information at the start of course regarding the subjects in this course, course leader/examiner, assignment due dates, examinations, assessment details, and text and materials required in the course. This information should be available to students in a concise and understandable form. During delivery of the course, the aspects above should be considered in the course materials provided to students. These aspects can contribute to sustain the quality of educational services and course materials delivered to students, and create positive feelings for students towards the e-learning systems.

Receiving more details about the effects of each exogenous factor on the each sub-dimension of SDQ is supportive for obtaining worthwhile findings in the e-learning systems field. IT infrastructure services positively affects fulfilment, privacy, responsiveness, and contact, and that lends support to delivering e-learning services with high quality. The availability of a wide range of IT infrastructure services is believed to be the main foundation of delivering lectures, materials, feedback, and answers of students' quires in a suitable time frame. The security of the system is an important requirement of users. One of the most important responsibilities of IT infrastructure services is the security of e-learning systems. The IT infrastructure services can also contribute to enhancing the responsiveness via offering convenient options to the students if they face academic or technical problems. E-learning systems depend on the connection between the services provider and users via multimedia. Adopting e-learning systems requires a wide range of electronic channels, and effective management to sustain and improve these channels. Offering and managing these channels are one of the most important services of IT infrastructure services. The availability of these channels enables students who adopt e-learning to connect with academic staff, other students, and university staff. However, the effect of IT infrastructure services on efficiency and availability was insignificant. System availability is related to correct performance of the technical functions of the system (Parasuraman et al. 2005). The e-learning systems are not different to traditional or electronic information systems, and may face technical problems. The system will not be available to students when it is temporarily suspended for maintenance. The design of the e-learning systems interface (website) may affect system availability if the site is complicated and has too much content. These types of sites need high speed internet connection to load pages, and this aspect may be not available on some devices used to access e-learning services, such as mobile phones. Eefficiency is related to the availability issue. In other words, if the system is not available it will be inefficient and students cannot achieve the required tasks. The issues of efficiency and availability are not entirely related to IT infrastructure services of the university because they depend on the facilities of students. In this regard, Parasuraman et al. state that "companies may not have full control over performance on this dimension (availability); the equipment at the customer's end (e.g., type of computer and Internet connection) is also likely to affect performance on this dimension" (2005 p. 18).

System quality affected four sub-dimensions of e-learning SDQ: efficiency; availability; fulfilment; and contact. The aspects of accuracy, flexibility, less sophistication, and integration of e-learning systems can assist students to perform their educational tasks more quickly and to access the system anywhere. System availability may relate to less sophisticated systems. In other words, if the interface of the system is not complicated students may not need high speed internet connection, and accessing the systems will be easy. The integration of e-learning systems will enable students to do their tasks effectively. EASE is an important software application which supports e-learning at USQ. This software is used by students to submit assignments easily and quickly. The integration between the e-learning system and EASE may support students in submitting their assignment effectively. The flexibility of e-learning systems provides some advantages, for instance availability of different channels of connection can offer different options for students to connect with academic staff and the university. Moreover, the flexibility of systems can provide students with alternative options if there is any problem with the main options.

Information quality impacted five of the six sub-dimensions of SDQ. The aspects of information quality, availability, understandability and conciseness play a critical role in providing students with high quality educational services. The efficiency of services is associated with the ability of students to explain and understand the content of materials. Students cannot obtain the course materials, feedback, or connect with other stakeholders without system availability.

CONCLUSION AND RECOMMENDATIONS

This study aimed to identify the factors affecting SDQ in the e-learning systems field. To achieve this objective, a causal model was proposed. The model was designed to obtain more details about the effects of each exogenous factor on each sub-dimension of SDQ. The sample of the study was 720 university students who use an e-learning system. The essential finding of this study is that IT infrastructure services, systems quality, and information quality significantly impact the SDQ of e-learning systems. Another significant finding is that IT infrastructure services play a critical role in enhancing system quality and information quality, and this construct can be considered as a foundation of delivering high quality educational services.

The main recommendation to the educational institutions who adopt e-learning systems is to pay considerable attention to IT infrastructure services via developing and maintaining these infrastructures. In addition, increase the investment in IT infrastructure services to extend the number and range of these services. Educational services providers should perform regular assessments to evaluate the quality of e-learning systems, information, and services delivered by these systems. Assessments should focus on different stakeholders' perceptions such as students, Academic staff, and ICT staff. For instance, evaluation of e-learning systems should take into account student satisfaction towards service delivery quality of e-learning systems. The survey should identify the students' attitudes toward these services, the factors enhancing satisfaction, and problems and barriers.

In future work, the factors affecting SDQ should be studied with consideration of different points of view, such as students, academic staff, and ICT staff. More attention should be paid to IT infrastructure services and the role of this construct in the success of e-learning systems.

The main limitation of this study is that only one university was surveyed. Conducting the study in many different institutions would be prohibitively costly and time-consuming but is an option for future research.

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