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INVESTIGATING E-LEARNING SYSTEM EFFECTIVENESS IN PAKISTAN: EVIDENCE FROM AN EXTENDED DELONE AND MCLEAN MODEL

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Abstract

This paper employed a quantitative cross-sectional methodology to examine the factors influencing the effectiveness of e-learning systems in Pakistan. The study adopted a survey research design to collect responses from students, teachers, and ICT support staff in urban areas of the Sindh region, Pakistan. An extended DeLone and McLean Information Systems Success Model with additional student training, teacher training, and native language construct guided the study in data collection and analysis. The regression analysis confirmed the positive impacts of student training and teacher training variables on service quality variable, native language construct on information quality variable, information quality, and system quality variables on the dependent variable system use, service quality variable on user satisfaction variable, user satisfaction variable on system use, and system use variable on the dependent variable net benefits. However, the impact of system quality on net benefits failed to be confirmed. The study recommended the capacity-building training for teachers and students, incorporating native languages into e-learning, improving e-learning system operational qualities, technical and real-time support for users, and enhancing user engagement.to enhance the overall user experiences and satisfaction, and the effectiveness of e-learning systems.

Keywords: e-learning, e-learning in Pakistan, effectiveness of e-learning, DeLone and McLean Model, user satisfaction of e-learning

Introduction

E-learning, often known as electronic learning, is an organized course or experience that is given online. It may also provide performance support content. An e-learning program might include a variety of components, including live or pre-recorded lecture content, video, quizzes, simulations, games, activities, and other interactive elements (*What Is E-Learning?*, n.d.).

E-learning has many advantages over traditional learning. E-learning is not limited to place or time. more accessible, e-learning reduces the costs of infrastructure, such as buildings, etc. It increases interactions among learners and instructors, improves knowledge retention, and the use technology powered learning interventions, such as 3d simulations, virtual reality, and augmented reality help learners better comprehend the subject matter. E-learning provides a continuous learning experience (*What Is ELearning? What Every Learning Organization Should Know*, n.d.)

Problem statement:

The outbreak of the COVID-19 pandemic forced academic institutions to close physical academic activities and compelled a quick transition to online learning systems. To mitigate the consequences of this closure and continue the education system, the governments urged institutions to shift to the online education system. Unfortunately, developing countries like Pakistan were not prepared in terms of limited infrastructure support, a lack of teachers, and learners' training to successfully implement the e-learning programs.(Adnan, 2020; Mumtaz et al., 2020) Although this shift occurred, the effectiveness and acceptance of the e-learning system implementations remain uncertain.

This paper builds on previous research on the perceived effectiveness of e-learning in Pakistan, which explores the users' perception of e-learning systems' effectiveness (Khalique et al., 2025). This paper extends the research by emphasizing the relationships between variables to examine the factors that contribute to the effectiveness of e-learning systems in Pakistan.

Aim & objective

- To investigate the factors that influence the effectiveness of e-learning systems.

Literature Review

Delone and McLean's Model is a widely used paradigm for evaluating the performance of information systems in enterprises. The model claims that information system success is a multifaceted concept comprising six facets: system quality, information quality, use, user satisfaction, individual impact, and organizational effect. One of the main characteristics of Delone and McLean's IS Success Model is its capability to provide an integrated framework for analyzing information system success.

(*Delone and McLean's IS Success Model*, n.d.).

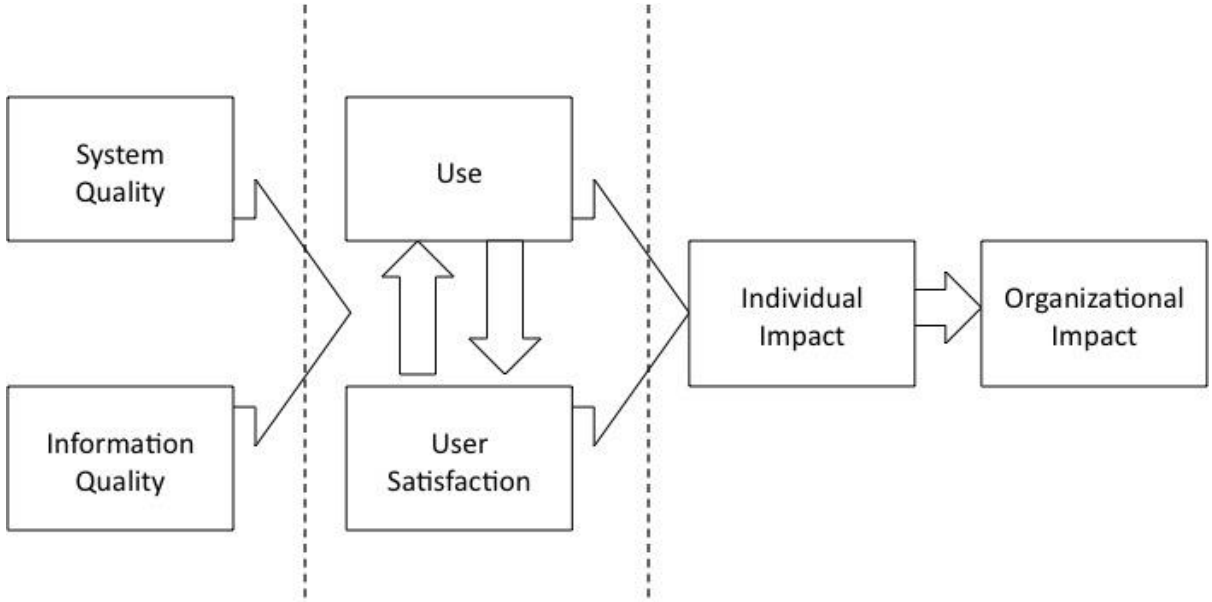

Figure 1. Information Systems Success Model (DeLone & McLean, 1992)

In response to DeLone and McLean's call for further refinement and validation of their model, other scholars extended and applied the model. DeLone and McLean, after 10 years of the initial model, presented an updated IS success model based on an evaluation of the many contributions made to it.

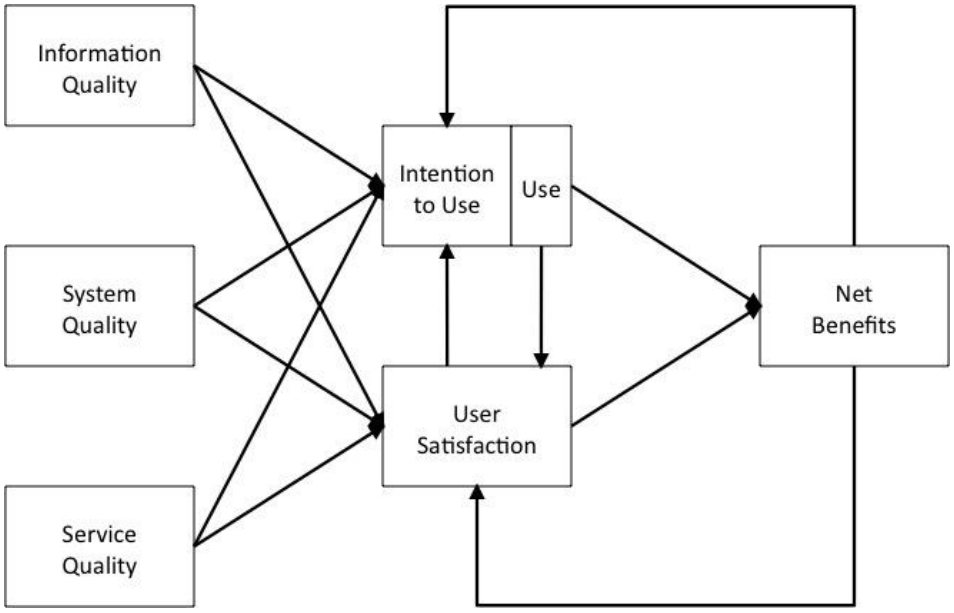

Figure 2. Updated Information Systems Success Model (Delone & McLean, 2003)

The new model is made up of six interconnected elements of IS success: information, system and service quality, use, user satisfaction, and net benefits. The updated model suggests that a system can be evaluated based on its information, system, and service quality; these features influence subsequent use or intention to use, as well as user satisfaction. Certain advantages will be gained from using the system. The net advantages will (positively or adversely) impact user satisfaction and future use of the information system (Nils Urbach & Benjamin Müller, n.d.).

The approach has been extensively utilized in IS research to assess the performance of various IS (Al Naqbi, 2024), such as e-commerce, healthcare, and business systems. According to research, the model can be a useful tool for figuring out what makes IS successful and where it needs to be improved.

Dimensions of IS success

a) Information quality

Information quality is the quality of the data that the system can produce, store, or distribute. It is an important metric used to assess information systems. Information quality affects users' intentions to use the system and their level of satisfaction with it; they both impact how much the system can benefit the user and the business.

b) System quality

The other most important criterion used to assess information systems is their overall quality. By means of mediational linkages between the usage intentions and user satisfaction constructs, system quality indirectly affects how well the system can provide benefits.

c) Service quality

Information systems are frequently assessed based on the quality of services they can provide. Service quality directly impacts system use and the extent of satisfaction with it, both of which influence the system's net benefits.

d) Use/ Intention to use

System utilization and usage intents are influenced by information, system, and service quality. System use is thought to have an impact on a user's satisfaction with the information system, subsequently affecting the system use. In addition to user satisfaction, system utilization directly affects the net advantages that the system may provide.

e) User satisfaction

information, system, and service quality, as well as by the user. User satisfaction has a direct impact on the overall advantages that an information system offers, just like real system utilization. The degree to which a user is happy or satisfied with the information system is referred to as satisfaction, and it is believed to be directly impacted by system use.

f) Net benefits

The net benefits that an information system can provide are a significant component of its overall value to users or the enterprise. The IS success model states that net system benefits are influenced by user happiness and system usage. It is believed that user satisfaction and inclinations to use the system are independently influenced by its advantages.

Research gap

There has been limited empirical research done on the effectiveness of e-learning systems and the D&M model of 2003 in Pakistan. In the past, there was little emphasis on examining the effectiveness of e-learning using the three main D&M 2003 constructs: information quality, system quality, and service quality. Until we improve information quality, system quality, and service quality, we will not be able to increase utilization and user satisfaction in any information system to a greater degree. By examining the effectiveness of e-learning systems, researchers and IS model designers and developers would be able to advance this field in Pakistan and Sindh.

RESEARCH METHODOLOGY

This paper applied a quantitative research methodology. Survey method using a 5-point Likert scale questionnaire was used to collect responses from respondents. The nature of the study was explanatory, and regression analysis using SPSS was used to measure the impact of independent variables on the dependent variables of the framework.

Research Framework and Hypotheses

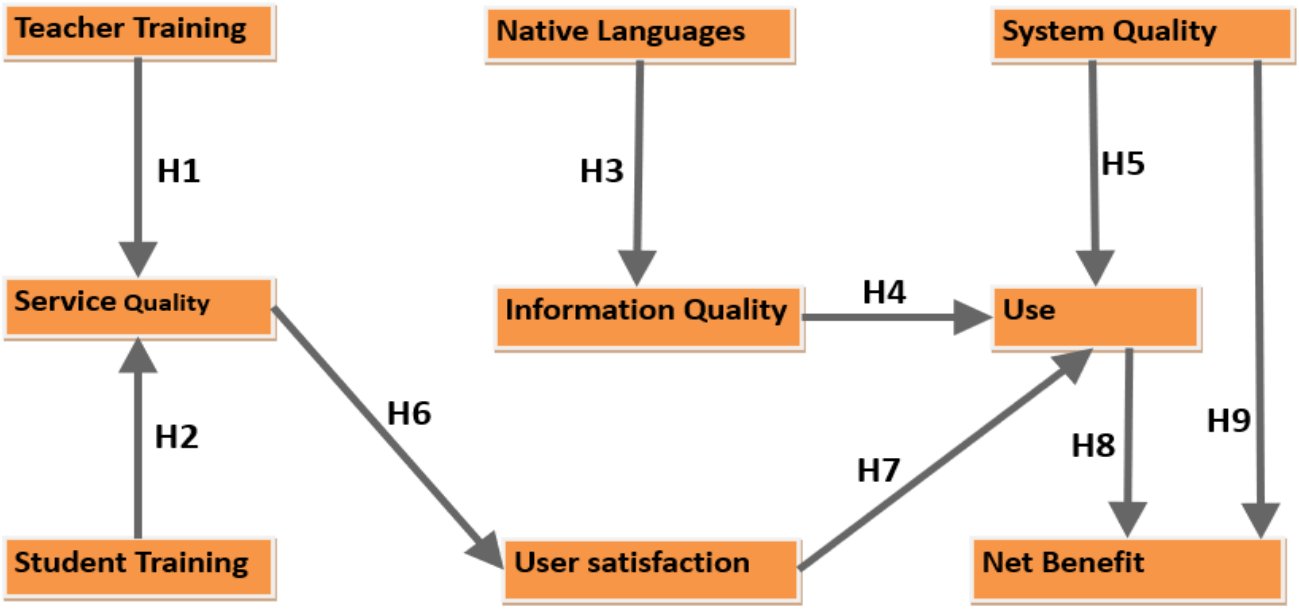

Figure 3. Study framework

Grounded on the DeLone and McLean Information Systems Success Model 2003 with additive factors of student training, teacher training, and native language, the study hypothesized that:

H1. Teacher training has a positive impact on service quality

H2. Student training has a positive impact on service quality

H3. Native language has a positive impact on information quality

H4. Information quality has a positive impact on use

H5. System quality has a positive impact on use

H6. Service quality has a positive impact on user satisfaction

H7. User satisfaction has a positive impact on use

H8. Use has a positive impact on net benefits

H9. System quality has a positive impact on net benefits

Population, Sampling, and Sample

The total population of the study consisted of all the students, teachers, and ICT support staff across the country. From the total population, the target population was those who are from the urban areas of the Sindh region, Pakistan, to complete the research within the limited available resources of time and money.

To select the sample participants, the study focused on those who have e-learning experiences, making them suitable participants. The sample was divided into separate groups based on shared properties such as students, teachers, and ICT support staff. Further, a random sampling method was applied to select the participants from the groups.

Data Collection procedure

The data collection involved the development and validation of a questionnaire. The questionnaire captured demographic information such as respondents' gender, age, qualification, role, and internet experience. Further, the questionnaire contained 5 point Likert scale question which represented that reflected DeLone and McLean's IS Success Model constructs with additional constructs of student training, teacher training, and native language. The questionnaire was made available online using Google Forms, and the link was distributed to social media, targeted Facebook pages, and WhatsApp groups. The same was also sent directly to many students.

Data Analysis

The study used regression analysis to measure the cause and effect of the construct of the study framework to gain an understanding of the factors that influence the effectiveness of the e-learning system in Pakistan.

RESULTS AND DISCUSSION

Reliability Testing

Cronbach's alpha test in SPSS measures the internal consistency. Cronbach's alpha test produces results between 0 & 1. Cronbach's alpha value of 0.7 is generally accepted; in some cases, 0.6 is also acceptable (Ahmed et al., 2023).

Cronbach's Alpha = .946

items = 24

Table 1. Constructs and items

Variable	Items
Student Training	ST1. Students should be trained before using E-Learning systems. ST2. A trained student learns better than an untrained one.
Teacher Training	TT1. A teacher should be trained before using E-Learning systems. TT2. Trained teachers teach better than an untrained one.
Native language	NL1. Learning is easy through electronic devices when it's offered to us in our local languages (Urdu/Sindhi). NL2. E-Learning in local languages makes our concepts clear
System Quality	SQ1. E-learning systems are always available to learn. SQ2. E-Learning systems are always up-to-date. SQ3. E-Learning systems are easy to use SQ4. E-Learning systems provide high-speed information access

Information quality	IQ1. Information from E-Learning systems is easy to understand. IQ2. Information from E-learning systems is formatted well. IQ3. Information from E-learning systems is concise IQ4. Information from E-learning systems is relevant to my work
Service quality	Ser.Q1. The e-learning systems quickly answer user queries Ser.Q2. The e-learning system allows students to discuss some issues with their lecturers. Ser.Q3. The e-learning system enables users to comment and share information. Ser.Q4. The e-learning system has student services representatives available online.
Use	USE1. I frequently use E-learning. USE2. I prefer the use of E-learning to Traditional hard-copy notebook learning.
User Satisfaction	US1. My work with the e-learning system gives me a great sense of personal satisfaction. US2. I feel comfortable using the electronic Learning system for learning and teaching purposes.
Net benefit	NB1 E-learning improves the performance of a student. NB2 Students using e-Learning systems obtain more marks in exams than their fellow students.

Demographics Gender

Table 2. Demographic statistics n=92

Demographic Variable	**Categories**	**Frequency**	**Percentage**
Gender	Male	79	85.87
	Female	12	13.04
	Prefer not to say	1	1.09
Age in years	Up to 25	31	33.70

	Up to 35	53	57.60
	Above 35	8	8.70
Occupation	Student	45	48.91
	Teacher	19	20.65
	Teacher as well as Student	4	4.35
	Government / Private Job	24	26.09
Academic Qualification	Up to 12	13	14.13
	14 Years	26	28.26
	16 Years	46	50.0
	Higher Education	7	7.61
Internet Use in Years	Up to 2	18	19.57
	Up to 5	36	39.13
	Up to 8	7	7.61
	Up to 10 or more	31	33.70

The descriptive analysis of demographic information suggests that the majority of respondents are men; this male dominance is due to males being more easily accessible and willing to engage than males in countries such as Pakistan. Almost half of the responders are students, with the remaining half divided almost equally between teachers and ICT support personnel. Overall, the figures show a sufficient representation of the targeted respondents. Furthermore, the respondents came from a variety of educational backgrounds, ranging from secondary to higher degrees. The majority of responders had 14 or 16 years of education, indicating that they were young. Furthermore, respondents have adequate online experience to convey their opinions on the usefulness of eLearning programs. A considerable 39.13% reported having up to five years of internet experience, while 33.70% reported using the internet for ten years or more.

Overall, the results suggest that the respondents are diverse in gender, age, education, occupation, and internet usage, making the sample suitable to gain a diverse and deeper understanding of the subject matter.

Hypotheses Testing

Table 3. Regression statistics

Hypotheses	**Hypotheses relationship**	**Coefficient**	**P**	**Supported**
H1	TT-->Ser Q.	3.5222	.001	Yes
H2	ST---->Ser Q	4.783	.000	Yes

H3	NL----->IQ	6.466	.000	Yes
H4	IQ--->USE	3.386	.001	Yes
H5	SQ---->USE	3.945	.000	Yes
H6	SQ--->NB	0.046	.963	No
H7	Ser.Q---> US	3.342	.001	Yes
H8	US--->Use	7.236	.000	Yes
H9	Use--->NB	5.008	.000	Yes

The study measured the impact of exogenous variables on the endogenous variables and used $p<0.05$ as a cutoff value.

The regression analysis in SPSS confirms the positive and significant impacts of student training and teacher training variables on service quality variable, native language construct on information quality variable, information quality, and system quality variables on the dependent variable system use, service quality variable on user satisfaction variable, user satisfaction variable on system use, and system use variable on the dependent variable net benefits. However, the impact of system quality on net benefits failed to be confirmed.

CONCLUSION

This study examined the factors that influence the effectiveness of e-learning systems in Pakistan. The study used an extended DeLone and McLean Information Systems Success Model with the extension of student training, teacher training, and native languages.

As indicated by the regression analysis results, the study proved that information quality, system quality, service quality, along with the added factors student training, teacher training, and native language, are predictors of effective e-learning system use and user satisfaction. further the study confirms that the use influences the net benefits of users.

Recommendations

Based on the study findings, the study recommends

- To improve service quality, educational institutions should develop structured, continuous training programs that focus on digital literacy, platform utilization, and online pedagogy.
- Institutions and politicians should incorporate regional languages (such as Sindhi and Urdu) into learning platforms to improve comprehension, accessibility, and participation.

- To enhance system use, institutions should invest in e-learning platforms that are easy to use, dependable, and speedy. Content should be accurate, well-structured, and tailored to the needs of the learners.
- To increase user satisfaction with e-learning systems, users should receive responsive technical support, real-time assistance, and explicit guide methods.
- To maximize net advantages, institutions should include tactics that encourage active usage, such as interactive tools, assessments, and engagement-driven learning methodologies.

The study also suggests that, because the relationship between system quality and net benefits was not substantiated, future work should focus on indirect pathways for system quality's impact on net benefits (for example, through use and satisfaction), rather than direct impact.

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