Need Satisfaction and Net Educational Outcome through Educational Technology in Higher Education: A Modelling Approach

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Abstract

This research has been undertaken to investigate the net educational outcome through the use of educational technologies as perceived by the students of higher education in Kuwait. The Jennex and Olfman'sModel of Technical Quality forms the theoretical basis of the research. The research adopts positivist paradigm of research with an empirical approach (n=226). Eight direct and six indirect hypotheses were tested to find the significance of relationship between the variables of study. The results indicated that system quality had a direct positive relationship with learner satisfaction, service quality had direct positive relationship with both intention to use and learner satisfaction, and learner satisfaction had a direct positive relationship with net educational outcome. It was also found that learner satisfaction had a positive mediating relationship between system quality and service quality, and net educational outcome. These results have led to the implications drawn to the decision makers of higher education in the form of suggestions to improve the effectiveness of educational technologies in higher education. The research could be of interest to both academicians and researchers in educational technologies.

Keywords: system quality, service quality, knowledge quality, learner satisfaction, intention to use, net educational outcome, educational technologies.

1. Introduction

Educational technologies in various form such as text, audio and video through satellite TV, computer based learning, internet or intranet based learning and web learning are becoming popular day-by-day. Educational technology encompasses all the form of Information and Communication Technologies (ICTs) being used in learning. Further, the unavoidable circumstances of work from home due to the recent pandemic COVID-19 has also necessitated learn from home, as social distancing is now being practiced in all walks of life. However, the effectiveness of these educational technologies in comparison with the physical mode of learning has to be studied in details, particularly with the need satisfaction and net educational outcome achievement.

There are theoretical perspectives which enable the deeper understanding of the educational technologies and instructional theory, theory of learning, educational psychology, performance theories, media theories are some of them [1]. Basically, the role of educational technologies is to open avenues for students, teachers and all the stake holders in education for the creation of a healthy and constructive learning environment. The educational technology should continuously expand access to quality education, mediate the communication between educators, provide the resources for knowledge development, and prevent the friction between the stakeholders of education on issues related to education [2]. There is a need to have a close monitoring of the technologies used in education and introduce checks and balances to ensure that the growth of these technologies will be in the right direction, and by and large, oriented towards the advancement of the society towards a sustainable growth.

This necessitates a systematic study of the existing educational technologies to ensure that they serve the purpose for which they have been created. Thus, the following are the objectives of this research.

- Identify the antecedents to the intention to use and learner satisfaction in educational technologies.
- Determine the significance of relationships of intention to use and learner satisfaction in educational technologies with their antecedents.

- Investigate the mediating role of intention to use and learner satisfaction in educational technologies between the antecedents and the net educational outcome, as perceived by the learners in higher education.
- Make suggestions to the policy makers and managers of educational technologies so as to enhance the effectiveness of educational technologies.

2. Literature Review

Educational technology based research studies have been active since 1980s. For instance, Jonassen (1985) [3] emphasized that the goal of educational technologies should not be only to deliver the content and act as a medium between the learners and the teachers, instead be a tool to motivate the learners to develop a desire to become lifelong learners and be self-motivated towards learning and be able to seek knowledge by themselves independently and gain the required skills and knowledge to apply the principles of various educational disciplines. Dooley(1999) [4] proposed a model for educational technology based on the benefits of technologies, instructional management, and professional development of teacher. Mcconatha, Praul& Lynch (2008) [4] performed an empirical assessment of educational technologies based on a sample size of 112 students in higher education and found that the students using educational technologies outperformed those who were on the conventional model of learning.

Jin& Bridges (2014) [5] selected 28 studies on educational technologies in health sciences and found that the technologies of particular significance in outcome achievement with respect to richness in problem or case contexts, student development, medical expertise, dissemination of expert knowledge and skills, collaborative learning and reflective learning. Watty, McKay & Ngo (2016) [6] identified that the educator resistance to technology was the key barrier in the adopting of educational technologies based on the qualitative data collected from higher educational institutes. Ching, Hsu & Baldwin (2018) [7] studied the effectiveness of educational technologies in the context of computational thinking and found that it takes more time both to the students and teachers as students have to invest their time on idiosyncrasies of the technology usage and teachers have to invest time on content development and presentation. However, they opined that the integration of pedagogies with the most appropriate technology can enhance learning effectiveness on the long run. Luckin&Cukurova (2019) [8] have considered the role of Artificial Intelligence (AI) in educational technologies and found that there is a need to build inter-stake holder partnerships between AI developers, educators and researchers. Their claim is that data forms the basis for the success or failure of educational technologies as its analysis can provide information regarding the progressive development of the learning process. Wu, Corr& Rau (2019) conducted a quasi-experiment with 565 chemistry students in higher education and found that the educational technology was effective in providing feedback on student progress and promoted collaborative learning. Abad-Segura et al., (2020) [10] analyzed the sustainability of educational technologies during the period of 2015 to 2019 and found that computer education was the most productive and successful in student collaboration and they concluded that sustainability can be guaranteed in this area. Reinhold et al., (2020) [11] have found that educational technologies in the context of mathematics can help only low achieving students and does not make a major impact on high achieving students.

There are several similar studies on educational technologies; however, the major research gap lies in the lack of empirical investigation in educational technologies focusing on the learner satisfaction and net educational outcome achievement. Filling this research gap would not only pave the way to success of the educational technologies, but also provide guidelines on how a progressive development can be made.

3. Research Methodology

3.1. The Hypothetical Model

The hypothetical model is developed based on the linkages between the variables of interest as established by the earlier researchers.

3.1.1. Linkage between system quality and intention to use. There are several research studies in which system quality (SQL) and intention to use (INU) have been related positively in different contexts (e.g., [12],[13], [14]). Tang, Hsu &Kiet (2014) [15] , using a sample size of 206 e-learners in a technological institute in Taiwan, found that in the context of web based e-learning systems found that the SQL had a positive impact on INU. Calisir et al., (2014) [16] used a sample size of 546 respondents in a web-based learning system in Turkey and found that SQL had an influence on INU through the mediating role of perceived ease of use and attitude towards the usage. Ramayah, Ahmad & Lo (2010) [17] collected data from 1616 students from public universities in Malaysia and found that SQL was a strong predictor of INU.

There are several such studies which have established relationships between these two variables; however, there is no research evidence in the context of educational technology usage in higher education in Kuwait, and hence, the following hypothesis has been postulated.
H1: System quality has a direct positive relationship with intention to use.

3.1.2. Linkage between system quality and learner satisfaction. Almahamid& Rub (2011) [18], using a sample size of 188 students from Petra University in Jordan, established a relationship between SQL and LNS. Alshare et al., (2011) [19], adopted the structural equation modelling using a sample of 674 college students in an online course found that SQL had a positive relationship with LNS. Yu, Chang & Chen (2018) [20] have taken a different approach through the use of a fuzzy linguistic scale and taking the case study method applying in a university of science and technology in the context of e-learning. The sample size was 406 student using e-learning platform and questionnaire survey was used for the collection of data. The result of the study was that the outcome was in agreement of the 86% of the earlier studies which had established a strong positive relationship between SQL and LNS. There are many other research studies linking these two variables in many different contexts such as e-learning, web usage, online purchase etc., (e.g., [19], [21],[22],[23], [20]). However, more research is required to establish the positive relationship between these two variables in the context of the use of educational technology in higher education, and hence the following hypothesis is postulated.
H2: System quality has a direct positive relationship with learner satisfaction.

3.1.3. Linkage between knowledge quality and intention to use. Yun (2013) [24] used a sample size of 245 nurses randomly selected from five hospitals in Seoul to test the influence of the knowledge quality (KNQ) of the available technological support in the form of knowledge management system (KMS) on their intention to use (INU) the system in the healthcare sector. The results through multiple hierarchical regression analysis indicted that while the informatics competency of nurses played a major role KNQ was found to be the significant predictor of the INU the KMS. Behnam et al., (2020) [25] applied the same concept to the INU the sports services in the Urmia University, Iran with a random sample of 686 students and found that the two variables were positively directly related to each other. Sun et al., (2008) [26] conducted a survey based research using a sample size of 295 in Taiwan to identify the factors which influence the intention to use (INU) e-learning resources in 16 different courses of MBA and found that the knowledge quality (KNQ) in the form of the content of the e-learning course was one among the critical factors. There are many such studies which have established the relationships between these two variables in various other contexts from e-learning to online shopping (e.g., [16], [25], [27],[28], [29]) however, more research is required to establish this relationship in the context of educational technology usage in higher education, and hence the following hypothesis is postulated.
H3: Knowledge quality has a direct positive relationship with intention to use.

3.1.4. Linkage between knowledge quality and learner satisfaction. Johnson, Aragon & Shaik (2000) [30] conducted a comparative study between the conventional undergraduate study and online mode of study in Midwestern University in the United States and it was found that in both the cases the students had considered knowledge quality (KNQ) to be one of the important factors influencing the learner satisfaction (LNS). Li, Marsh &Rienties (2016) [31] adopted modelling and simulation approach to study the influence of the antecedents of learner satisfaction using the data of 62,986 undergraduate students in 401 undergraduate online modules. While learner characteristics were found to be important, it was revealed that the KNQ available had a significant bearing on learner satisfaction. There are many such studies where KNQ has been found to be an important predictor of LNS in many different contexts (e.g., [32], [33],[34], [35]). However, the relationship between these variables has not been tested in the context of the use of educational technology and hence the following hypothesis has been postulated.
H4: Knowledge quality has a direct positive relationship with learner satisfaction.

3.1.5. Linkage between service quality and intention to use. Oghuma et al., (2016) [36] using sample size of 334 mobile instant messaging users in South Korea found that the perceived service quality (SVQ) of the users as well as the usability affected the intention to use (INU). In another study in South Korea with a sample size of 1189 customers, Park, Lee, Kwon &Pobil (2015) [37] have established the same relationship in flight service quality. Qutaishat (2013) [38] in the context of e-government services in Jordan, with a sample size of 211, proved that SVQ had a positive effect on INU. Shiau& Chau (2016) [39] conducted a research in cloud computing classroom using six theoretical models dealing with INU and also developed and integrated model by combining these six models. The sample size was 478 students who were using cloud computing classrooms.

The results indicated that all the six models had a significant predictive power and the integrated model provided the empirical proof to the fact that SVQ is an important predictor of SVQ. There are similar studies in many other contexts which have provided proof for the relationship between these two variables (e.g., [40], [41][42]. [43]). However, there are not many studies in the context of educational technology in this direction and there is a need to provide an empirical evidence to this relationship and hence the following hypothesis is postulated.

H5: Service quality has a direct positive relationship with intention to use.

3.1.6. Linkage between service quality and learner satisfaction. It is revealed through hypothesis testing that the learner's intention to use the educational technologies is mainly governed by the service quality and this finding is in alignment with many of the earlier researchers (e.g., [36], [37] [39], [40], [42],).Asoodar, Vaezi&Izanloo (2016) [44] conducted a research exclusively to study on learner satisfaction (LNS) in the context of e-learning using a sample size of 600 in Science and Technology Campus of Virtual University in Iran and found that service quality (SVQ) was a major contributor to the LNS. Pham et al., (2019) [45] studied SVQ in the context of e-learning as a second order construct comprising - system, instructor and material quality, with a sample of 1232 students from a university in Vietnam, and found that system quality was the prime predictor of LNS followed by the instructor quality. Zhai et al., (2017) [35] studied the learner satisfaction in flipped classroom model using 178 undergraduate students in a flipped English classroom in China, It was observed that the perceived service quality as a first order dimension was a mediator with significant impact. Hamid & Nick (2019) [46] performed a comparative research on the service quality of private versus public distance education in Malaysia using a sample size of and found that learner satisfaction differed significantly in the two with a sample size of 640 students. While significant influence of SVQ on LNS was observed in both the cases, public distance education outperformed the private distance education. There are many research studies which have linked SVQ and LNS in many different contexts (e.g., [32], [47],[48]) Most of the studies are either dealing with specific dimensions of service quality and are mainly in the context of banking, tourism, and hospitals and more need to be done in the higher education and hence the following hypothesis is postulated.

H6: Service quality has a direct positive relationship with learner satisfaction.

3.1.7. Linkage between intention to use and net educational outcomes. Intention to use (INU) has the potential to enable the user to achieve the desired outcome in any situation of technology usage in general. Alenezi& Karim (2010) [49] have undertaken a research in Saudi Arabian governmental universities to find the enjoyment, curiosity to use computer, computer savvy nature and online experience in influencing the students' intention to use e-learning with a sample size of 402 students and found that students' attitude plays a vital role behind the INU which may lead to the achievement of the desired outcomes. There are more number of studies directed towards the understanding of the factors contributing to the INU than its role in outcome achievement (e.g., [50],[51], [52]). However, there are studies which have made an attempt to find the bearing of INU on outcome achievement. Tey& Moses (2018) [53] used a sample size of 600 and found that the students' achievement orientation and goal directed would promote the INU and help them better the achievement of net educational outcomes (NEO). Snead & Harrell (1994) [54] have used expectancy theory as the basis to explain why INU any form of a device or technology can potentially lead towards the outcome achievement among the managers in the organization. Chen & Wu (2020) [55] using a sample size of 47 provided empirical evidence to the fact that perceived usefulness as well as attitude towards use positively influences the intention to use which in turn can enable the outcome achievement in the context of IT-integrated mathematics remedial course. Joo, Park & Lim (2018) [56] with a sample size of 296 from 3 Korean universities to study the relationship between teacher self-efficacy, perceived ease of use, and perceived usefulness and found that INU has bearing on outcome achievement. While there are many such studies, in the context of educational technologies the relationship between INU and NEO is yet to be explored fully and hence the following hypothesis is postulated.

H7: Intention to use has a direct positive relationship with net educational outcomes.

3.1.8. Linkage between learner satisfaction and net educational outcomes

Chae, & Shin (2016) [57] has associated the learner satisfaction (LNS) through the tutoring styles with net educational outcome (NEO) achievement through a sample size of 818 students in a e-learning class in Korea. Johnson, Aragon & Shaik (2000) [30] have undertaken a comparative analysis of face-to-face learning and online learning and found that in several measures of learning outcome achievement there was no difference between the two forms of learning. Green, Inan& Denton (2012) [58] conducted a study on the learner

satisfaction in the context of educational outcome achievement and found that the technical assistance is the main factor contributing to the learner satisfaction which can help in educational outcome achievement. There are many other studies which have established the linkage between these two variables and to study the relationship between these two variables in the context of educational technologies the following hypothesis is postulated.

H8: Learner satisfaction has a direct positive relationship with net educational outcome.

In addition to these variables, the research has also made an attempt to find the indirect relationships in the following form.

H9: Intention to use has a direct mediating relationship between system quality and net educational outcome.

H10: Intention to use has a direct mediating relationship between knowledge quality and net educational outcome.

H11: Intention to use has a direct mediating relationship between service quality and net educational outcome.

H12: Learner satisfaction has a direct mediating relationship between system quality and net educational outcome.

H13: Learner satisfaction has a direct mediating relationship between knowledge quality and net educational outcome.

H14: Learner satisfaction has a direct mediating relationship between service quality and net educational outcome.

The hypothetical model is shown in Figure 1 which depicts the linkages discussed in the previous sections.

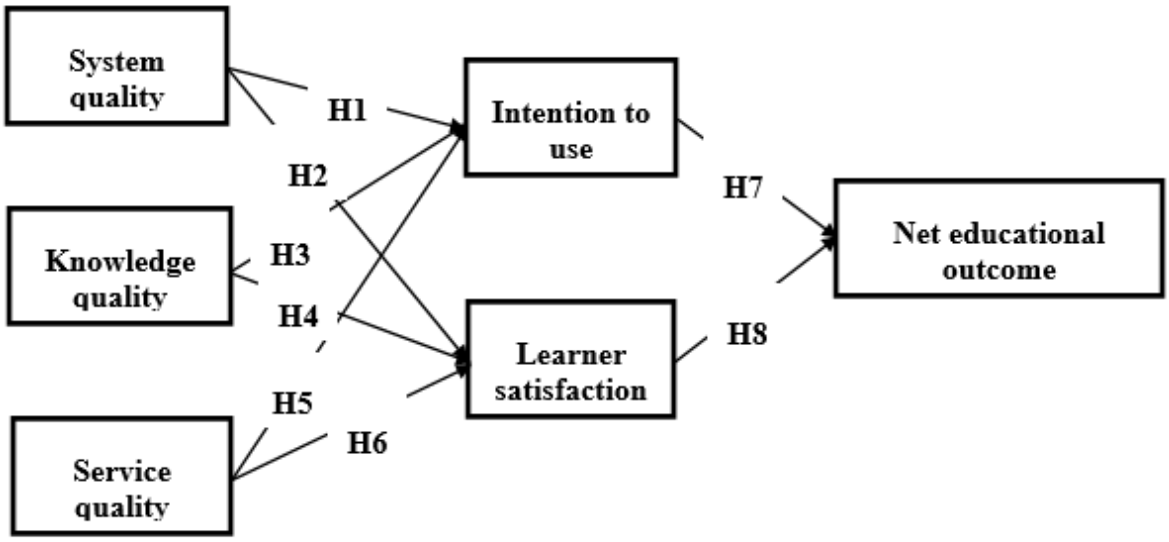

Figure 1: Hypothetical Model

3.2. The Questionnaire Development

The questionnaire development and validation was through the standard procedure and the Table 1 shows the dimensions, main components, items used in the questionnaire and the contributing authors. System quality has two distinct components: level and form. Level includes completeness of the search in the technology used and effectiveness of knowledge base and the linkages provided in the search. Service quality has to be measured in terms of the resources and encouragement provided to the students to make use of the educational technologies. Resources are mainly in the form of the technical support and allowance for the dialogue between the students and the faculty or the service providers. Encouragement for the use of the educational technologies should come from all the stake holders in education which includes peer group, faculty, parents, and by and large by the whole society. There must be encouragement for the knowledge sharing between the faculty as well as students. Also, there must be encouragement for online discussions among the students under the faculty supervision. Knowledge or information quality of the educational technology mainly includes richness and linkages. Richness refers mainly to the relevance of the material in the educational technology systems, the ease of understanding of the resources, and the adequacy of the available knowledge, the context of the resources with reference to the courses, and currency which refers to the state of being commonly known.

User satisfaction in the context of educational technology has been renamed to learner satisfaction as the very purpose of educational technologies is to meet the educational requirements of the students or the learners. The learner satisfaction is in terms of utilization and knowledge application. Utilization refers to the effectiveness of dissemination of knowledge and application of the knowledge should be in the form of direct applications, decision making, problem solving, and the ability to develop reasoning and questioning of the rules and routines in order to understand why and how they are important in building of knowledge with the society on the focus. Intention to use or the perceived benefits refers to the capability and usefulness of the systems. Capability could be in the form of its self-efficacy and the ability to enhance the cognitive ability of the learners. Usefulness could be in the form of the tendency to learn and perceived usefulness of the educational technologies. Net benefits in the context of this research is changed to net educational outcome because in an outcome based system of education the ultimate benefit to the students will be in the form of how the educational technologies help the students in the outcome achievement of the courses.

Table 1: Jennex & Olfman's KMS success model dimensions and related items

Dimensions	Component Items	Items in the questionnaire	Contributing authors
System Quality (SQL)	**Level** Completeness of search, Effectiveness -knowledge base, Effectiveness - linkage, Speed of retrieval, Ease of search, Reliability **Form** Computerization, Integration	The system allows for adequate information searches. The system allows adequate people searches. Searching for sources of knowledge base through the system is easy. The search function of the system is easy to use. The system allows finding most of the organizational information online. The speed of information retrieval is quite adequate. The system is quite reliable. The system provides all the necessary knowledge sources required for my course. There is a need to access more than one system to locate the needed information (N).	[59],[60], [61], [62], [63],[64], [65], [66], [67], [68], [69].
Service Quality (SVQ)	**Resources** Technical support: Allow sufficient time for dialogue **Encouragement** from peers: from supervisor, Endorse knowledge sharing, Encourage online discussion	Students are encouraged to engage in online exploration and experimentation by the faculty. Students are provided all the support to make the effective us of educational technology. The institution actively endorses knowledge sharing. The institution encourages online discussion of new ideas and working methods. There is sufficient time available to engage in dialogue online with faculty members about important problems and solutions. There is specific person (or group) available to help when faced with difficulties with the system tools. The system often encounters problems and crashes (N).	[64], [69], [70], [71],[72], [73], [74],[75], [76], [77].
Knowledge/ Information Quality (KNQ)	**Richness** Relevance, Understandability, Adequacy, Contextuality and Currency **Linkages** Completeness, Accuracy, Current	The system provides information/knowledge that uses recognized vocabulary rather than highly specialized terminology. The system provides up-to-date information/knowledge. The knowledge portal of the system links to a complete collection of documents and data. The content in the system is quite relevant. The content in the system is easily understandable. There are adequate number of examples and exercises available in the system content. The knowledge provided in the system is not accurate (N). The organization keeps updating its knowledge portal so that the latest knowledge is available to students.	[64], [69], [78].[79], [80],[81], [82], [83], [84], [85], [86], [87], [89].

Use/UserSatisfaction changed to Learner satisfaction (LNS)	**Utilization** Distribution/dissemination **Knowledge Application** Decision making and problem solving Questioning rules and routines	The system helps me in carrying out all the course requirements. The knowledge from the system helps me in decision-making and problem-solving tasks. The dissemination of knowledge is very effective. The system promotes my questioning and reasoning ability. My educational objectives are met by the system. I have got more than what I had expected from the system. The system does helps me in achieving the course outcomes (N). The knowledge from the system is useful in searching and exploring alternatives.	[64], [69], [90], [91], [92], [93], [94], [95],[96], [97].
Intention to Use / Perceived Benefit (INU)	**Capability** Self-efficacy, Cognitive capability **Usefulness** Willingness to search, Tendency to analyse, perceived usefulness	The system can be operated without the help of anybody. It is easy to use the information/knowledge found in the system. I am deriving several benefits out of the system related to my course outcome achievement. I find the system to be quite useful. The system does not promote my desire to learn (N).	[64], [69], [77], [98], [99], [100], [101], [102], [103], [104], [105].
Net Benefits changed to Net Educational Outcome (NEO)	**Change** Cognitive change, Behavioural change **Performance** Better decisions, Fewer mistakes, Better experience transfer/knowledge, Reuse, Better cycle time	The system has brought cognitive changes in me. The system has induced behavioural changes in me. The system has helped me in making better decisions. I am convinced that the system can guarantee the course outcome achievement. The system has enabled me to get better grades. The system helps me in reducing the mistakes which are likely while learning. The system enhances my analytical skills. The system does not allow faster educational outcome achievement (N).	[69], [100], [106], [107],[108],[109], [110], [111], [112], [113], [114], [115].

3.3. Sample Design

This research is based on a sample size of 226 students in higher education making use of educational technologies. The sample selection is purely based on purposive sampling and the students have been chosen purposely for their experience in the usage of educational technologies. The sampling frame was the list of students in bachelor degree programme in Kuwait and the sampling unit was an individual student. Non-probability based sampling method has been used in this research as the research demanded the selection of a sample purposely for a given problem situation of issues related to the use of educational technology.

The sampling plan was designed in the form of online data collection by reaching to the students through google forms and the forms were posted until the desired sample size was reached. As a basis rule in structural equation modelling (SEM) the thumb rule of the sample size was at least ten times the number of items in the questionnaire. So, based on this rule the sample size estimate was 180; however, the research used 226 samples.

4. Analysis and Discussion

The analysis was carried out using Structural Equation Modelling essentially comprising measurement model – that provides the reliability and validity of the study (descriptive statistics), and structural model – that enables the hypothesis (inferential statistics) [116].

4.1. Measurement Model

The demographic distribution of the respondents was in terms of their gender, age, and educational qualification. In terms of gender there were 56% female and 44% male student. Age wise 65% were bachelor degree students, 30% were master's degree students, and the remaining were doctoral students. There were

70% bachelor degree students, 20% master's degree students and the rest were doctoral degree students. The principles of Structural Equation Modelling (SEM) necessitates the use of at least two indicators to measure the latent variable [117]. However, in this research three indicators have been used for each of the latent variables based on the relative importance of these variables. The reliability and validity of measurement has been given in Table 2. The Cronbach's Alpha values range from 0.7 to 0.9 indicating moderate to high reliability (cut off = 0.6)[116]. Another measure used for reliability check is the composite reliability, the values of which range from 0.8 to 0.9 indicating moderate to high reliability (cut off = 0.6)[116]. Dillon-Goldstein's rho_A is the third measure of reliability of the data and the values ranging from 0.7 to 0.9 suggest unidimensionality of the variables [118], where it can be concluded that all the factors are unidimensional and unique. In addition the convergent validity of the variables is measured through Average Variance Extracted (AVE) the cut off value of which is 0.5 which indicates that at least 50% of the variance of the observed variable is explained by the construct under consideration [118]. In this research as the values of AVE are ranging from 0.6 to 0.8 (table 4) which indicates that the variables have a high convergent validity. Convergent validity that indicates that the factors associated to the research variable are representing the variables to the required extent is measured through the factor loadings. In the present case the factor loadings range from 0.8 to 0.9 (Table 3), which indicates adequate convergent validity (cut off 0.7) [118]. Further the path coefficients show the strength of relationships (effective connectivity) between variables [116]. In the present case the path coefficients vary from 0.1 to 0.6 indicating that the variables have the potential to increase from 10 percent to 60 percent with the change of values of the exogenous variables of study. The final measure of validity of the study is through the discriminant validity that is established through the condition that the square root of AVE of each item should be greater than its inter-item correlation with the rest of the variables. It can be observed that (Table 4) the AVE values (shown in bold) are higher than the inter-item correlations of the variable with rest of the variables, and hence, the measurement has the required discriminant validity. All these indices of the measurement model indicate that the required reliability and validity of the data and its measurement has been attained. Finally, the goodness of the fit of the model is indicated by the R^2 values of the endogenous variables which is an indicator of the influence of the exogenous variables on the endogenous variables. In the present case the R^2 values for the three endogenous variables, namely, intention to use, learner satisfaction and net educational outcome are 0.480, 0.414 and 0.235 respectively. Thus, it is indicated that percentage influence of exogenous variables on the endogenous variables vary from 23.5 percent to 48 percent which is which is quite adequate (cut off value 10%)[118].

Table 2: Reliability and Validity Indices

	Cronbach's Alpha	**rho_A**	**Composite Reliability**	**Average Variance Extracted (AVE)**
INU	0.74	0.75	0.85	0.66
KNQ	0.79	0.88	0.87	0.70
LNS	0.74	0.75	0.85	0.66
NEO	0.85	0.88	0.91	0.77
SQL	0.79	0.83	0.88	0.70
SVQ	0.71	0.74	0.84	0.63

Table 3: Factor Loading

	INU	KNQ	LNS	NEO	SQL	SVQ
INU1	0.85					
INU2	0.77					
INU4	0.81					
KNQ2		0.81				
KNQ3		0.80				
KNQ4		0.89				
LNS2			0.84			
LNS3			0.81			
LNS4			0.79			
NEO1				0.85		
NEO2				0.89		
NEO4				0.89		
SQL1					0.82	
SQL2					0.87	
SQL3					0.83	
SVQ2						0.73
SVQ3						0.79
SVQ4						0.86

Table 4: Inter-item Correlation with Average Variance Extracted

	INU	KNQ	LNS	NEO	SQL	SVQ
INU	**0.81**					
KNQ	0.38	**0.84**				
LNS	0.62	0.40	**0.81**			
NEO	0.34	0.45	0.48	**0.88**		
SQL	0.39	0.47	0.45	0.45	**0.84**	
SVQ	0.68	0.42	0.60	0.41	0.42	**0.80**

4.2. Structural Model

Hypothesis testing is enabled through the structural model in the Structural Equation Modelling (SEM). In this research there were eight direct relationships and six indirect relationships which were to be tested. The following hypotheses are supported (Table 5 and Figure 2):

Direct Relationships

H2: System quality has a direct positive relationship with learner satisfaction.

H5: Service quality has a direct positive relationship with intention to use.

H6: Service quality has a direct positive relationship with learner satisfaction.

H8: Learner satisfaction has a direct positive relationship with net educational outcome.

Following indirect relationship testing hypotheses were supported (Table 6).

H12: Learner satisfaction has a direct mediating relationship between system quality and net educational outcome.

H14: Learner satisfaction has a direct mediating relationship between service quality and net educational outcome.

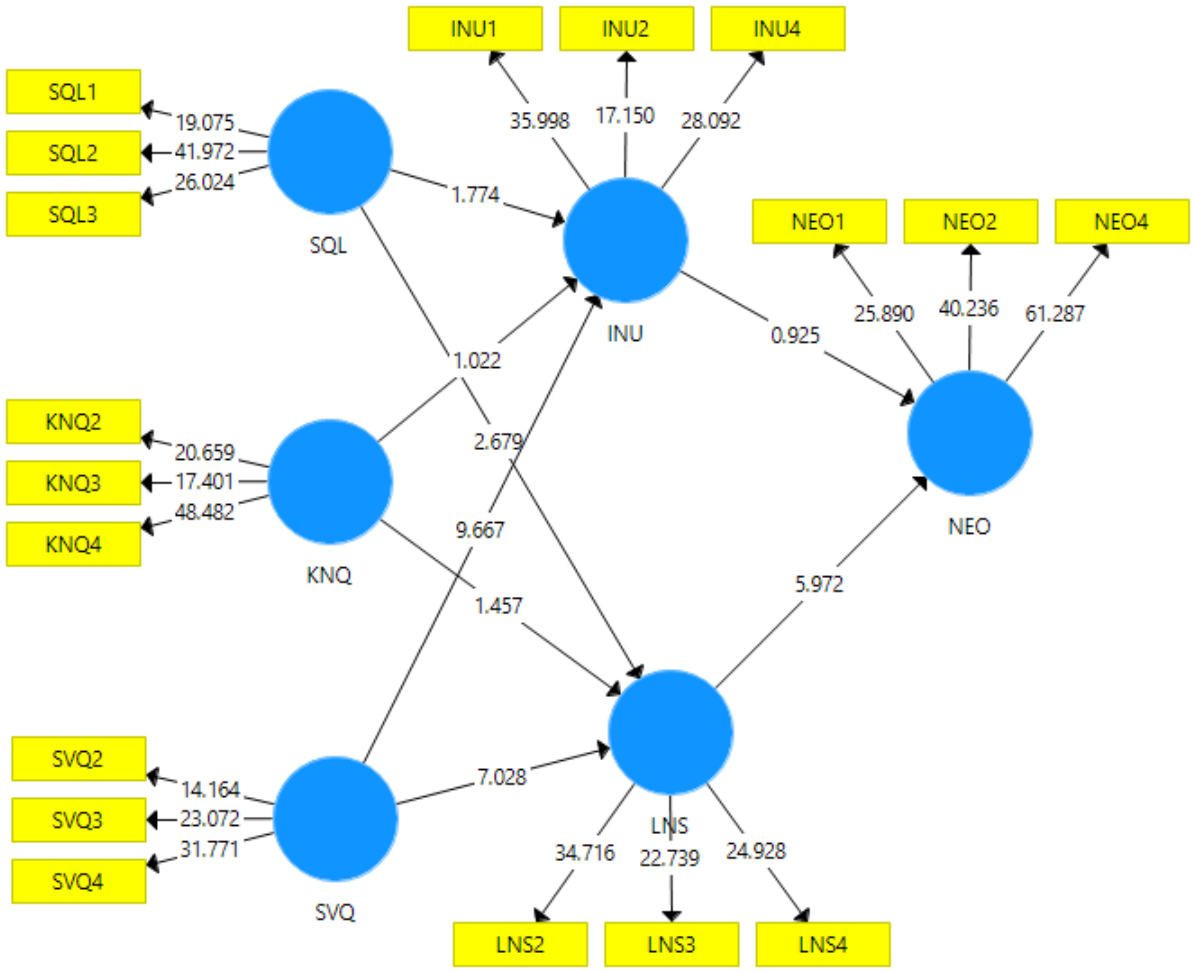

Figure 2: The Structural Model

Table 5: The t-statistics (Direct relationships)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Hypothesis
INU -> NEO	0.07	0.08	0.08	0.93	0.36	Not supported
KNQ -> INU	0.08	0.08	0.08	1.02	0.31	Not supported
KNQ -> LNS	0.11	0.11	0.08	1.46	0.15	Not supported
LNS -> NEO	0.44	0.44	0.07	5.97	0.00	Supported
SQL -> INU	0.10	0.10	0.06	1.77	0.08	Not supported
SQL -> LNS	0.21	0.21	0.08	2.68	0.01	Supported
SVQ -> INU	0.60	0.61	0.06	9.67	0.00	Supported
SVQ -> LNS	0.47	0.47	0.07	7.03	0.00	Supported

Table 6: The t-statistics (In-direct relationships)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
KNQ -> INU -> NEO	0.01	0.01	0.01	0.52	0.60
SQL -> INU -> NEO	0.01	0.01	0.01	0.71	0.48
SVQ -> INU -> NEO	0.05	0.05	0.05	0.89	0.37
KNQ -> LNS -> NEO	0.05	0.05	0.04	1.35	0.18
SQL -> LNS -> NEO	0.09	0.09	0.04	2.29	0.02
SVQ -> LNS -> NEO	0.20	0.21	0.04	4.66	0.00

The direct relationship testing has revealed that system quality and service quality have a significant positive relationship with learner satisfaction. The results are in agreement with some of the earlier studies (e.g., [18],[19], [20],[22]) and also it is in disagreement with some of the studies which have established the linkage between knowledge quality and learner satisfaction (e.g., [32],[30], [32]). While it cannot be considered that knowledge quality is not important as the hypothesis is not supported the revelation is that in the context of present study, the system quality and service quality are more critical in providing learner satisfaction. Finally, it is found through the hypothesis testing that learner satisfaction has a direct positive relationship with net educational outcome which is again in agreement with the findings of a group of researchers (e.g., [30], [57], [58]).

While the direct relationships are important to decide on the variable which needs to be controlled to obtain a better result on a variable of interest, the mediating role played by a variable is also important as it has an intermediate role to play. In this research it has been revealed through hypothesis testing that system quality and service quality can enable learners to achieve the net educational outcome successfully through the mediation of learner satisfaction. In other words, among the variables of interest to this research, enhancing the learner satisfaction has to be the focus of educational technology implementation team in higher education.

5. Implications to Educators

Hypothesis testing has enabled the identification of the critical variables having bearing on the educational outcome achievement of students in higher education. This can be a major source for drawing implications to assist the educators who have embarked into the implementation of educational technologies to enhance the effectiveness of pedagogical aspects in higher education. Following are the specific suggestions to the educators:

- The team managing educational technologies may consider measures to enhance the system quality of the educational technologies that affect the learner satisfaction significantly. The system quality of the educational technologies has three distinct components: technical capabilities, form of operations management, and level of operations management [119]. Measures to enhance technical capabilities could be in the form of upgradation of ICTs on a regular basis so that the learners will be able to access the information and knowledge they require at the highest speed and can build communities of practice and forums to exchange valuable knowledge and apply it to create more knowledge in the form of published material, projects, intellectual property development and research and development activities. The second component, namely, the form of operations management has to be revised on a periodic basis to meet the changing needs of the learners. Form refers to the computerization and integration of the processes involved in pedagogy. A highly skilled team of educational technology developers and academicians has to be formed to decide on the computer interventions on all possible aspects of learning through the capturing of the data and presenting them in audio-visual forms for easy comprehension of the learners. The third aspect, namely, the level refers to the ability to use the historic data to current situations. This is where the earlier work undertaken by the students not only in the university, but also across the universities in the world should be made available to the use of the learner without infringing on intellectual property rights. The challenge lies in separating the past data, information and knowledge which would is obsolete and filter the one which is relevant in the current context. Again, a teamwork between the experts of educational technology developers and academicians could pave the way to success.

- Through the hypothesis testing it was revealed that service quality provided in the educational technologies is a very critical variable which is more important than the aforementioned system quality because it can influence both the intention to use educational technologies as well as the learner satisfaction obtained through the usage. Service quality is a very widely researched area when it comes to service rendered by professionals, but it is not the case when it comes to the technologies. There is a need to conduct more research specifically focused on the service aspects of educational technologies. There are two distinct models of service quality measurement, namely, SERQUAL and SERVPERF and while the former is based on the service expectation and performance the latter based on performance [120]. Both the models have relative advantages as well as disadvantages; however, a performance based approach could be of more use in the context of educational technologies and the sole purpose of it is to enable the student demonstrate higher level of educational outcome achievement. The recommendations to the educational experts is that they take stock of the tangibles, responsiveness, reliability, assurance, and empathy components involved in the imparting of education through educational technologies and use it for quality enhancement periodically. The evaluation scores on these dimensions could be used in the performance appraisal of the professors in higher education so that there could be a continual improvement in the module delivery. Both the qualitative and quantitative assessment of service quality could add value to the process of quality enhancement of educational technologies.
- The third revelation of the study through the hypothesis testing is that learner satisfaction has not only a direct positive relationship with the net educational outcome achievement, but also is a significant mediator variable between both system quality as well as service quality and the net educational outcome achievement. It goes without saying that the educational technologies will not remain in business if they do not meet the requirements of learner satisfaction. So, the educators need to study the dimensions of leaner satisfaction and fine tune the system quality and service quality of the educational technologies to meet the requirements. Even though knowledge quality has not been identified as the variable as critical as system and service quality in this research its importance also cannot be undermined. The indication was only that system quality and service quality had much higher bearing on the learner satisfaction. It is because currently knowledge is available in all the universities in the forms of books, periodicals, journals, project reports, corporate annual reports and the media reports and there cannot be a dearth of it. But, it has to be adequately supported by the systems and the service aspects by the educational technologies. The focus on six prime factors: students, professors, course, technology, design, and the learning environment [121] should be the priority of the educators in ensuring the learner satisfaction. The students' needs with respect to the motivation towards the particular course and comprehension of the building block of knowledge have to be considered during the development of the educational technologies. As the professors are responsible to the knowledge content to be delivered through the educational technologies it is important that they have to be provided with adequate support to access the latest information in the area/s of their expertise. The course has to be relevant and current, and also include the most recent happenings related to the specific topics. The technology adopted should be user friendly and any student should be able to use it with little or no supervision from the instructors and mainly supported with adequate number of audio-visuals and media linkages. The design of the pedagogy should be very well structured and ensure gradual increase in complexity so that it would be easy for the learner to pass through the phases from the basis to the advanced level. Finally, the learning environment should be very congenial to learning so that the students are well motivated towards knowledge enrichment and it should transform them into lifelong learners. A due consideration to these six factors of focus would ensure learner satisfaction and make sure that the educational technologies deliver what they are intended to deliver to the student community.

6. Conclusion

Educational technologies are becoming popular in the universities across the world and pandemic situations such as the COVID-19 have made them very handy as the students can learn from home. However, much needs to be done in terms of the study on their effectiveness as the technology itself is in the evolutionary stages. There are several challenges to be faced in making the implementation of these technologies in a full-fledged manner. This research has made an attempt to empirically investigate on the effectiveness of educational technologies specifically in terms of the net educational outcome achievement in higher education.

Through the research it could be concluded that system quality and service quality were relatively of higher significance than the knowledge quality in connection to the educational technologies. It could also be concluded through the hypothesis testing that learner satisfaction had a major role to play in the success of educational technologies as it not only had a direct bearing on net educational outcome achievement, but also acted as a significant mediator between the system quality and service quality, and net educational outcome achievement. These findings were the basis for the implications drawn to the decision makers in higher education so that the effectiveness of educational technologies can be enhanced.

The study is limited to the location of Kuwait with a sample size of 226 students of higher, so generalization of the results is possible only if the study could be extended beyond this demographic boundary and adopts a longitudinal time scale of research. However, the implications drawn in the form of suggestions to the authorities in higher education may be worthwhile as they are based on empirical evidence. It has to be mentioned that the study had made use of structural equation modelling, which is based on partial least square technique and the limitations of this second generation statistical analysis tool is applicable to this research too.

This research has presented the state of educational technologies in higher education in the context of Kuwait as a country that is keen on the development of these technologies. The outcome of this research can contribute to the body of knowledge in this area and could be of use to both the academicians and practitioners.

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