



The potential role of collaborative learning in enhancing e-learning systems: evidence from Saudi Arabia

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Despite the considerable potential for e-learning to help bring about improved learning outcomes, particularly for female students and students who need to rely on distance learning, feedback from current users of e-learning systems in the Kingdom of Saudi Arabia (KSA) suggests a relatively low level of satisfaction. This study adopts a mixed-methods approach to investigate the underlying reasons for this situation. The results indicate that students are not unhappy with the information technology infrastructure or with other technical aspects. However, many students report a low level of interaction between them and their fellow students. When such interactions do occur, an overwhelming majority of students indicate that they find such interactions. Together, these findings suggest that greater student interaction, which could be fostered through the use of collaborative learning, is likely to be both popular with students and beneficial to their learning outcomes.

Keywords: e-learning, collaborative learning, Saudi Arabia.

Introduction and background

According to the Communications and Information Technology Commission (CITC), the Kingdom of Saudi Arabia (KSA) is one of the fastest growing countries in the world in terms of e-learning. CITC data shows an explosive growth in the number of internet users generally, from a mere 200,000 in 2000 to 4.8 million in 2006 (CITC 2010). The number of students enrolled in institutions of higher education has also increased significantly in recent years. As a result, many of these institutions have turned to e-learning systems as a means to help broaden and enhance access to their courses and subjects (Al Saif 2005). Reflecting this trend, a growing number of research studies have been conducted on e-learning in KSA. Many of these studies have focused on identifying the key factors that differentiate online education from face-to-face learning, analysing the advantages and disadvantages of online courses, investigating factors that facilitate or hinder the adoption of e-learning, or developing strategies to achieve a suitable online learning environment (Alshehri 2005). To date, however, relatively little attention has been paid to the issue of assessing the e-learning environments that have been set up in the country, especially from the viewpoint of student users.

This paper is part of a research project that has been conducted in response to this gap in the literature. The overall project's aim is to evaluate existing e-learning environments in KSA on the basis of a range of criteria and dimensions (Alkhalaf, Nguyen & Drew 2010). A key purpose of the present paper is to focus more narrowly on student perceptions and feedback regarding these e-learning environments. It turns out that the level of satisfaction among student users is rather low. In the paper we also investigate some factors which may account for this disappointing result. Our findings suggest that one possible method to enhance existing e-learning environments may be to promote greater use of collaborative learning, which has the potential to make e-learning both more popular with the students and more effective in terms of learning outcomes.

Interest in e-learning has grown rapidly during the past decade or so in KSA, for at least several reasons (Albalawi 2007). First, the demand for higher education has far outstripped supply, such that institutions are faced with overcrowding and insufficient facilities and human resources for the delivery of traditional-style education to all of the nation's qualified applicants for admission. This has occurred despite the fact that in the five years to 2009, growth in the higher education system had seen the opening of one university every three months and five colleges every month, and the award of 800 scholarships every month to students going abroad for further studies (Al-Shehri 2010). According to Al-Khalifa (2010), "thousands of students are over-enrolled ... and are simply given the course materials and sent home to study on their own." E-learning has been suggested as a means to overcome the continuing limitations.

Second, KSA is a large country in terms of geographical area, with a significant number of communities being isolated from major population centres. E-learning offers the potential to deliver educational services to remote locations, thereby reducing disparities across the various regions and areas. Third, in KSA's higher education, men and women receive their instruction in separate classes, for cultural and religious reasons (Mirza 2007, 2008). This puts further strains on the limited facilities and human resources available. In particular, there is a considerable shortage of female lecturers (Al-Khalifa 2010). It has been observed, accordingly, that women are often among the strongest supporters of e-learning, and may have the most to gain from further growth in e-learning (Bates 2009).

In 2008 the KSA Ministry of Higher Education established a National Centre of E-learning & Distance Learning to promote and facilitate the spread of e-learning systems in Saudi universities. For a description of how various e-learning environments have been set up throughout the country, in the universities as well as the technical education and vocational training sector, see Al-Khalifa (2010) and Al-Jarf (2007). The latter also provided an analysis of the challenges facing providers of these e-learning environments. In keeping with the rapid expansion in e-learning infrastructure and usage, the number of studies focusing on Saudi experiences with e-learning has also grown. According to a survey by Weber (2010), the total number of peer-reviewed studies of e-learning in KSA published during the period 2000-2010 was over 150, making the country the second highest producer of such studies in the Middle East and North Africa region.

Despite this voluminous literature, the number of studies that focused on assessments or feedback from students who have actually used the existing systems has been rather small. For example, Ali, *et al.* (2003) were more interested in factors which influence students' preferences for online courses vs. conventional classes than in the feedback from students who have taken online courses. Similarly, Alenezi, *et al.* (2010) focused mainly on the determinants of students' decision to accept or reject e-learning, rather than their experiences once they have

decided to accept. In this paper, we contribute toward addressing this relative gap in the literature by studying the requirements, preferences, as well as experiences of students who have used e-learning systems in KSA.

Methods

The research underlying this paper involved a mixed-methods approach. Informed by the findings of previous studies of e-learning in KSA, a series of interviews were conducted to obtain qualitative information. Based on this information, as well as a review of related studies involving user satisfaction surveys, a questionnaire instrument was then designed and used to collect quantitative ratings.

Four faculty members from King Saud University and two from Qassim University were selected at random for the interviews. The only requirement was that they had conducted teaching with some use of e-learning technology. The questionnaire instrument consisted of 21 questions, which had been developed after a review of a large number of recent surveys of user perceptions and satisfaction in the ICT, IS and e-learning fields, including Mansour & Mupinga (2007), Gable, Sedera & Chan (2008), Wang, Tang & Tang (2001), Wang & Liao (2007) and Wang, Wang & Shee (2007). Questionnaire forms were distributed to 130 undergraduate students at the same two universities as above, again at random, with the only proviso that the recipient had taken a course which used e-learning technology. 88 sets of responses were returned, but only 77 sets contained usable responses.

Findings

Qualitative findings from interviews

The findings from the interviews were qualitative. Due to space limitations, they cannot be described in detail here. It is nevertheless important to acknowledge that they helped the authors to gain a better understanding of the e-learning situation in KSA, especially the use (or non-use) of collaborative-learning tools and methods, and students' general attitudes about e-learning. In turn, this knowledge facilitated the development of the questions to be included in the survey instrument.

Quantitative findings from questionnaire survey

Table 1 presents a numerical summary of the responses obtained from the 77 participants in the questionnaire survey. The answers to each question are coded according to a five-point Likert scale, where typically 1 indicates the least, and 5 the most, favourable rating from an e-learning point of view. The first 7 questions relate to the respondent's personal preferences, requirements and acceptance of e-learning as an alternative mode of learning. The average ratings on these questions are mostly between 3.0 (indicating a neutral stance) and 4.0 (indicating a favourable stance).

For example, in response to Question A1, the average rating is 3.47, suggesting that students were generally confident and comfortable with using the relevant technology required for e-learning. Similarly, the mean response to Question A2 is 3.53, indicating that students had a moderate amount of trust in the information that was presented through e-learning. The mean response to Question A3 is quite high (4.21), suggesting considerable enthusiasm for audio and video material, and pointing to an area where e-learning technology clearly has the potential to make a positive contribution. The mean rating for Question A4 is also favourable (3.94), confirming that students found it useful to be able to download and/or print learning materials for ready access.

Question A5 is of direct relevance to our purposes, as it asks participants to indicate the extent to which they would prefer if the lecturer used e-learning technology, including collaboration tool. Students' responses are rather lukewarm: the average rating is only 2.88, which is slightly less than neutral. In the context of answers provided to other questions as well as to this one, we interpret this rating as indicating that where students already had access to lecturers on a face-to-face basis, they did not have any strong desire for increased use of e-learning technology. This result is consistent with previous findings (e.g., Ali, *et al.* 2003).

By contrast, students provided highly affirmative responses when asked whether e-learning offers opportunity

for women to attend online classes instead of mixed classes (Question A6), giving this question one of the highest mean ratings (4.58) in the survey. It is clear that, on the whole, respondents recognised the important role that e-learning can play in helping women to overcome possible obstacles to higher education. This is consistent with the suggestions from some previous authors that the biggest winners from greater use of e-learning in KSA are likely to be women (see references provided above).

It is interesting to compare the moderately favourable responses (mean = 3.57) to Question A7, which asks the extent to which students *accepted* the use of e-learning instead of face-to-face classes, with the rating of only 2.88 obtained for Question A5 (discussed above). Taken together, these responses suggest that although students with access to face-to-face classes did not particularly wish to see greater use of e-learning technology, they did recognise the essential role of e-learning in the current KSA context, e.g., to meet the requirements of a rapidly growing education system and to address the needs of female students as well as students in remote areas.

The next 5 questions are related to various aspects of the existing e-learning setup. Question B1 is the most general, asking students to provide an overall rating on the current use of e-learning in KSA. The answers are generally negative, yielding a mean rating of only 2.22, the lowest of all mean ratings in Table 1. (Recall that in this context, a rating of 2 would indicate an assessment of “poor“.) In view of the vast amounts of resources that have been invested in developing e-learning systems in the Kingdom over recent years, such negative assessments must be seen as disappointing. However, they are consistent with the suggestion made by some previous authors (e.g., Bates 2007) that e-learning in KSA is like the road system there: the infrastructure is already in place and is generally good, but usage of the infrastructure remains poor.

Table 1: Summary of responses to survey questions

Questions		Mean	SD
<i>Personal preferences and acceptance of eLearning</i>			
A1	How confident are you in the use of e-learning technology?	3.47	1.10
A2	How much do you trust the information which is presented through e-learning technology?	3.53	0.86
A3	To what extent does the quality of audio and video material help you to obtain a high level of e-learning?	4.21	0.92
A4	How important is it for you to be able to download and / or print e-learning materials?	3.94	1.08
A5	I would prefer if the lecturer used e-learning technology, including collaboration tools.	2.88	1.23
A6	Does e-learning offer opportunity for women to attend online classes instead of mixed classes?	4.58	0.89
A7	To what extent do you accept the use of e-learning instead of face-to-face classes?	3.57	0.93
<i>Aspects of e-learning including technical issues</i>			
B1	How do you rate the use of e-learning in Saudi Arabia's universities?	2.22	0.98
B2	How do you rate the response time of your e-learning system ('browser speed')?	3.36	1.08
B3	How would you rate the level of availability (ease of access) of e-learning during peak usage times?	3.36	1.77
B4	How would you rate the importance of the e-learning technology infrastructure (software and hardware) in this class?	4.22	1.02
B5	The information or functionality that you need is easy to find (system is easy to navigate).	2.61	0.97
<i>Interaction and collaboration</i>			

C1	Are you able to interact with the lecturer during class, using the available e-learning technology?	3.37	1.15
C2	How would you rate the level of interaction with your classmates or other students during use of the e-learning system?	2.82	0.98
C3	Does this course require that you collaborate with other students in the class (e.g. group project)?	3.21	1.97
C4	Do you feel the need to collaborate (discuss or informally interact) with other students in this class?	3.86	1.77
C5	How would you rate the usefulness of interaction with your classmates or other students during use of the e-learning system?	4.60	0.97
C6	How do you rate the ease of using collaborative e-learning in this course?	3.36	0.85
C7	Does the technology provide facilities for collaboration?	4.21	1.5
C8	If you are using the technology to interact with classmates (individuals or in groups) please rate the ease of use of this technology.	3.47	0.84
C9	The design of the collaboration tools (chatroom, discussion board, etc) is suitable for my needs.	3.87	0.98

Responses to Questions B2 to B5 generally support the above interpretation. The mean ratings for B2 and B3 (both 3.36) indicate that browser speed, system response time, etc. were not a problem for students, even during peak usage times. Responses to Question B4 (mean = 4.22) confirm that students saw both software and hardware infrastructure as highly important. This finding has implications for designers and advocates of e-learning systems, as does the fact that answers to Question B5 (about the ease of navigating e-learning systems) are generally negative (mean = 2.61). To the extent that dissatisfaction with current systems could be reduced via changes in information technology systems, it appears that the most useful of such changes are likely to be on the “soft”, rather than the “hard”, side.

The last 9 questions in Table 1 focus on the interaction and collaboration between users of the current e-learning systems. For brevity, we shall now discuss overall patterns in the responses to these questions, highlighting individual questions only where they are of special interest. In general, the ratings obtained for Questions C1 to C9 are quite positive, ranging mostly from 3.36 to 3.87. On the lower side, there are two exceptions to this general observation. Question C2 asks the respondent to rate the level of interaction with their classmates or other students during use of their e-learning system, whilst Question C3 asks if the relevant course requires students to collaborate with each other. The average responses (2.82 and 3.21, respectively) are close to neutral, but they mask the fact that the distributions of the relevant ratings are bi-modal: a sizable group of the respondents had not been required to collaborate (C3), and therefore it is not surprising that their ratings for Question C2 are lower than ratings from students who had been required to do so. As we shall see below, how these bi-modal distributions relate to each other may hold significant implications for academics as well as designers of e-learning systems.

On the upper side, a clear exception is Question C5, which is about students’ assessment of the usefulness of interaction with their fellow students. The mean rating for this question (4.60) is the highest of all questions included in the survey. This overwhelmingly positive response suggests that a relatively efficacious (“low-hanging fruit”) approach to improving students’ satisfaction would be to facilitate and encourage greater interaction and collaboration among themselves. It has long been accepted that a collaborative approach to learning offers many distinct advantages (see below). The current results suggest that those advantages apply strongly in the case of e-learning in KSA at the present time.

If universities were to decide to make a shift toward collaborative learning, it would be highly feasible to carry out this shift from an infrastructure point of view: at 4.21, the mean rating for Question C7 is higher than most, indicating that the existing technology already provided adequate facilities for student interaction and collaboration. This result is consistent with the average rating for Question C9, which indicates a favourable

(3.87) assessment of the current design of collaboration tools, such as chat rooms, discussion boards, etc.

Differences in responses by male and female students

It is evident from the above discussion that in KSA female students have requirements and expectations regarding e-learning that may be quite different from those of male students. Accordingly, Table 2 compares and contrasts the responses from male and female participants. The last two columns present summary results from applying the non-parametric Mann-Whitney test to corresponding ratings from these two groups.

It turns out that the answers from women differ significantly (at the 10% significance level) from men's responses to only three questions. In response to Question A1 and C6, the ratings from women are systematically lower than from men, indicating that female students tend to feel less confident and comfortable with using e-learning technology in general and with collaboration-enabling technology in particular. Nevertheless, they are more receptive than men to the possibility of greater use of e-learning technology by current lecturers (Question A5). Taken together, these results suggest that although women might be less likely to perceive themselves as proficient with the technologies involved, they tend to see greater net benefits arising from a hypothetical increase in the use by faculty members of e-learning technology.

Differences in responses by students who were required, and students who were not required, to collaborate

Table 3 presents a comparison between ratings from students who were not required by their e-learning course to collaborate with fellow students and ratings from students who were required to do so. Mann-Whitney test results indicate that the ratings from the latter group are significantly higher than ratings from the former with regard to a number of questions. Of these, Questions C4 and C2 are probably the least surprising inclusions: in courses where students were required to collaborate, one would indeed expect that they felt a greater need to do so (overlapping perhaps with a sense of compulsion), and that they ended up collaborating more than if there had been no such requirement.

Table 2: Differences in responses by male and female students

Questions (abbreviated)		Males		Females		Mann-Whitney	
		N1	Mean	N2	Mean	Z	Prob.
A1	Confident in the use of e-learning technology?	51	3.61	17	3.06	-1.89	0.06
A2	Trust information presented through e-learning?	48	3.50	14	3.64	-0.46	0.64
A3	Quality of audio and video material help you?	56	4.27	16	4.00	-1.07	0.28
A4	Important to download & print materials?	48	3.94	14	3.93	-0.48	0.63
A5	Prefer if lecturer used e-learning technology.	45	2.73	12	3.42	-1.69	0.09
A6	e-Learning offers opportunity for women to attend?	45	4.71	15	4.20	-1.61	0.11
A7	Do you accept e-learning instead of face-to-face?	53	3.58	16	3.50	-0.20	0.84
B1	How do you rate the use of e-learning in Saudi Arabia's universities?	48	2.21	12	2.25	-0.25	0.80
B2	Rate response time ('browser speed')?	48	3.35	13	3.38	-0.24	0.81
B3	Rate availability during peak usage times?	36	3.33	9	3.44	-0.18	0.85
B4	Rate importance of technology infrastructure (software and hardware)?	44	4.27	10	4.00	-0.93	0.35
B5	System is easy to navigate?	53	2.55	16	2.81	-1.37	0.17
C1	Able to interact with lecturer during class, using the available e-learning technology?	49	3.39	16	3.31	-0.41	0.68

C2	Rate level of interaction with classmates or other students during use of the e-learning system?	51	2.75	14	3.07	-1.06	0.29
C3	Rate usefulness of interaction with classmates or other students during use of system?	39	4.56	11	4.73	-0.11	0.92
C4	Does this course require that you collaborate with other students in the class (e.g. group project)?	50	3.06	16	3.69	-0.98	0.33
C5	Do you feel the need to collaborate with other students?	54	3.70	17	4.35	-1.11	0.27
C6	Rate the ease of using collaborative e-learning?	43	3.49	16	3.00	-1.93	0.05
C7	Does the technology provide facilities for collaboration?	46	4.13	11	1.45	-0.64	0.52
C8	If you are using the technology to interact with classmates please rate ease of use of this technology	48	3.50	14	3.36	-0.54	0.59
C9	Design of collaboration tools (chatroom, discussion board, etc) is suitable for my needs	47	3.81	13	4.08	-0.71	0.48

Of greater interest is that ratings for Question A5 from the latter group (required to collaborate) are significantly higher than those from the former, suggesting that as students were required to collaborate with each other, such interaction tended to spill over to greater acceptance of usage by the *lecturers* of e-learning technology. It is also interesting to note that students who were required to collaborate gave significantly lower ratings for Question A4, suggesting that they might find information sharing and peer-group discussion to be more useful than strict adherence to class material, which tended to be far more important to students who studied by themselves.

Two other results reported in Table 3 are also of considerable interest, despite being not statistically significant (at the 10% level). First, responses to Question B1 suggest that students who were required to collaborate in their e-learning course might have a rather more favourable view of e-learning overall: their average rating is 2.41 compared with 2.14 for the group not required to collaborate -- the difference would have been significant at the 30% level. Second, 14 of the students who were not required to collaborate *did so anyway*: as their mean rating for Question C3 (4.93) shows, these 14 students were nearly unanimous in reporting that the experience was very useful to them (recall that 5 is the highest possible rating).

Table 3: Impact of requirement to collaborate

Questions (abbreviated)		Not required to collaborate		Required to collaborate		Mann-Whitney	
		N1	Mean	N2	Mean	Z	Prob
A1	Confident in the use of e-learning technology?	24	3.79	32	3.16	-2.04	0.04
A2	Trust information presented through e-learning?	20	3.55	31	3.52	-0.05	0.96
A3	Quality of audio and video material help you?	27	4.41	32	4.03	-1.58	0.11
A4	Important to download & print materials?	22	4.23	30	3.73	-1.88	0.06
A5	Prefer if lecturer used e-learning technology.	20	2.50	30	3.13	-1.97	0.05
A6	e-Learning offers opportunity for women to attend?	20	4.60	30	4.57	-0.58	0.56
A7	Do you accept e-learning instead of face-to-face?	26	3.65	32	3.44	-0.65	0.52
B1	How do you rate the use of e-learning in Saudi Arabia's universities?	22	2.14	29	2.41	-1.04	0.30
B2	Rate response time ('browser speed')?	23	3.48	29	3.14	-0.94	0.35
B3	Rate availability during peak usage times?	13	3.77	25	2.96	-1.35	0.18

B4	Rate importance of technology infrastructure (software and hardware)?	20	4.25	24	4.38	-0.08	0.94
B5	System is easy to navigate?	25	2.68	31	2.58	-0.42	0.68
C1	Able to interact with lecturer during class, using the available e-learning technology?	22	3.09	32	3.41	-1.12	0.26
C2	Rate level of interaction with classmates or other students during use of the e-learning system?	22	2.36	31	3.03	-2.25	0.03
C3	Rate usefulness of interaction with classmates or other students during use of system?	14	4.93	28	4.46	-1.48	0.14
C4	Does this course require that you collaborate with other students in the class (e.g. group project)?	28	1.00	35	5.00		
C5	Do you feel the need to collaborate with other students?	28	2.64	34	4.85	-4.73	0.00
C6	Rate the ease of using collaborative e-learning?	20	3.50	31	3.19	-1.04	0.30
C7	Does the technology provide facilities for collaboration?	22	3.91	27	4.48	-1.15	0.25
C8	If you are using the technology to interact with classmates please rate ease of use of this technology	21	3.33	31	3.55	-0.86	0.39
C9	Design of collaboration tools (chatroom, discussion board, etc) is suitable for my needs	19	4.16	30	3.87	-1.04	0.30

Implications: potential role of collaborative learning

A natural implication of the above findings would seem to be that e-learning courses in KSA should encourage, or indeed should even require, students to collaborate. Thus the collaborative (or cooperative) learning approach may be able to play an important role in enhancing the effectiveness of current e-learning environments. This learning approach has long been the subject of much study by educational researchers and designers (e.g., Slavin 1980, 1983a, 1983b, Hooper 1992, Koschmann 1996, Okamoto 2003, Tomsic & Suthers 2006, Dewiyanti, *et al.* 2007, Liaw & Huang 2007, Cattafi & Metzner 2007).

Collaborative e-learning offers many advantages. The process itself tends to increase interaction and create a sense of belonging. Collaborative e-learning environments may allow students, especially those who are shy in face-to-face situations, to participate in online discussions and meetings, offer and receive critiques, negotiate, and build consensus. This advantage may be of special significance in KSA, where face-to-face interactions between male and female learners are often not an option.

Of course, conflict between individuals can also occur, and a poorly designed or poorly run e-learning environment may allow some negative, undesirable interactions to develop. Therefore, care must be taken in developing and moderating the relevant environment.

In the current context, where many Saudi universities have already put in place their own e-learning environments, the process of increasing the emphasis on collaborative learning can be implemented through a series of coordinated, institution-wide measures, as illustrated in Figure 1. As envisaged, there would be a project (upper left hand side of Figure 1) aimed at coordinating efforts to enhance the existing e-learning environment, and possibly another project (lower left hand side) aimed at enhancing the learning management system (LMS) if this is required.

The e-learning improvement project's key activities would be:

1. to redefine/amend principles, policies and tasks associated with the current e-learning environment in order to re-orient it more toward collaborative learning;
2. to provide training and technical support to faculty staff as they revise their teaching materials and methods; and
3. to redefine/amend principles, policies and tasks of the LMS.

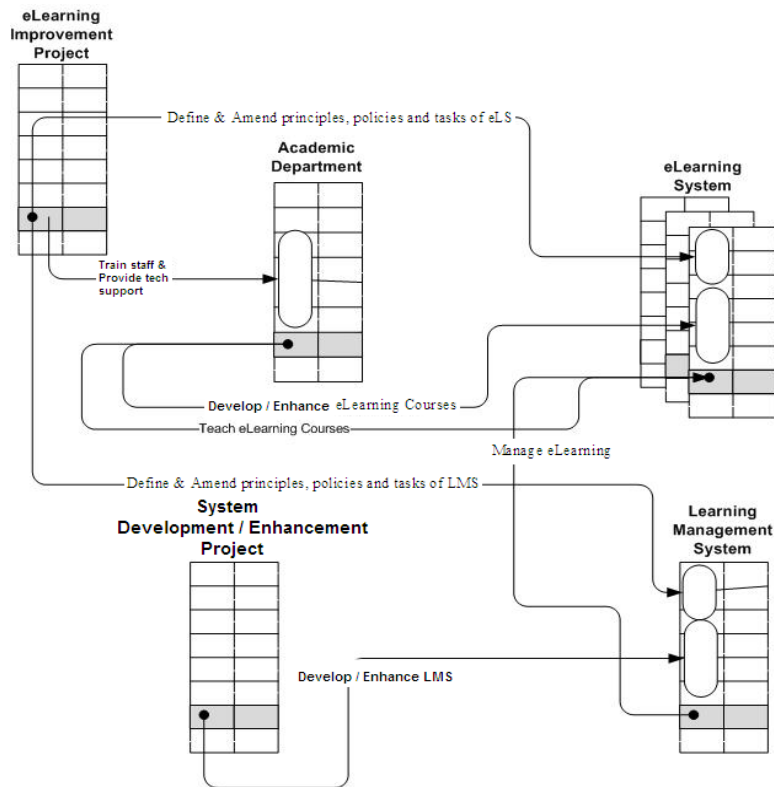


Figure 1: Proposed measures to enhance existing e-learning environments

Conclusion

Responses from students at two major Saudi Arabian universities suggest that existing e-learning systems in the country are rated rather unfavorably by student users. This has occurred despite massive investments having been made in terms of infrastructure, hardware and software, and despite the fact that students are generally satisfied with technical issues, such as browser speeds and system availability during peak usage times. There are reasons to believe that student satisfaction levels may be increased if they are encouraged (or indeed required) to interact more with their classmates and colleagues while using e-learning systems.

At present student dissatisfaction does not stem from a lack of available technology: indeed, students are satisfied with the design of available collaboration tools (e.g. chatrooms and discussion boards). However, it appears that course designs have not made sufficient use of such collaboration tools. Almost half of the responding students report that they are not required to collaborate with other students. Students who are required to collaborate (e.g. group projects) tend to report more positive responses to e-learning experiences. Efforts to encourage student interaction, even to the extent of requiring students to complete compulsory collaborative tasks, are thus likely to enhance Saudi Arabian students' e-learning experiences.

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