

INTERACTIONS IN E-LEARNING IN UNDERGRADUATE COURSES

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Abstract

The purpose of this paper is to investigate the common characteristics of the use of interaction (UI) from cases in Saudi Arabia. This study investigates the interactions between students, instructors, interface, and the content in distance education courses. The study was conducted in the College of Applied Studies and Community Service at King Saud University. The survey was distributed to 505 female college students selected randomly from a pool of 1,500 female students who were attending five basic courses in different areas. The measurements of interaction included frequency and interval. An exploratory factor analysis was used to examine the common components in this context. The result revealed that UI is composed of three main factors, namely human-to-human interactions, human-to-non-human interactions, and access duration. The results of this study show the use of interactions, which reflects the students' actual use. This study also helps give administrators and instructors a better understanding of the pattern of interaction from the student perspective. It could be implied that students perceived the interaction in three distinct contexts by means of out-of-class communication, channel to learning experiences, and time spent.

Keywords: interaction; learner – interface; learner – learners; learner – instructor; learner – content.

INTRODUCTION

Like many other programs which offer courses via distance technology, the College of Applied Studies and Community Service at King Saud University has found that one factor that plays a primary role in determining course quality is students' perceptions of the degree of interaction in learning. The research literature supports this observation (Fulford & Zhang, 1993; KLesius, Homan, & Thompson, 1997; Zhang & Fulford, 1994; Smith, 1996; Zirkin & Sumler, 1995). In fact, in their annotated bibliography on this topic, Zirkin and Sumler (1995) found that interaction seemed to have an impact on student achievement, as well as satisfaction: "The weight of evidence from the research reviewed was that increased student involvement by immediate interaction resulted in increased learning as reflected by test performance, grades, and student satisfaction"(Zirkin and Sumler, 1995).

As distance education has progressed from correspondence courses to online learning, opportunities for interpersonal interactions have increased. Early correspondence courses enabled learners and instructors to interact, albeit with significant time lag between message production and reception. Video conferencing made it possible for learners and instructors to interact in real-time, and it also facilitated learner to learner interaction, although the required equipment often made

this too costly for mainstream use. With the emergence of the internet, particularly e-mail and the World Wide Web (WWW), it has become possible to promote a high degree of interaction within a technologically mainstream and cost-effective learning environment.

The application of instruction is varied across courses in universities. It depends on the objectives and existing physical, financial and managerial environments each university faces (Siritongthaworn & Krairit, 2004). However, most of the courses in universities in Saudi Arabia are taught mainly in the classroom. Some of courses adopt to supplement the face-to-face instruction for certain purposes (Al Fahad, 2008). More investigation regarding this type of instruction is needed.

The use of interactions is considered an important factor in teaching and learning via computer-mediated communication settings (Pena-Shaff *et al.*, 2001). It could be comparable to the contact point where knowledge transfers to the students' cognition, either from an instructor during class lecture or from course materials during personal study time (Bransford *et al.*, 1999). It is necessary for students not only obtaining content, but also exchanging ideas as well as engaging in active and collaborative learning (Alavi *et al.*, 1995; Leidner & Jarvenpaa, 1995; Mortera-Gutierrez, 2002). Many studies claim that the use of interactions in online learning is directly related to achievement in and attitude of the course pursued (Chau, 1996; Mortera-Gutierrez, 2002; Opitz, 2002; Glenn *et al.*, 2003). However, more research should be done on the framework and implication of interactions in distance learning and Internet-based settings (Arbaugh, 2000; Bork, 2002; Jung *et al.*, 2002; Mortera-Gutierrez, 2002; Gao & Lehman, 2003). In the Arab world, there are many projects concerning distance education.

This paper attempts to study the following research question: What are the common characteristics of interactions that happen during a student's use of supplemental classroom instruction? The following section explains the theoretical background in building the framework and developing the measure of use for interaction (UI) in the context. The next sections will discuss the research methodology, data analysis, results and discussion.

LITERATURE REVIEW

Use of interactions is accepted as one of the key elements in distance education (Jung *et al.*, 2002; Mortera-Gutierrez, 2002) and in differentiating distance education from traditional face-to-face instruction (Mortera-Gutierrez, 2002). The major differences between these two instructional methods lie in the level of intimacy and immediacy created by the social presence of the instructor and peers during instruction (Gunawardena, 1995; Chidambaram, 1996; Sia, Jan, & Wei, 2002). The face-to-face classroom environment provides a higher chance for intimacy and immediacy for the learners than the existing environment due to the presence of paraverbal (e.g. tone of voice, inflection, voice volume) and nonverbal (e.g. eye movement, facial expression, hand gestures, body language cues) communication (Gunawardena, 1995; Warkentin *et al.*, 1997).

Learning should be an active process in which interactivity is encouraged (Northrup, 2001). Vrasidas and Mclsaac define interaction as "the process consisting of the reciprocal actions of two or more actors within a given context" (1999:25). Keegan (1996) understands interaction as the key to effective learning, and Moore considers interaction "a defining characteristic of education" (1989:2).

Interaction has a variety of functions in the educational process. The value of other people's perspectives often gained through interaction is a key component in the constructivist learning theories (Jonassen, 1992). In addition, interaction is critical to creating the learning communities advocated by Lipman (1991) and Wenger (1998), who have focused on the critical role of the community in learning. Moreover, Sims argues that the word "interactive" implies "better experiences, more active learning, enhanced interest and motivation" (1999:257).

Chickering and Ehrmann (1996) suggest seven principles of good practice with computers and telecommunication technologies. The following four are related to interaction: 1) encouraging contacts between students and faculty; 2) developing reciprocity and cooperation among students; 3) using active learning techniques; and 4) giving prompt feedback. These principles can be applied to interaction between students as well as between teachers and students.

Moore (1989) has outlined three types of interactions that have become a framework for the study of interaction: learner-content interaction, learner-instructor interaction and learner-learner interaction. Learner-content interaction is defined as "the process of intellectually interacting with content that results in changes in the learner's understanding, the learner's perspective, or the cognitive structures of the learner's mind" (Moore, 1989:2). It refers to the process in which each learner processes the course information for their own knowledge understanding and knowledge construction. Learner-instructor interaction involves communication between the instructor and the students in a course, and, with the instructor's facilitation, it attempts to stimulate and motivate learners to understand the content in the learning process. Learner-learner interaction is communication between one learner and another learner with or without the real-time presence of an instructor. In distance learning, instructor-learner interaction and learner-learner interaction often occur via computer-mediated communication, although it may include other forms of interpersonal communication, whether online or off-line, which occur during the duration of a course.

In the consecutive years after Moore's research, Hillman, Willis, and Gunawardena have added another type of interaction in the electronic learning environment: Learner-interface interaction. This type of interaction is defined as "the process of manipulating tools to accomplish a task" (1994:34).

It was verified that a student in a distance education environment has to interact with a medium or the technology used to deliver instruction. A certain extent of technological proficiency is required for interaction with the technology in an environment (Kawachi, 2003). Furthermore, in environments where each student is treated as a distinct individual, Bork (2002) proposed that student's language and culture are other aspects in interacting with the interface.

Sutton (2001) has defined the fifth form of interaction as "vicarious interaction", which is a derivative form of interaction distinct from the four previous items. It takes place when a student does not participate directly but actively observes and cognitively processes both the interaction between the instructor and other students, and those between two or more students during the instructional delivery. Nonetheless, a study of the effects of vicarious interaction found no evidence that the vicarious interactions contribute to the improvement in learning quality of students (Kawachi, 2003).

METHODOLOGY

The study was conducted in the College of Applied Studies and Community Service, King Saud University, Riyadh, Saudi Arabia. The survey was conducted in Arabic. The survey questionnaire was distributed to 505 female college students selected randomly from a pool of 1500 female students who were attending five basic courses. The courses included Introduction to Islamic culture (IS 101), Islam and Building Society (IS 102), Arabic Language Skills (AL 101), Arabic Writing (AL 103) and English (Eng. 101). The ages of the respondents/participants who were involved in this study ranged from 18 to 22. Every course contained approximately 65 to 125 students. Our target respondents were students who used a supplementary tool in the main classroom teaching. In order to access specific respondents, several criteria were used in selecting the courses to be investigated, as seen below:

1. The main instruction is conducted in the classroom basis. The student takes a supplementary role in either all or part of the instruction of the course. This is restricted to only the asynchronous web-based instruction.
2. There is a clear and active evidence of online, two-way communication between both instructor to learners, and learner to learner in the course website to enhance learning.
3. At least two benefits from resource depository and out-of-class communication are expected from the course selected. Other benefits, such as modes of homework submission, course-on-demand, etc., could be in addition but are not required.

The investigation started from meeting with some practitioners in educational technology field in universities. The suggestions of tentative courses or universities were received. The observations were made in the courses where access was allowed. Interviews with the relevant course instructors were conducted in order to examine if the course's characteristics met the requirements. The investigation was performed between January and April 2008. Reviews of the content of selected course websites were done with permission from the corresponding instructors. The interaction characteristics of the selected courses were outlined based on content from the literature. Only the characteristics that were found in common among four cases were included. Questionnaires that were first proposed by Moore were adapted from the literature and included five types of interaction; they assess the dimensions of frequency and interval. The measurement of interaction looked into the dimension of frequency and interval (Table 1).

TABLE 1: Main items measuring interaction in e-learning

Interactions		Items
Learner-interface	1	UI 1 The average number of times you log in to the course website (times per week).
	2	UI 2 Maximum time spent online on this course page each time you logged in (hours).
	3	UI 3 Time spent online on this course page in average each time you logged in (hours).
Lerner-content	1	UI 4 Number of times you access to read, see or download course materials through system.
	2	UI 5 Number of times you access to read, see or download additional resources related to the course through system.
Learner instructor	1	UI 6 The number of times you ask or discuss with the instructor through course web board.
Learner-learners	1	UI 7 Number of postings on the issues you don't clearly understand or the issues you'd like to share with the others on the course web board.
	2	UI 8 Number of postings from which you obtain feedbacks from your friends on the main course web board.
	3	UI 9 Number of times you answer, discuss or propose ideas for the issues posted by the others on the main course web board.
Vicarious	1	UI 10 Number of times you access to (only) read the messages posted by others in the course web board.

UI : The Use of Interaction

The survey questionnaire asked ten key questions that aimed to measure interactions in the environment. The data for this study was gathered by means of a paper and pencil survey. All subjects were asked to respond to the questionnaire, and the researchers assured them their confidentiality would be guaranteed. The five major components covered in the questionnaire included learner-interface interaction, learner-content interaction, learner-instructor interaction, learner-learner interaction and vicarious interaction.

Data was collected on the last class of each course in April 2008. Data was analyzed using the SPSS statistical package for Social Science, Version 10.0. The results were reported using descriptive statistics such as percentages, mean and standard deviation.

RESULTS AND DISCUSSION

Table 2 presents primary descriptive statistics of data. Analysis was performed using the SPSS statistical application. Two main statistical diagnostic measures used in this study were factor analysis and reliability coefficient (Gatignon H., 2003:44). In factor analysis, principle component analysis with orthogonal varimax rotation was used for factor extraction. The factors that account for adequately large variance were presented in a more meaningful configuration.

Respondents of the survey were undergraduate female students undertaking five selected courses. They were between the ages of 18 to 22 years-old. Every course contained approximately 65 to 125 students. The total number of respondents was 505.

This section presents the results of the factor analysis. The factor analysis by principal components was adopted in the data analysis for the purpose of partitioning the experimental variables into factors that influence the use of interaction. The purpose of factor analysis was to summarize interrelationships and establish levels of variances in decision variables as they influenced a given phenomenon. The following reports were generated in the factor analysis using SPSS, Version 10.0.

Descriptive Statistics

The descriptive statistics give the mean and standard deviation of the sample population on each decision variable. The descriptive statistics are presented in Table 2. Data in Table 2 displays that there was clear evidence that "Learner to interface, UI(1)" was rated the highest variable that affected the use of interaction, as it has the highest mean ($m=1.30$). On the other hand, "Learner to instructor UI(6)", was the least important variable in terms of affecting the use of interaction, as it had the lowest mean ($m=1.19$). This data demonstrates the presence of all five types of interaction and further confirms that the environment at the College of Applied Studies is rich with the necessary interactions that educators need.

TABLE 2: Descriptive statistics of data for use of interactions

	N		Mean	Std. Deviation
	Valid	Missing		
	505	0	1.73	0.67
UI 1	491	14	1.30	0.58
UI 2	493	12	1.16	0.42
UI 3	487	18	1.17	0.45

UI 4	488	17	1.21	0.48
UI 5	483	22	1.25	0.51
UI 6	476	29	1.19	0.45
UI 7	481	24	1.24	0.53
UI 8	478	27	1.26	0.50
UI 9	479	29	1.24	0.53
UI 10	479	26	1.28	0.55

UI : Use of Interaction

Commonalities

Table 3 shows the results of extracted commonalities of all the variables. It shows the proportion of the variance of a variable explained by the common factors. Data in Table 3 shows that the "Learner-interface UI(1)" interaction had the smaller percentage (24.9%) of variance that can be predicted or explained by the other nine variables. On the other hand, "Learner-interface UI(2)" interaction recorded the highest variation (64.4%), which was accounted for by the other nine variables. These results reveal the importance attached to the use of "Learner-interface UI(1)" interaction. The commonality of 64.4% in the "learner-interface UI(2)" interaction can be predicted by the usage of other variables studied. Thus, an improvement in the usage of other variables will have a corresponding effect on the learner-interface UI(2) interaction.

TABLE 3: Commonalities (Extraction Method: Principle Component Analysis)

	Initial	Extraction
A1	1.000	0.249
A2	1.000	0.644
A3	1.000	0.529
A4	1.000	0.502
A5	1.000	0.507
A6	1.000	0.595
A7	1.000	0.591
A8	1.000	0.567
A9	1.000	0.481
A10	1.000	0.630

Rotated Component Matrix and Cronbach's Alpha of UI Items

Another statistical analysis instrument employed in this study was the reliability coefficient, Cronbach's alpha (Cronbach, 1951). This instrument was used to estimate the scale consistency among items in the group (Hair *et al.*, 1998). The Cronbach's alpha value generally exceeded the level of 0.70, though it is considered

acceptable at 0.60 in exploratory research (Hair, *et al.*, 1998). Table 4 illustrates the factors extracted from factor analysis and the Cronbach's alpha from reliability analysis of the data.

TABLE 4 : Rotated Component Matrix for Factor Analysis in the Use of Interaction

	Component	
	1	2
UI 1	0.412	
UI 2	0.801	
UI 3	0.694	
UI 4	0.664	
UI 5	0.615	
UI 6	0.645	
UI 7		0.761
UI 8		0.700
UI 9		0.486
UI10		0.749
<i>Rotation Sums of Squared Loadings:</i>		
<i>Total: (Eigen Value)</i>	<i>2.877</i>	<i>2.317</i>
<i>% of Variance</i>	<i>28.771</i>	<i>23.173</i>
<i>Cumulative %</i>	<i>28.771</i>	<i>51.943</i>
<i>Cronbach's alpha</i>	<i>0.7701</i>	<i>0.7237</i>

Extracted Method : Principle Component Analysis
 Rotation Method: Varimax with Kaiser Normalization
 a : Rotation Converged in 5 interactions
 Note: The factor values lower than 0.400 are not presented

Factor analysis loaded ten questionnaire items in two components. Item UI(1) to UI(6), and UI(7) to UI(10) formed components 1 and 2, respectively. These factors contributed to the explanation in UI variable (51.94%) of total variance. Internal consistency, represented by coefficient alpha, of all items was as much as 0.8361. It reported an existence of cohesive internal relationships of all measurement items in representing UI.

The first component represents the most influential element on UI at a figure of 28.77% of total variance explained. It signifies the group of items, measuring interactions between learner and interface, learner and content, and human-to-human, human-to-non-human, or human and human. This tells us that the respondents perceived the items in this group as one factor: the interaction between human-to-non-human or human and human interaction. Alpha value of this factor was 0.7701, representing a high internal consistency of this component.

UI could be explained by the second factor, 23.17% of the total variance in this study. The items under this group depict the interactions between learner and learners and vicarious interaction. The result shows that the respondents perceived all types of interaction with humans as one factor when exposed during use. The

reliability analysis reports 0.7237 as the alpha value, which is over the acceptable criterion.

Two factors from UI items help us to understand the pattern of interaction used by students. Although the items were not divided into five groups according to five types of interaction (Moore, 1989; Hillman, Willis & Gunawardena, 1994; Sutton, 2001), the items portrayed the students' viewpoint, which differs from the instructor or knowledge provider perspective. In this context, students gave less priority to class attendance, which is considered to be their main instructional delivery method. Interactions between learner-to-interface and learner-to-learners, including vicarious interaction, were mostly done during face-to-face sessions, either in class or outside of class, which is more convenient than online communication. In other words, this factor is viewed as after-class or out-of-class communication. They interacted with both content and interface with more awareness of active learning. This could be the reason why they perceived these two types of interaction as one factor representing human-to-non-human interaction. It provided for them content and learning experiences found in the system. Even though the content provided students with extended learning experiences, students usually considered the content being taught in the classroom as a higher priority. Content was viewed as an additional but not compulsory source of learning. During the interviews, the student respondents agreed that the interface was so user-friendly they had no problems interacting with the technology.

CONCLUSIONS AND IMPLICATIONS

This paper investigates the student's use of interaction (UI) during access. In this context, interaction is used to supplement the classroom instruction. A survey of UI was conducted and the data was divided into three dimensions: human-to-human interaction, human-to-non-human interaction and access duration. It could be implied that students had three distinct concerns: means of out-of-class communication, a channel to enrich learning experiences and time spent online.

When designing course activities, e-learning instructors should be aware of students' perception of UI. One main activity is communication within the learning community. Instructors should take an important role in facilitating conversations online, either synchronously or asynchronously. The idea is to start with a friendly, interesting, entertaining and informal atmosphere and then begin to develop a feeling of cohesion and a bigger sense of community.

The next dimension of interaction is a channel to learning experiences in the mode of human-to-non-human interaction. In addition to user-friendliness, design of hypertext or hyperlinks could help create flexibility in accessing the content. A chapter designed in the form of small but related objects could assist learners who like to learn non-linearly.

Infrastructure should be adequately equipped so that it is convenient for the students to communicate. The time spent by the students on each chapter should also be consistently controlled when designing a module. Furthermore, it should not take longer than the time period in which an individual can concentrate. For example, the time allotted for each session or chapter should not exceed two hours. If the time period is too long, it may not enrich learning experiences and instead may cause stress and fatigue among students.

Future research should cover more courses in the sample due to increased availability of technology in the future. Moreover, the course activities leading to more varied types of interaction on learning should be investigated. An identical study in which program of study or discipline of course is a control variable should be conducted to see if there is any difference in the result.

REFERENCES

- Alavi, M., Wheeler, B.C. & Valacich, J. S. 1995. Using IT to reengineer business education: An exploratory investigation of collaborative tel. *MIS Quarterly*, 19(3), 293-312.
- Al Fahad, N. F. 2008. Surveying instructor and learner attitudes towards courses in the College of Applied Studies and Community Service in Saudi Arabia *IASK Proceeding TL 2008 – Teaching & Learning*, 26-28 May, 2008. Aveiro, Portugal.
- Arbangan, J. B. 2000. How classroom environment and student engagement affect learning in internet based MBA Courses. *Business Communication Quarterly*, 63(4), 90-26 .
- Bork, A. 2002. Interactive learning – interactive learning : Twenty years later. *Contemporary Issues in Technology & Teacher Education*, 2(4): 605-611.
- Bransford, J. D., Brown, A.L. & Cocking, R. R., eds. 1999. *How People Learn: Brain, Mind, Experience, and School*, Washington D. C: National Academy Press.
- Chau, P. Y. K. 1996. An empirical assessment of a modified technology acceptance model *Journal of Management Information Systems*, 13(2): 185-204.
- Chickering, A. W., & Ehrmann, S. C. 1996. Implementing the seven principles: technology as lever. *AAHE Bulletin*. <http://www.aahebulletin.com/public/archive/sevenprinciples.asp>. (5 august 2006)
- Cronbach, L.J. 1951. Coefficient alpha and the internal structure of tests. *Psychometrics*, 16, 397-334.
- Fulford, C. & Zhang, S. 1993. Perception of interaction: The critical predictor in distance education". *American Journal of Distance Education*, 7 (3), 8-21.
- Gao, T, and Lehman, J. D. 2003. The effects of different levels of interaction on the achievement and motivational perceptions of college students in a web-based learning environment. *J. of Interactive Learning Research* 14(4): 367-386.
- Gatignon, H. 2003. *Statistical Analysis of Management Data*. Kluwer Academic Publisher (44-66)
- Glenn, L. M., Jones, C. G. & Hoyt, J. E. 2003. The effect of interaction levels on student performance: A comparative analysis of web-mediated versus traditional delivery. *Journal of Interactive Learning Research*, 14(3): 285-299.
- Gunawardena, C. N. 1995. Social presence theory and implications for interaction and collaborative learning in computer conferences. *International Journal of Educational Telecommunications*. 1(2): 147-166.
- Hair, J.F., Anderson, R.E., Tatham, R.L., & Black, W. C. 1998. *Multivariate Data Analysis*, 5th ed . Upper Saddle River, New Jersey: Prentice-Hall.
- Hillman, D. C. A., Willis, D. J., & Gunawardena, C. N. 1994. Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. *American Journal of Distance Education*, 8(2): 30-42.
- Jonassen, D. H. 1992. Evaluating constructivistic learning. In T. M. Duffy & D. H. Jonassen (Eds.), *Constructivism and the technology of instruction: A conversation* (137-148). Hillsdale, NJ: Erlbaum.
- Jung, I., Choi, S., Lim, C. & Leem, J. 2002. Effects of different types of interaction on learning achievement, satisfaction and participation in web-based instruction. *Innovations in Education and Teaching International* 39(2): 153-162.
- Keegan, D. 1996. *Foundations of distance education*. New York: Routledge.
- Klesins, J., Homan, S. & Thompson, T. 1997. Distance education compared to traditional instruction: The Students' view. *International Journal of Instructional Media*. 24 (3), 207-220.
- Leidner, D. E. & Jarvenpaa, S. L. 1995. The use of information technology to enhance management of school education: A theoretical view. *MIS Quarterly*, 19(3): 265-291.
- Lipman, M. 1991. *Thinking in education*. Cambridge, NY: Cambridge University Press.
- Moore, M. G. 1989. Three types of interaction. *American Journal of Distance Education*. 3(2): 1-6.

- Mortera-Gutierrez, F. 2002. Instructor interaction in distance education environments, *Journal of Interactive Learning Research* 13(3): 191-209.
- Northrup, P. 2001. A framework for designing interactivity into web-based instruction. *Educational Technology*, 41(2): 31-39.
- Opitz, C. 2002. Online course accessibility: A call for responsibility and necessity. *Educational Technology Review*, 10(1): 81-105.
- Pena-Shaff, J., Martin, W. & Gay, G. 2001. An epistemological framework for analyzing student interactions in computer mediated communication environments. *Journal of Interactive Learning Research*, 12(1): 41-68.
- Sia, C. L., Tan, B.C.Y., & Wei, K.K., (2002). Group polarization and computer – mediated Communication: Effect of communication cues, social presence, and anonymity. *Information System Research*, 13 (1): 70-90.
- Sims, R. 1999. Interactivity on stage: Strategies for learner-designer communication. *Australian J. of Educational Technology*, 15(3): 257-272.
- Smith, C. K., 1996. May, Convenience vs. connection; computer students' views on distance learning. *Paper presented at the Annual Forum of the Association for Institutional Research*, Albuquerque, New Mexico. (ERIC Document Reproduction Service No. ED 397725).
- Vrasidas, C. & Mclsaac, M. S. 1999. Factors influencing interaction in an online course. *American Journal of Distance Education*, 13(3):22-36.
- Warkentin, M. E., Sayeed, Li. & Hightower, R. 1997. Virtual teams versus face-to-face teams: An exploratory study for a web-based conference system, *Decision Sciences*, 28(4): 975-996.
- Zhang, C. & Fulford, S. 1994. Are interaction time and psychological interactivity the same thing in the distance learning television classroom? *Educational Technology*, 34 (6), 58-64.
- Zirkin, B. & Sumler, D. 1995. Interactive or non – interactive? That is the question! An annotated bibliography. *Journal of Distance Education*, 10(1), 95-112.

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