

Comparison of the Effectiveness of Communication between the Traditional Lecture and IELS

A. Althobaiti, M. Munro

Abstract—Communication and effective information exchange within technology has become a crucial part of delivering knowledge to students during the learning process. It enables better understanding, builds trust and respect, and increases the sharing of knowledge between students. This paper examines the communication between undergraduate students and their lecturers during the traditional lecture and when using the Interactive Electronic Lecture System (IELS). The IELS is an application that offers a set of components which support the effective communication between students and their peers and between students and their lecturers. Moreover, this paper highlights communication skills such as sender, receiver, channel and feedback. It will show how the IELS creates a rich communication environment between its users and how they communicate effectively. To examine and assess the effectiveness of communication, an experiment was conducted on groups of users; students and lecturers. The first group communicated in the traditional lecture while the second group communicated by means of the IELS application. The results show that there was more effective communication between the second group than the first.

Keywords—Communication, effective information exchange.

I. INTRODUCTION

THE development of diverse human skills and abilities has become a necessity that should be archived, especially in the construction and development of the learning process. Therefore communication and effective information exchange is an important new technology that has underpinned the learning process in recent years. The rapid evolution of technology is evidence of the value of increasing communication to enhancing learning, whether between individuals or as group activities [1]. Applications developers and computer researchers are not taking full advantage of computer applications, unless they focus on interactivity [2]. Nowadays it is clearly evident in public places such as trains, buses and stations to what extent young people communicate with their hand-held devices: mobiles, laptops or tablets. They appear to be in their own individual world when they communicate via these devices, projecting a range of different emotions that would lead us to observe that they have full interaction with them and spend a great deal of time on these interactions. Such behaviour may reduce face-to-face interaction between human beings with people interacting

more with their computers or mobile apps to exchange or participate in knowledge acquisition or skills development.

II. COMMUNICATION

Communication is the way of exchanging information or ideas between two sides or more via some channel, including signs or symbols. The communication process is the answer to the following questions: Who says? What Says? In Which Channel? To Whom? With What Effect? [3] Communication permeates all levels of human expertise and it is central to understanding human behaviour or aims to change behaviour among individuals, organisations and societies. Communication is the process of exchanging knowledge and meaning by use of signs and symbols [4]. It consists of encoding and sending messages and receiving and decoding them. In this context there are five main elements which make up the communication process. These elements are sender, receiver, message, channel and feedback as shown in Fig. 1. The Interactive electronic lecture system (IELS) is a developed system that was created to be an effective channel that enhances the communication process between students and lecturers at King Abdulaziz University (KAU). The promise of the IELS system is that it should meet the needs of its users and that technology has a role in enabling access and effective communication. It also offers a rich environment for communication between its users and gives them more space and freedom. The new channels of communication also allow individuals to deliver messages easily to public receivers, even between strangers who have not met before [5].

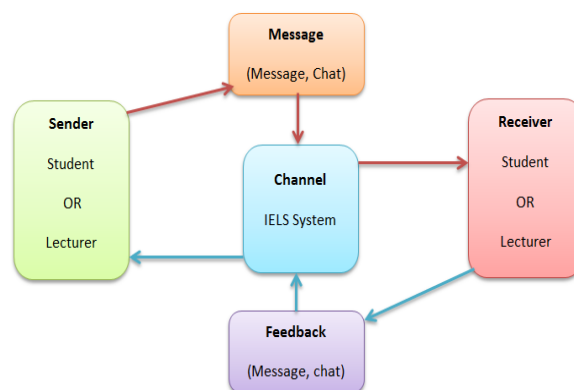


Fig. 1 Communication process elements

III. INTERACTIVE ELECTRONIC LECTURE SYSTEM

In recent years, there has been an increasing shift in the use of a single user interface of multimedia toward supporting the

A. A. is a PhD. Candidate in the School of Engineering and Computing Sciences at Durham University, UK and a lecturer at King Abdulaziz University, Saudi Arabia (e-mail: aralthbaiti@kau.edu.sa).

M. M. is an Emeritus Professor in the School of Engineering and Computing Sciences at Durham University (e-mail: malcolm.munro@durham.ac.uk).

interaction between users via groups that work closely together; for example, during training courses or meeting sessions [6]. Interaction with devices has become vital to the success of users [7]. In respect of the revolution of computers and other new devices such as mobiles and tablets, there is an interaction with apps which may take the learner closer to knowledge. Interactivity is a powerful technology tool that can be used in the learning process to make it more effective and efficient as well as to generate a satisfactory learning environment. Interactivity plays an important role in the development of learning skills, and the acquisition of knowledge. From various perspectives, interactivity has been explained in diverse and numerous fields as a two-way communication between learners or between learner and machine. Also it means allowing a two-way flow of information between a computer and a computer-user; responding to a user's input: a fully interactive map of the area. Interactivity is defined as "reciprocal activity between a learner and a multimedia learning system, in which the reaction of the learner is dependent upon the reaction of the system and vice versa" [8]. It is described as the core of learning, and is evident at all levels of engagement [9]. Interactivity is also a message loop which occurs from the perspective of the learner and back to him after being processed from a machine or another learner [10]. Another definition of interactivity is that it is a process-related, variable characteristic of communication settings that could lead to engagement and sociability between people and computers [11].

The IELS system represents an opportunity to improve lecturing. It consists of three components: lectures, video clips and interactive interface. To build an e-learning environment, the interactive system has to take into consideration the learner's needs during the whole e-learning life cycle [12]. Also the development of the e-learning system should consider the alignment of individual and organizational learning needs, the integration of learning and communication between individuals [13]. Therefore the IELS system was built according to users' needs and was designed to address issues such as accessibility, usability, interactivity, learnability, communication and satisfaction when delivering lectures to undergraduate students. The focus of this paper is to examine the effectiveness of communication among IELS groups.

Some research studies have been conducted to examine how to create effective communication between students and their peers and between students and their lecturers. For example, an electronic voting system has been developed for lecturers to help them communicate with their students and it has been aimed to increasing the lecturer's knowledge of students' understanding [14]. It was found that these voting systems are best understood as a tool rather than a teaching approach, and that to use the tools effectively requires an understanding and belief in active learning.

IV. METHOD

Both qualitative and quantitative methods were used in this study. For the qualitative approach, a case study was used.

This technique was used to make it possible for students who stated their ideas to express their experiences of the communication process using the IELS environment in a realistic and holistic way. Two types of instrument were used to evaluate the effectiveness of communication between the traditional lecture and the IELS system. The first type was in the form of a questionnaire submitted to the students when they had completed the experiment and the second instrument was the system report that records the entire communication process between its users via technologies such as chat box and box messages. The questionnaire format was designed according to the Likert scale in which 5 = Outstanding, 4 = Good, 3 = Satisfactory, 2 = Poor, and 1 = Unsatisfactory.

A. Participants

The study cohort consisted of 64 volunteers randomly selected from students in the IT and Education departments at KAU University in the 2013 academic year who were taking a lecture using the IELS system. These students communicated with each other and with their lecturers to examine and evaluate the efficiency of IELS system. A total of 32 students were from the IT Department and represented group A while the other 32 students were from the Education Department and represented group B. The group of IT students was divided equally into two groups; 16 students represented A1 who communicated during a traditional lecture, while the other 16 students, who represented group A2, communicated using the IELS system. The same lecture was presented for the Education group which was divided into groups, B1 and B2, and they worked under the same conditions as groups A1 and A2.

B. Research Questions

To analyse and evaluate the IELS communication, the following questions were addressed as shown in Table I.

TABLE I
RESEARCH QUESTIONS

| No | Question |
|----|---|
| Q1 | Is it easy to communicate with my lecturer using the IELS? |
| Q2 | Is it easy to obtain feedback from my lecturer using the IELS? |
| Q3 | Does my lecturer support me via IELS? |
| Q4 | Does the IELS motivate me to concentrate on the lecture contents? |

V. RESULTS ANALYSIS

A. Analysis of Questionnaire

When the traditional lecture was delivered to groups A1 and B1 no significant communication was registered apart from a few questions asked by some students of their lecturers. The two subgroups, A2 and B2, communicated using the IELS system group. In order to compare between them the questionnaire was analysed. In order to analyse the effectiveness of communication between students when using the IELS system, and to examine the differences between the IELS groups, parametric and nonparametric statistical tests were conducted. Parametric statistical measures were applied when the Shapiro-Wilk normality tests showed that the

distribution was significantly different from a normal distribution, while nonparametric statistical measures were applied when normality tests showed that the distribution was not significantly different from a normal distribution.

To examine the IELTS communication, the research questions were translated into four statements and given to the IELTS student groups to measure their perspective of communication between users. Table II shows the statements that evaluate IELTS communication. To analyse this question null hypotheses were formulated according to the statements.

TABLE II
NULL HYPOTHESES

| No | NH |
|----|---|
| Q1 | NH.1 There is no difference between the means of communication between students and their lecturer via the IELTS system from the perspective of the IT and Education groups |
| Q2 | NH.2 There is no difference between the means of obtaining easy feedback via the IELTS system from the perspective of the IT and Education groups |
| Q3 | NH.3 There is no difference between the means of lecturer support via the IELTS system from the perspective of the IT and Education groups |
| Q4 | NH.4 There is no difference between the means of motivation via the IELTS system from the perspective of the IT and Education groups |

1. Normality Distribution Test

To determine what type of test will be used to examine the significance level of communication when using the IELTS application between the IT and Education groups, the Shapiro-Wilk Test was conducted to examine the normal distribution. Table III shows that all the items were below the significance level of 0.05 for example, item C1 was at a significance level of 0.043 for the IT group, while it was at a significance level of .001 for the Education group, which indicates that the data for all items were not normally distributed between the IT and Education groups, except for item C4 for IT group which, at 0.065 was slightly higher than the significance level of 0.05.

TABLE III
NORMALITY DISTRIBUTION TEST FOR GROUPS

| Item | Statement | Action | Shapiro-Wilk Test | |
|------|---|-----------|-------------------|------|
| | | | df | Sig. |
| C1 | It was easy to communicate with my lecturer using the IELTS | IT | 16 | .043 |
| | | Education | 16 | .001 |
| C2 | It was easy to obtain feedback from my lecturer using the IELTS | IT | 16 | .026 |
| | | Education | 16 | .030 |
| C3 | My lecturer supported me via the IELTS | IT | 16 | .044 |
| | | Education | 16 | .001 |
| C4 | The IELTS motivated me to concentrate on the lecture contents | IT | 16 | .065 |
| | | Education | 16 | .001 |

2. Basic Statistical Analysis

Table IV shows that the highest mean was for item C2 which had a mean of 3.88 with an SD of 0.873 for the IT group, while it had a mean of 3.56 with an SD of 0.814 for the Education group. However, with regard to item C4 the means were the same at 3.63 for both groups. The overall results show that, in terms of their perception regarding communication when using the IELTS application, the mean for the IT group was 3.74, which is close to Good, while the mean for the Education group was 3.49, which is between Good and Satisfactory.

TABLE IV
MEANS OF COMMUNICATION OF STUDENT

| Item | Statement | Actions | N | Mean | S.D |
|------|---|-----------|----|------|------|
| C1 | It was easy to communicate with my lecturer using the IELTS | IT | 16 | 3.69 | .873 |
| | | Education | 16 | 3.38 | .619 |
| C2 | It was easy to obtain feedback from my lecturer using the IELTS | IT | 16 | 3.88 | .957 |
| | | Education | 16 | 3.56 | .814 |
| C3 | My lecturer supported me via the IELTS | IT | 16 | 3.75 | .856 |
| | | Education | 16 | 3.38 | .619 |
| C4 | The IELTS motivated me to concentrate on the lecture contents | IT | 16 | 3.63 | .957 |
| | | Education | 16 | 3.63 | .719 |

Average mean of IT is 3.74. Average mean of Education is 3.49

3. Mann-Whitney U Test

The findings in Table V show that there is no significant difference between the Education and IT groups in all items

TABLE V
MAN-WHITNEY U TEST FOR IELTS COMMUNICATION

| | Statement | Mann-Whitney U | Z | Sig. (2-tailed) | G | N | Mean Rank |
|----|---|----------------|--------|-----------------|----|----|-----------|
| C1 | It was easy to communicate with my lecturer using the IELTS | 102.500 | -1.043 | .297 | IT | 16 | 18.09 |
| | | | | | ED | 16 | 14.91 |
| C2 | It was easy to obtain feedback from my lecturer using the IELTS | 103.000 | -.995 | .320 | IT | 16 | 18.06 |
| | | | | | ED | 16 | 14.94 |
| C3 | My lecturer supported me via the IELTS | 95.000 | -1.350 | .177 | IT | 16 | 18.56 |
| | | | | | ED | 16 | 14.44 |
| C4 | The IELTS motivated me to concentrate on the lecture contents | 125.000 | -.121 | .904 | IT | 16 | 16.69 |
| | | | | | ED | 16 | 16.31 |

Overall, Table VI shows that there is no significant difference between the means between the students and their lecturers among the Education and the IT groups and that it fails to reject the null hypotheses. This shows that there is no difference between the means via the IELTS system from the perspective of the IT and Education student groups.

TABLE VI
NULL HYPOTHESES TEST

| Null hypotheses | Result |
|---|----------------|
| NH1 There is no difference between the means regarding the ease of communication with the lecturer via the IELTS system from the perspective of the IT and Education groups | Fail to reject |
| NH2 There is no difference between the means regarding ease of obtaining feedback via the IELTS system from the perspective of the IT and Education groups | Fail to reject |
| NH3 There is no difference between the means of lecturer support via the IELTS system from the perspective of the IT and Education groups | Fail to reject |
| NH4 There is no difference between the means of motivation via the IELTS system from the perspective of IT and Education groups | Fail to reject |

B. Analysis of Information Exchange

1. Analysis of Information Exchanges between Group A and Group B Using IELTS

The IELTS system offers a rich communication environment that allows users to contact each other. This will enhance the communication between students themselves and with their lecturers. For example; via messages box, students can send email to each other or to their lecturer. In addition the IELTS system offers a chat area. Quantitative analysis is conducted to

analyse the two-way exchange of information. Therefore the time it takes to deliver the lecture is taken into consideration in this analysis. The real time for the traditional lecture is 50 minutes. When recording and converting the traditional lecture format into short video clips according to the lecture topics and taking out all pauses in the traditional lecture the IELTS clips duration was 42 minutes for the Education group and 39 for the IT group. This means that 8 minutes was left out of the clips for group B, and 11 minutes for group A. This time allows the IELTS users to make effective contact with each other and discuss or ask questions about any relevant topic in the lecture content.

2. Analysis of Sent Messages from Students

To analyse the sent messages from students to each other or to their lecturer, the number of messages was divided by the number of free minutes to determine how many messages were sent per minute. Table VII shows sent messages per minute among the IT and Education student groups.

TABLE VII
SENT MESSAGES PER MINUTE

| | Group | Free Minutes | Sent messages | Message per Min |
|----|-------|--------------|---------------|-----------------|
| 1 | IT(A) | 11 | 4 | 0.36 |
| 2 | IT(A) | 11 | 3 | 0.27 |
| 3 | IT(A) | 11 | 2 | 0.18 |
| 4 | IT(A) | 11 | 3 | 0.27 |
| 5 | IT(A) | 11 | 2 | 0.18 |
| 6 | IT(A) | 11 | 4 | 0.36 |
| 7 | IT(A) | 11 | 3 | 0.27 |
| 8 | IT(A) | 11 | 4 | 0.36 |
| 9 | IT(A) | 11 | 2 | 0.18 |
| 10 | IT(A) | 11 | 3 | 0.27 |
| 11 | IT(A) | 11 | 2 | 0.18 |
| 12 | IT(A) | 11 | 3 | 0.27 |
| 13 | IT(A) | 11 | 3 | 0.27 |
| 14 | IT(A) | 11 | 4 | 0.36 |
| 15 | IT(A) | 11 | 3 | 0.27 |
| 16 | IT(A) | 11 | 3 | 0.27 |
| 17 | ED(B) | 8 | 2 | 0.25 |
| 18 | ED(B) | 8 | 3 | 0.38 |
| 19 | ED(B) | 8 | 0 | 0.00 |
| 20 | ED(B) | 8 | 1 | 0.13 |
| 21 | ED(B) | 8 | 3 | 0.38 |
| 22 | ED(B) | 8 | 2 | 0.25 |
| 23 | ED(B) | 8 | 3 | 0.38 |
| 24 | ED(B) | 8 | 4 | 0.50 |
| 25 | ED(B) | 8 | 1 | 0.13 |
| 26 | ED(B) | 8 | 0 | 0.00 |
| 27 | ED(B) | 8 | 2 | 0.25 |
| 28 | ED(B) | 8 | 1 | 0.13 |
| 29 | ED(B) | 8 | 3 | 0.38 |
| 30 | ED(B) | 8 | 2 | 0.25 |
| 31 | ED(B) | 8 | 3 | 0.38 |
| 32 | ED(B) | 8 | 0 | 0.00 |

To analyse the mean of sent messages from students to students and students to lecturers among the IT and the Education groups, basic statistical tests were conducted. Table VIII shows that the IT group had a mean of 3.00 and an SD of .730 which was higher than that of the Education group had a mean of 1.88 and an SD of 1.258.

TABLE VIII
BASIC STATISTICS OF MESSAGES PER MINUTE

| | Group | N | Mean | Std. Deviation | Std. Error Mean |
|---------------|-------|----|------|----------------|-----------------|
| Sent Messages | IT | 16 | 3.00 | .730 | .183 |
| | ED | 16 | 1.88 | 1.258 | .315 |

To analyse whether there was a significant difference in sent messages an independent t-Test was conducted. Table IX shows there was a significant difference between the IT and Education groups because the level of significance was at 0.005 which is below the significance level of 0.05.

TABLE IX
INDEPENDENT t-TEST (SENT MESSAGES)

| t-Test for Equality of Means | | | | | |
|------------------------------|-----------------------------|-------|--------|----------------|-----------------|
| | | t | df | Sig.(2-tailed) | Mean Difference |
| Sent Messages per min | Equal variances assumed | 3.093 | 30 | .004 | 1.125 |
| | Equal variances not assumed | 3.093 | 24.076 | .005 | 1.125 |

3. Analysis of Chat from Students

To analyse the chat from students the number of chat items was divided by the number of free minutes. Table X shows sent chat per minute between students and students and students and their lecturers among IT and Education student groups.

TABLE X
SENT CHAT PER MINUTE

| | Group | Free Minutes | Sent Chat | Chat per Min |
|----|-------|--------------|-----------|--------------|
| 1 | IT(A) | 11 | 3 | .27 |
| 2 | IT(A) | 11 | 5 | .45 |
| 3 | IT(A) | 11 | 3 | .27 |
| 4 | IT(A) | 11 | 4 | .36 |
| 5 | IT(A) | 11 | 7 | .64 |
| 6 | IT(A) | 11 | 4 | .36 |
| 7 | IT(A) | 11 | 3 | .27 |
| 8 | IT(A) | 11 | 4 | .36 |
| 9 | IT(A) | 11 | 4 | .36 |
| 10 | IT(A) | 11 | 5 | .45 |
| 11 | IT(A) | 11 | 4 | .36 |
| 12 | IT(A) | 11 | 7 | .64 |
| 13 | IT(A) | 11 | 3 | .27 |
| 14 | IT(A) | 11 | 4 | .36 |
| 15 | IT(A) | 11 | 2 | .18 |
| 16 | IT(A) | 11 | 1 | .09 |
| 17 | ED(B) | 8 | 5 | .63 |
| 18 | ED(B) | 8 | 4 | .50 |
| 19 | ED(B) | 8 | 6 | .75 |
| 20 | ED(B) | 8 | 3 | .38 |
| 21 | ED(B) | 8 | 5 | .63 |
| 22 | ED(B) | 8 | 2 | .25 |
| 23 | ED(B) | 8 | 2 | .25 |
| 24 | ED(B) | 8 | 1 | .13 |
| 25 | ED(B) | 8 | 4 | .50 |
| 26 | ED(B) | 8 | 3 | .38 |
| 27 | ED(B) | 8 | 5 | .63 |
| 28 | ED(B) | 8 | 4 | .50 |
| 29 | ED(B) | 8 | 4 | .50 |
| 30 | ED(B) | 8 | 6 | .75 |
| 31 | ED(B) | 8 | 3 | .38 |
| 32 | ED(B) | 8 | 4 | .50 |

To analyse the mean of the chat items basic statistical has been conducted. Table XI shows that the higher mean was at a mean of 3.94 with an SD of 1.569 for IT group, while it was at a mean of 3.81 with an SD of 1.424 for Education group.

TABLE XI
BASIS STATISTICS OF CHAT PER MINUTE

| | Group | N | Mean | Std. Deviation | Std. Error Mean |
|------------|-------|----|------|----------------|-----------------|
| IELS Group | ED | 16 | 3.81 | 1.424 | .356 |
| | IT | 16 | 3.94 | 1.569 | .392 |

To analyse the significant difference of chat an independent t-Test conducted. Table XII shows there was no significant difference between both groups because the level of significant was at 0.815 which is higher than the significant level of 0.05.

TABLE XII
INDEPENDENT t-TEST (SENT CHAT)
t-Test for Equality of Means

| | | t | df | Sig.(2-tailed) | Mean Difference |
|-------------------|-----------------------------|-------|--------|----------------|-----------------|
| Sent Chat per min | Equal variances assumed | -.870 | 30 | .815 | .125 |
| | Equal variances not assumed | -.870 | 29.723 | .815 | .125 |

VI. CONCLUSION

To conclude, the IELS system was implemented to evaluate the effectiveness of communication between students and their peers and students and their lecturers. Firstly, no real communication was recorded among the traditional lecture groups because the lecturer took up all the time talking while the students just listened. Only a few questions were asked in the traditional lecture groups. The IELS system provided effective communication between the student groups based on the results in Section V that show that there was satisfaction regarding the IELS and they were able to stay in contact with each other or with their lecturers as they wished. The results also show that there was no significant difference between the IT and Education student groups when they used the chat area, while there was a significant difference in sending and receiving messages. This could be related to their experiences, but overall the IT and Education student groups were happy to communicate using the IELS system.

REFERENCES

- [1] G. Beauchamp, S. Kennewell, Interactivity in the classroom and its impact on learning, Publisher, City, 2010.
- [2] P.A. Gustavsen, E. Tilley, Public relations communication through corporate websites: Towards an understanding of the role of interactivity, Publisher, City, 2003.
- [3] H.D. Lasswell, The structure and function of communication in society, Publisher, City, 1948.
- [4] S.P. Morreale, B.H. Spitzberg, J.K. Barge, Human communication: Motivation, knowledge, and skills, Cengage Learning, 2007.
- [5] S.-K. Lo, T. Lie, Selection of communication technologies—A perspective based on information richness theory and trust, Publisher, City, 2008.
- [6] P. Barthelmess, E. Kaiser, R. Lunsford, D. McGee, P. Cohen, S. Oviatt, Human-centered collaborative interaction, in: Proceedings of the 1st

ACM international workshop on Human-centered multimedia, ACM, 2006, pp. 1-8.

- [7] A. Schmidt, Implicit human computer interaction through context, Publisher, City, 2000.
- [8] S. Domagk, R.N. Schwartz, J.L. Plass, Interactivity in multimedia learning: An integrated model, Publisher, City, 2010.
- [9] R. Donnelly, Harmonizing technology with interaction in blended problem-based learning, Publisher, City, 2010.
- [10] M. Yacci, Interactivity demystified: A structural definition for distance education and intelligent CBT, Publisher, City, 2000.
- [11] S. Rafaeli, F. Sudweeks, Networked interactivity, Publisher, City, 1997.
- [12] M. Oliver, J. Petch, Towards an effective framework for the evaluation of e-learning, Publisher, City.
- [13] M. Wang, W. Ran, J. Liao, S.J. Yang, A Performance-Oriented Approach to E-Learning in the Workplace, Publisher, City, 2010.
- [14] V. Simpson, M. Oliver, Electronic voting systems for lectures then and now: A comparison of research and practice, Publisher, City, 2007.



Ahmed Al-Thobaiti, was born in Taif, Saudi Arabia. He received his Master's degree in Technology Enhanced Learning from the Faculty of Advanced Technology, The University of South Wales, United Kingdom, 2008. He is currently a PhD Student in the School of Engineering and Computing Sciences at Durham University, UK and a lecturer at King Abdulaziz University, Saudi Arabia. His research interests are focused on e-learning, developing interactive applications, and electronic communication skills.



Malcolm Munro is Emeritus Professor in the School of Engineering and Computing Sciences at Durham University. His main interests are focused on Software Visualisation, Software Maintenance and Evolution, and Program Comprehension. The concern of the research is to establish how Legacy Systems evolve over time and to discover representations (visualisations) of those systems to enable better understanding of change.