Comparison Study of Learning Using the Traditional Lecture and the IELS

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Abstract: The main goal of this paper is to assess the learnability of the Interactive Electronic Lecture System (IELS) and to compare learning outcomes of undergraduate students who attended traditional lectures with those who used the IELS. Both groups were tested before and after this experiment was conducted. They were given pre-tests and post-tests to examine their learning outcomes. The IELS group was also asked to complete a questionnaire to measure their attitudes when they used the IELS application. The results showed that the IELS students achieved higher learning outcomes than the traditional group.

Key words: Comparison, learnability, learning outcomes.

1. Introduction

There is a continuing need, globally, to make the learning process easier and more efficient. King Abdulaziz University (KAU) in Saudi Arabia is very keen to enhance the learning process and is striving to provide rich electronic resources to serve all its students; therefore its lecturers are very keen to present lecture content using new methods and technology that can support and enhance students' learning outcomes.

In the context of using e-lectures, a new model of lecturing, the Interactive Electronic Lecture System (IELS), was designed and developed to be applied in order to enhance the learning process at KAU. An analysis of the goals, effectiveness and impacts of the IELS at KAU has been conducted in this research to ascertain whether the IELS system improves students' performance, taking into consideration their needs. Interactive learning within the IELS will enable students to build trust and respect, foster learning and accomplish goals.

This paper will compare the student learning outcomes of two groups, a control group and an experimental group. The control group were offered traditional lectures while the experimental group used the Interactive Electronic Lecture System (IELS). Research questions have been addressed and then translated into null hypotheses. Quantitative tests such as the Shapiro-Wilk test and the independent t-test have been used to determine whether there is a significant difference between the learning outcomes of the traditional lecture and IELS application.

2. Learning Theories

Pedagogy and sciences include a wide range of theories that offer explanations and clarifications of the

phenomena or events on which those theories might be applied. There are a number of different theories regarding how people learn. Learning theories can be considered as organized attempts to generate knowledge about human behaviour in order to explain a behavioural and unpredictable phenomenon[1]. Of course the main objective of learning theories is to understand human behaviour in terms of how it is formed and to identify its variables and causes [2]. It is useful to consider the application of theories in order to determine how students learn, as well as how they are taught. This suggests that teaching activities and learning contexts might be designed and implemented by taking the principles of learning theories into consideration. Learning theories are classified into three groups: behaviourism, cognitivism, and constructivism. Each group suggests that the learning process depends on different assumptions derived from ancient philosophy regarding the mind, knowledge, the role of genetics and also the environment. Traditional teaching is a very complex activity and that complexity is extended even further when teaching is delivered online or electronically [3]. In the past, in accordance with behaviourism and cognitive theories, teachers played the main role in the learning process by transferring knowledge to their students; therefore the students' outcomes depended on the teacher's ability and how well they were able to transfer the knowledge to their students [4]. However, constructivism theory takes a different view, concentrating on the students themselves and on how to create an individual learning experience for each student. In constructivism theory each student can have their own particular ideas and unique way of acquiring knowledge [5]. Whenever people pay attention to content they learn more, this means the increase in knowledge level depends on the attention paid to the content [6]. Constructivism theory plays a crucial role in educational institutions and higher education, and educationists tend to support it. Constructivism theorists believe that humans learn by constructing their own understanding and knowledge and this knowledge can be reflected on new experiences [7].

Thus, the main hypotheses of constructivism theory are as follows: Learning is an active process, so learners construct their own knowledge and they learn how to learn. In addition, learning consists of language which has a profound effect on the learning process. It is a social activity associated with the individual coming into contact with others: the teacher, peers, family and friends. Learning does not occur instantly, but it takes time, and real learning needs individual ideas to be re-checked again and again, which leads to reflection and testing that in turn leads to learning. It is a contextual process, so humans learn from the relationship between what they know and what they believe, and approve or reject. In addition, previous experience is necessary for learning to take place; it is unlikely that the integration of new knowledge will occur without having previous learning. According to constructivism theory, learning is not just a constant change in behaviour resulting from experience or enhanced by training, but real learning is the change that occurs from meditation cognitive processes[8]. This theory also describes the human being as an active learner with developed knowledge. Thus the proposed research into the e-lecture might be developed to enable students to build their knowledge due to their ability to interact with its content.

3. Study Design

Study design is an important stage of research, in particular when the researcher is attempting to draw up systematic procedures and methods to solve a research problem[9]. Quantitative method refers to numerical data collected using a mathematical or statistical tool, while qualitative method indicates non-numerical information that is not based on a mathematical or statistical tool, for instance sound, text and images [10].

3.1. Experiment Map

The experiment was designed to be carried out using two groups. The first group was the control group (traditional group) with lectures delivered by the traditional method. The second group was the

experimental group with lectures delivered by the IELS. Thirty-two volunteer students participated and they were randomly divided into the two groups. This is shown in Fig. 1 in the experiment map. Both groups were given a pre-test and a post-test to be able to evaluate the learning outcomes. The second group were given a questionnaire to evaluate the learnability of the IELS and evaluate the learning outcomes. Group B worked under two different conditions and was therefore divided into two subgroups; B1 and B2. B1 worked under a popup action condition, while B2 worked under a click action condition. In order to ensure suitable methods two common designs were applied in the experiment: within-subject design and between-group design.

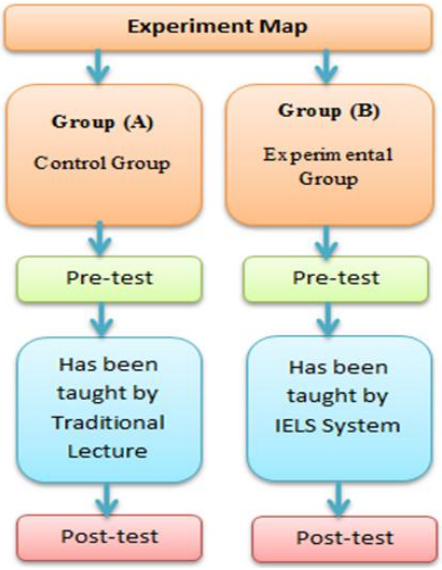

Fig. 1. Experiment map.

3.2. Popup Action

The popup action is a kind of interactive question that appears spontaneously when the video clip is running. It is designed to ensure that the students are following the content of the lecture and concentrating carefully. This action was delivered to experimental group B1; the group was trained in this action, but they were not informed of exactly when the popup question would occur in the actual experiment. The lecturer has the privilege of setting up this action according to subtopics that need to be focused on in the lecture.

3.3. Click Action

The second interactive action, click action, was delivered to experimental group B2. The technique of the click action differs from that of the popup action which appears then disappears. For the click action, the lecturer uploads the clip and identifies its duration and subtopic. Then the lecturer sets up a button saying "Click Here" which will appear at the bottom of the screen when the clip begins. Statements regarding content from the clip, which need to be learned, will appear at the bottom of the screen under the "Click Here" button. The student is required to read these statements, then watch the clip and click on the button when the lecturer mentions each statement or talks about it.

3.4. Within Subject Design

A within-subject design is called repeated measure because all participants receive the same treatment. It was applied to all participants whose situations were similar and their learning outcomes were tested twice, in pre-test and post-test. A within-subjects design is one in which the same individuals participate in all of the experimental conditions – that is, repeated measures are taken from the same people, thereby

examining the differences within the subjects.

This method reduces any error variance associated with individual differences [11]. This design was applied to both groups. The conditions of all participants in this group were the same and they were offered pre-tests as well post-tests to check their learning outcomes before and after applying the experiment. Group A consisted of a set of students who were offered learning via the traditional lecture, while group B worked under IELS condition. For data collection each group was measured by within-subject methods to test the independent variables for all participants in each group separately, as shown in Fig. 2.

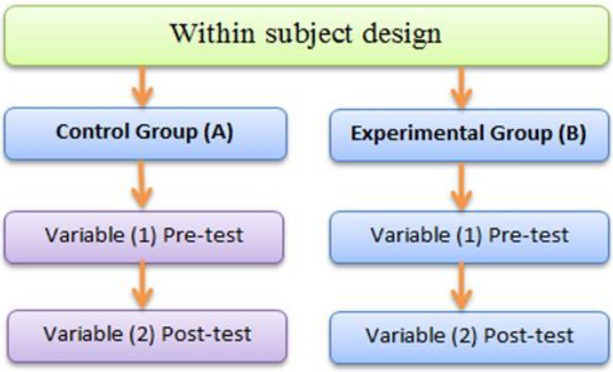

Fig. 2. Within subject design.

3.5. Between Group Design

In order to test the research hypothesis another method, between-group design, was applied in this experiment (Fig. 3). A between-groups design is one that can be used if participation in one condition makes it impossible for a participant to take part in another [12]. A between-groups design is an experimental design in which different groups are assigned to the different conditions in the experiment. That is, the control group and the experimental group consist of different people. The point of the study then is to examine any observed differences between the groups.

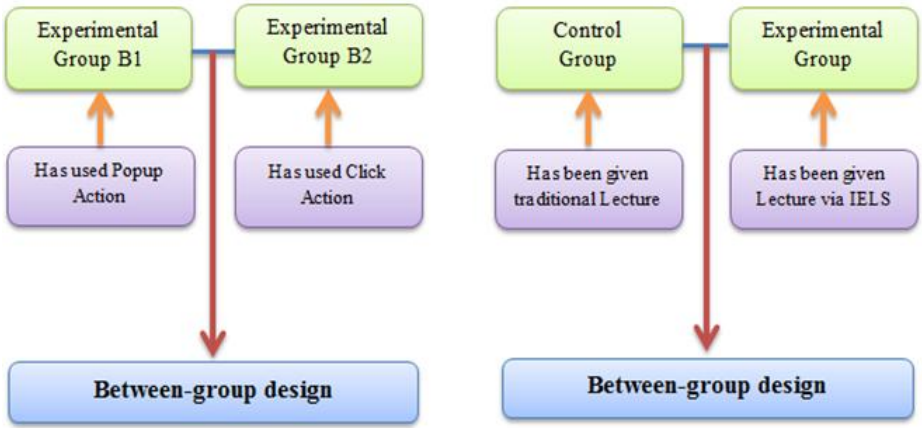

Fig. 3. Between group design.

This method is suitable for comparing between the traditional group and the experimental group. Therefore different participants were selected randomly for these groups to make sure the confounding variables were equally distributed within all conditions. Random distribution of students between groups ensures that any differences between the groups are the consequence of chance and not of systematic bias [13]. Furthermore, the use of this method in this research means the control group's performance cannot

affect the experimental group's performance because each group has different conditions or independent variables. The independent variable was measured for all participants and both groups. Therefore this method is based on an independent measurement.

3.6. Research Questions and Hypotheses

To analyse and evaluate the IELS learnability, the following questions were addressed as shown in Table 1.

Table 1. Research Questions

No	Questions
Q1	Is it easy to learn using the IELS?
Q2	Is it easy to learn using the IELS actions?
Q3	Does the IELS application offer learning when a user wants it?
Q4	Does the IELS application facilitate the learning process?
Q5	Does the IELS application deliver more learning outcomes than the traditional lecture?

These questions were translated into five statements and given to the IELS students group to measure their perceptions of the learnability of the IELS. The students were asked to rank the statements that were designed according to the Likert scale based on a scale that ranged from 5 = Outstanding, 4 = Good, 3 = Satisfactory, 2 = Poor, to 1 = Unsatisfactory.

Table 2 shows the statements that evaluate IELS learnability. To analyse these questions null hypotheses were formulated according to the questionnaire items as shown in Table 2.

Table 2. Statement of Questions and Null Hypotheses

ID	Statement	Null hypotheses
L1	It was easy to learn using the IELS	NH1. There is no difference in ease of learning using the IELS from the perspective of student groups
L2	IELS actions make it easy to learn	NH2. There is no difference in ease of learning between the click and popup actions from the perspective of student groups
L3	IELS offered learning at any time	NH3. There is no difference between the means in to learning at any time from the IELS from the perspective of student groups
L4	IELS facilitates the learning process	NH4. There is no difference between the means in facilitation of the learning process from the perspective of student groups
L5	IELS offered more learning than the traditional lecture	NH5. There is no difference between the means in the amount of learning offered from the perspective of student groups

4. Results

In this section the questionnaire, pre-test and post-test are analysed. The questionnaire was distributed to the students to discover their attitudes when using the IELS application. Quantitative methods were used to investigate the significant differences between the groups. The level of significance that determined whether to reject or fail to reject the null hypotheses was 0.05. Pre-test and post-test were applied for groups A and B to find the differences between them.

4.1. Analysis of Questionnaire (Learnability)

Sixteen undergraduate students from the IT department were asked to complete the questionnaire after

using the IELS application. Eight students (group B1) used IELS via popup action while the other eight (group B2) used IELS via click action. Quantitative data obtained from the questionnaire was used to analyse the learnability of the IELS groups. The Shapiro-Wilk test was conducted to check the data normality of the distribution [14]. Also basic statistical analysis was performed to obtain the means of the subjects and show their attitudes regarding learnability. In addition the independent t-test was used to compare the means of groups B1 and B2 and decide whether to reject the null hypotheses or fail to reject [15].

4.2. Normal Distribution Test

To determine normality of distribution in order to measure the learnability of the IELS between groups B1 and B2 the Shapiro-Wilk test was used. Table 3 shows that the P value is larger than 0.05, which means the learnability was normally distributed for all items.

Table 3. Normality Distribution Test for (B)

Item	Statement	Action	Shapiro-Wilk Test	
			df	Sig.
L1	It was easy to learn from the IELS	B1 (Popup)	8	.056
		B2 (Click)	8	.067
L2	ILEA actions are easy to learn from the IELS	B1 (Popup)	8	.324
		B2 (Click)	8	.056
L3	IELS offered learning to me at any time as wanted	B1 (Popup)	8	.037
		B2 (Click)	8	.093
L4	IELS facilitates the learning process	B1 (Popup)	8	.324
		B2 (Click)	8	.324
L5	IELS offered me more learning than traditional lectures	B1 (Popup)	8	.067
		B2 (Click)	8	.067

4.3. Basic Statistic Analysis

Table 4. Means of Learnability of Student

Item	Statement	Actions	N	Mean	S.D
L1	It was easy to learn from the IELS	B1 (Popup)	8	3.75	.707
		B2 (Click)	8	3.88	.835
L2	ILEA actions are easy to learn from the IELS	B1 (Popup)	8	3.38	.916
		B2 (Click)	8	3.75	.707
L3	IELS offered learning at any time as wanted	B1 (Popup)	8	3.88	.641
		B2 (Click)	8	4.00	.756
L4	IELS facilitated the learning process	B1 (Popup)	8	3.63	.916
		B2 (Click)	8	3.63	.916
L5	IELS offered more learning than the traditional lectures	B1 (Popup)	8	3.88	.835
		B2 (Click)	8	3.88	.835
Average mean of B1 3.70 Average means of B2 3.83					

Table 4 shows a basic analysis that includes the means and the standard deviation for the IELS groups. Results show that L1 has the higher mean at 3.88 with an SD of 0.835 for group B2 (click action), while the mean of group B1 (popup action) was at 3.75 with an SD of 0.707 for. For L2 the higher mean was 3.75 with an SD of 0.707 for B2 and 3.38 with an SD of 0.916 for B1. For L3 the higher mean was 4.00 with an SD of

0.756 for B2, while the mean was 3.88 with an SD of 0.641 for B1. For L4 both groups, B1 and B2, had the same means of 3.63 with an SD of 0.916. In addition for L5 both groups had the same means of 3.88 with an SD of 0.835. Table 4 also shows that the average mean for B2 was 3.83, slightly higher than the mean of B1 which was 3.70.

4.4. Independent T-Test

To check whether there was a significant difference between Groups B1 and B2 the independent t-test was used to examine the null hypotheses. Table 5 Shows that all p values for all items were greater than .05 (P >.05) which means there were no significant differences between the means of groups B1 and B2 when they learned using the IELS application.

Table 5. Independent Sample T-Test

Item	Statement	t	df	Sig.
L1	It was easy to learn from the IELS	-.323	14	.751
L2	ILEA actions are easy to learn from the IELS	-.917	14	.375
L3	IELS offered learning to me for any time as wanted	-.357	14	.727
L4	IELS facilitates the learning process	.000	14	1.000
L5	IELS offered me more learning than the traditional lectures	.000	14	1.000

Table 6 shows that all null hypotheses failed to be rejected. This indicates that there was no significant difference between the means of group B1 and the means of group B2 when they worked on the IELS application using different actions.

Table 6. Null Hypotheses Result

Null hypotheses	Result
NH1 There is no difference in ease of learning with the IELS system from the perspective of IELS students groups	Fail to reject
NH2 There is no difference in ease of learning between click or popup action from the perspective of IELS students groups	Fail to reject
NH3 There is no difference between the means of learn any time from the IELS from the perspective of IELS students groups	Fail to reject
NH4 There is no difference between the means of facilitate the learning process from the perspective of IELS students groups	Fail to reject
NH5 There is no difference between the means of IELS offers more learning from the IELS from the perspective of IELS students groups	Fail to reject

4.5. Analysis of Pre-Test and Post-Test (Learning Outcomes)

In this paper the students' knowledge was tested twice: before and after each type of lecture was delivered to both groups of students. Pre-test and post-test analysis enabled a comparison to be made between the traditional lecture group and the IELS group learning outcomes before and after delivery of learning.

4.5.1. Analysis of pre-test

The 32 IT students were divided into two groups, traditional and experimental; both groups were tested before the lecture was delivered. There were 15 questions in both tests and marks out of 15 were awarded. Table 7 shows no great difference between the means of the two groups; the mean of the IELS group was

5.75 with an SD of 1.528 which was slightly higher than the traditional group that had a mean of 5.06 with an SD of 1.569.

Table 7. Basic Statistics for Pre-Test Groups A&B

	Group	*N*	Mean	Std. D	Std. Error
Pre test	A	16	5.06	1.569	.392
	B	16	5.75	1.528	.382

To examine the significant differences between group A and group B the t-test was used. Table 8 shows that there is no significant difference between the groups' learning outcomes within the pre-test with the t-test at -1.256 and the significance level was at .219 which is higher than the level of significance of 0.05.

Table 8. Independent T-Test (For Pre-Test)

		t	df	Sig.(2-tailed)	Mean Difference
Pre test	Equal variances assumed	-1.256	30	.219	-.688
	Equal variances not assumed	-1.256	29.978	.219	-.688

4.5.2. Analysis of post-test

Groups A and B were both given a post-test to check their learning outcomes after the lectures and to examine the efficiency of the lecture formats. As shown in Table 9, the mean of group B was higher than that of group B. It had a mean of 13.75 with an SD of 1.183 while group A had a mean of 8.19 with an SD of 2.713.

Table 9. Basic Statistics for Post-test Group A&B

	Group	N	Mean	Std. D	Std. Error
Post test	A	16	8.19	2.713	.678
	B	16	13.75	1.183	.296

To examine the significant difference between groups A and B the t-test was used. Table 10 shows that there is a significant difference between their learning outcomes within the post-test with the t-test at -7.517 and the significance level at .000 which is below the level of significance of 0.05. This indicates that the IELS format has a more positive effect on students' learning outcomes than the traditional lecture format.

Table 10. Independent T-Test (For Post-Test)

		T	df	Sig.(2-tailed)	Mean Difference
Post test	Equal variances assumed	-7.517	30	.000	-5.563
	Equal variances not assumed	-7.517	20.506	.000	-5.563

4.5.3. Analysis of pre-test and post-test result for IELS group

Table 11 shows that the result of the pre-test for group B had a mean of 7.67 with an SD of 1.784 while the result for the post-test had a mean of 13.75 with an SD of 1.183 for the same group.

To test the significance level between the IELS group before and after using the IELS system the paired

sample test was used. Table 12 shows a significant difference between the mean of the IELS group, because the level of significance was at .000 which is below the level of 0.05.

Table 11. Basic Statistics for Pre & Post-Test for IELS

	Test	*N*	Mean	Std. D	Std. Error
IELS Group	Pre	16	7.63	1.784	.446
	Post	16	13.75	1.183	.296

Table 12. Paired Sample T-Test for Equality of Means

	Mean	Std. D.	*t*	df	Sig.(2-tailed)
Pre-test Post test	-6.125	2.156	-11.362	15	.000

5. Discussion

The aim of this study is to enhance the learning process at King Abdualaziz University. The purpose of the adoption of a new format of lecturing is to encourage KAU undergraduate students to use the new technique in lecturing instead of the traditional lecture. Some learning aspects were analysed according to the defined research questions. The subjects were asked to submit their answers when they used the IELS system. They were also given pre and post-tests to check their learning outcomes. Five items were evaluated to check the efficiency of the learnability of the IELS. Two types of research instrument were used to check the learning outcomes between the two experiment groups.

Tests were carried out to assess the learning outcomes of the two groups. The pre-test result showed that there was no significant difference between the means of the groups. The post-test results showed that there was a significant difference between the groups, because students in the experimental group achieved more learning outcomes than those in the traditional group. This indicates that there is a positive affect when students learn by the IELS application. This leads us to conclude that IELS application supports the learning process and enhances students' achievements at KAU.

A questionnaire was given to the experiment (IELS) group to assess their perception of the learnability of IELS. Analysis of the questionnaire compared two types of action which were used with the IELS application, popup action and click action. Group B was divided into two sub groups B1 and B2 to check the IELS learnability and its efficiency. The ELS actions made it easy to learn from and offer the learning whenever a user wanted. The IELS application facilitates the learning process and offers more learning outcomes than the traditional lecture. The study showed that there was no significant difference between them. The subjects indicated that the IELS application was easy to learn from. The average mean for group B1 was 3.70, while the average mean of B2 was 3.83 out of 5. This indicates that users of IELS were satisfied with the learnability of IELS when they used this application.

6. Conclusions

This study was conducted in order to examine the efficiency and the learnability of the IELS application during the learning process at KAU. It also aimed to compare learning outcomes between the traditional lecture and the IELS application. Thirty-two students were randomly selected to participate in this study. Two instruments were used to evaluate the IELS system. The study found that the IELS application supported the learning process and enhanced students' learning outcomes. It also found that the IELS provides learning any time the user wants it and facilitate learning.

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