

# Interactive Electronic Lecture System Design

Ahmed R. Althobaiti, Post Graduate  
School of Engineering and Computing Sciences  
Durham University  
Durham, UK

Malcolm Munro, Emeritus Professor  
School of Engineering and Computing Sciences  
Durham University  
Durham, UK

**Abstract**—*Technology design plays an important role in the learning process, possibly saving time and effort and enhancing the outcomes of the process. The primary purpose of this paper is to enhance and support the learning process at King Abdulaziz University (KAU) in Saudi Arabia. In fact, learning design depends on learning theories from educational psychology. The ADDIE model will be applied to design the Interactive Electronic Lecture System (IELS). The IELS is a novel format for presenting lectures. This paper defines the IELS system in terms of making the screen designs. In addition a number of features are explained, such as system interfaces, components and storyboards. The functionality of the system and what features have been included are also illustrated.*

**Keywords**— *Interactive Electronic Lecture Design*

## I. INTRODUCTION

In this paper, Worldwide, a great deal of research has contributed to the design of learning technology, whether by creating a radical enhanced learning environment or inventing a new technology via hardware, software and applications. Technology design plays an important role in the learning process, possibly saving time and effort and enhancing the outcomes of the process. [1] offers the example of how, instead of producing a static lecture on the laws of physics, a designer could develop an interactive module that might allow students to experiment with physics without a large amount of expenditure on elaborate equipment. With respect to the learning process, technology design could improve quality and reduce maintenance requirements. Learning design is a key process in technology learning. According to [2] the concept of learning design not only focuses on the learning activity itself but it also concentrates on the temporal and material conditions for learning. A number of design models can be applied to the learning process, for example, Dick, Carey & Carey ADDIE model [3], and Clark & Mayer model (2003). According to ADDIE model the IELS (Interactive Electronic Lectures System) was developed to enhance the learning and communication process at KAU (King Abdulaziz University) in Saudi Arabia.

## II. LITERATURE REVIEW

### A. Interactivity

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 has played 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. Interactivity is a two-way communication between learners or between learner and machine. [4] defines interactivity 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".

In essence, interactive applications enhance learner experience to increase the speed of accessing knowledge and information. The interface of any application should include some multimedia sources such as text, navigation, image, audio and video, which can be combined to create an integrated application and support its interactivity. Integrating all of these combinations of media in a computer allows the use of existing computing power to represent information interactively[5].

### B. Interactive Lecture

Most commonly, universities and higher education institutions deliver knowledge to their students via lectures or tutorials. The lecture is much more abstract than a tutorial and, in comparison, there seems to be a greater degree of interactivity in a tutorial than in a lecture. Compared with other teaching methods the lecture requires a great deal of preparation time from the lecturer, despite it being the least engaging method, with learners not being actively involved. In tutorials the learner has more work to do and is more involved, whereas in lectures the learner plays a passive role.

When discussion is increased to provide more interaction and participation in lectures between lecturer and learners or between learners themselves, it is referred to as an interactive lecture. Without using any technology or equipment a lesser degree of interaction between lecturer and learner, could occur in the lecture, whereas if diverse materials or prepared slide presentations are used as technologies that will enhance the interactivity of learning process, a new paradigm will be introduced which is the e-lecture.

In tertiary education, contingent teaching can be delivered to learners in two ways, either via the conventional lecture or the e-lecture. Recent technological developments provide a new model of lectures for the transition from the one-way lecture to the interaction approach, which allows learners to actively participate in lectures. Interactive lectures are designed to

obtain a rapid response from a group of learners in response to specific content. An e-lecture has more benefits and advantages than a traditional lecture[6]. For example the e-lecture can: improve lecturer attention, focusing it on learners' outcomes, make lectures more enjoyable, allow learners to participate more and to engage actively in lectures, and provide more motivation for learners.

### C. Human-Computer Interaction

Many users learn how to operate a computer using a keyboard and mouse to point, click and select icons, all of which are types of human interaction with the computer [7]. Interaction with devices has become vital to the success of users [8]. 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. Human computer interaction is built on the hypotheses that the computer has a specific understanding of user behaviour in a given case[6].

## III. INTERACTIVE ELECTRONIC LECTURE DESIGN

IELS is a web application that contains a number of elements developed together by using the PHP language to form the Interactive Electronic Lecture System (IELS). Fig 3.1 shows the elements of the system. The IELS consists of a number of main components, including lectures, video clips, and interactive interfaces. The IELS delivers lectures to undergraduate students in a novel format that creates an interactive environment which enables students to interact with the lecture content as well to communicate with other system users such as their lecturers and colleagues. Simply the IELS, is a lecturing application that has a flexible format for any module, can be uploaded as short clips and then certain interactive actions can be carried out which enable users to interact with the lecture contents.



Figure 3.1: IELS

### Design Process

As previously mentioned in this paper the ADDIE (Analyse, Design, Develop, Implement, Evaluate) is a continuous circle learning design model. It is a continue model which means that every phase will be evaluated and developed when there is in need. According to this model the IELS system

will be developed and created, therefore the following subsections have been applied. Fig3.2 shows the ADDE circle.

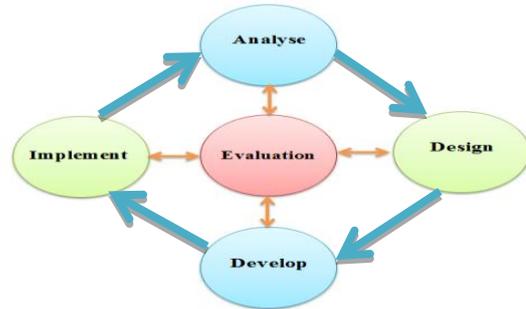


Figure 3.2: ADDIE Model

### A. Analysis

Analysis is the foundation phase of the ADDIE process, and is very important in the development of learning design. It is necessary to undertake sufficient investigation into every aspect of the learning process. This should be carried out by a designer who should brainstorm to clarify, identify and analyse all possible scenarios that may be applied in the learning process [9]. The investigation should consider many factors, including the learner's requirements and needs, content, materials, facilities, curriculum, learning goals and outcomes. Moreover, the designer should carry out some research on all the relevant techniques which could provide critical information for the next process.

To analysis and discover the requirements and the feasibility of creation the IELS, preliminary study has been conducted, therefore two types of users ; 33 students and 14 lecturers have participated. Taking users' requirements into consideration is a fundamental aspect of developing or designing a system and these were obtained from the preliminary study. Therefore this phase has been conducted to investigate and find out the answers of following questions:

- Who is the learner?
- What are the learner's needs?
- What will the learner learn?
- What outcomes may be achieved?
- What content exists?
- What content could be applied?
- What kind of lecture learner prefer?
- Is there a feasibility of developing an application such as the IELS?

This study was conducted on learners who are undergraduate students specifically at KAU. They preferred to use their mobile devices, and spent a great deal of time on them. They are

enjoying their machines using the interactive application and spend time working on. All of users are satisfied to work on an application such as IELS. Also the preliminary study found out there is a feasibility of development of an interactive electronic lecture application in order to support the learning process at KAU. It also found out that such an interactive application would improve the learning process and achieve greater communication between students themselves and their lecturers.

### B. Design

The design phase is started once the analysis phase is finished and has a clear vision and notion of the overall proposed lecturing system. This includes the goals which have been determined and detailed content that has been incorporated in the analysis phase and IELS users identified. Main pages and system components were drawn, and during this phase the comprehensive structure of the prototype has been drawn and created on paper such as shown in Fig 3.3. The content of lectures can also be developed and identified within this phase. In addition, learning strategies and content can be determined which might include, for example, strategies of organised and sequenced content, strategies of interaction between learner and content, as well as strategies of assessment [4]. The strategies were translated to some technology that will be used to enhance the level of interactivity between the learner and the application contents such as actions (Popup and Click). Some tools and software were identified such as PHP, Photoshop, and FileZilla to help to develop and create the IELS system.

### C. Develop

Successful development is based on obtaining comprehensive information during the analysis phase as well as taking the right decisions during the design phase. Clearly, in the same way that the prototype has been defined in the two phases a new framework needs to be formed for the development. So, in this

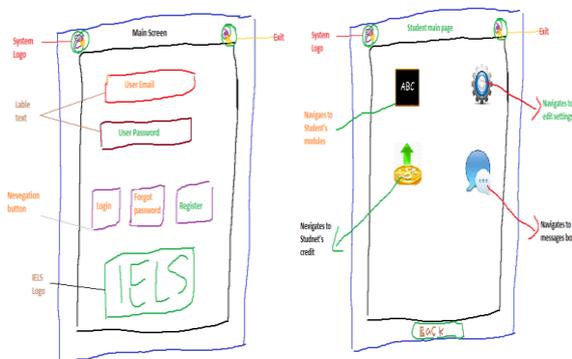


Figure 3.3; IELS

phase all plans and storyboards can be converted into a viable work [10]. Draft versions of the whole system can be generated in this phase and unsolved issues and problems may appear which might inspire the designer to predict appropriate solutions. As the target of this experiment is an Arabic student, therefore IELS screens were designed in their language as shown in Fig 3.4



Figure 3.4: IELS Screens

### D. Implement

Execution of work may be applied in this phase, possibly with the involvement and interaction of the learner and content for this system. The aim of the implementation phase is to check whether or not this system meets the learners' needs and requirements. It involves actual delivery of learning objectives to the learner throughout the learning process, and training must be an integral part in this phase [11]. During this phase the implementers also obtain feedback that may allow them to progress to completion of the project or, if necessary, to redesign the system. Some challenges or obstacles may be observed and so the programmer will be able to refine and redesign the prototype. It is important to realise that this phase is just a part of the design process and not the end of the process, because the quality and variety of the context of the design process requires all phases to be implemented.

In this phase the IELS system was uploaded to URL [www.ielsystem.com](http://www.ielsystem.com) to check that it is working smoothly. IELS features and content were tested such as register as a new user, sign in, sign out, edit personal settings, upload lecture clips, and test the IELS actions. This is also to verify that the system is working properly. Fig 3.5 shows some of the IELS screens when testing the system.



Figure 3.5; IELS Action test

### E. Evaluate

Evaluation is the systematic assessment of the worth or merit of the learning process using criteria against a set of standards [12]. It plays a crucial role in learning design and is intended to improve the whole learning design process and, therefore, continues throughout from the beginning to the end of the entire process. The purpose of this phase is to ensure that the learning design meets the requirements and needs of the learners. Two types of evaluation can be applied in this phase, formative evaluation and summative evaluation and the effectiveness and weakness of the system can be measured.

\* **Formative evaluation** Formative evaluation refers to evaluating continuously during each phase and between different phases. It aims to improve learning design before presenting it as the final version of IELS system for implementation. Formative evaluation often focuses on the development of a mentoring scheme [13]. According to this type of evaluation IELS as system subjected to some changes such as style of the application, colours, icons, navigation and so on that came from some users' feedback or from an expert review.

\* **Summative evaluation** Summative evaluation usually occurs after the implementation of the final version of the learning design. This type of evaluation assesses the overall effectiveness of the learning design. In other words it concentrates on whether or not the learning design has achieved the intended effects rather than providing information about improving it [14]. In this phase the focus of evaluating for the IELS system was to see how that system itself presents the lecture content in a motivated way and support the learning process within a novel style. It also was to enhance the interactivity between the lecture content and students, and to enhance the communication between the students and their lecturers. IELS system will evaluate the students' engagement with their lecturers and provide an easy way for communication. Figure 3.5 shows the student credit and chat box.

## IV. INTERACTIVE TECHNOLOGY

### A. Web Application

The IELS has been designed as a simple web application. It looks like a mobile app because the target of this application is undergraduate students; therefore it has been designed to be used on various devices such as mobile phones, tablets, desktops, laptops and even iPods. According to Portio Research [15] an estimated 1.2 billion people worldwide use mobile apps, and this figure is expected to increase to 4.4 billion by the end of 2017.

It has been designed with simple icons with images that explain what they navigate to. Therefore users can go from one page to another by clicking on the icon allocated. The IELS is designed for ease of use and accessibility for users, therefore there is no complexity when users need to navigate or move to a specific page.

### B. IELS Interactivity

The nature of IELS is to divide a lecture video that has been recorded into many clips according to the duration of the lecture and the lecture subtopic. This system allow students to interact with its features and lectures content as well. Therefore the IELS is an interactive system with the main focus on students' interactivity and engaging them with the lecture content; this system will explain what level of interactivity that will be achieved and this will be reflected on students' learning outcomes when the system is compared with traditional lectures.

Another aspect of IELS is that it motivates students to focus on the lecture content when they view the lecture, in particular when they know that the system will test their ability when they view the clips. So the actions (Popup or Click) will encourage them to concentrate and remain motivated. This means that students will focus and try to achieve a high level of credit which indicates their correct understanding of the lecture content. The system will also place students in a competitive learning environment which is another means of motivation.

In addition, the IELS will enhance the communication process between students and their lecturer as well as between students themselves. The IELS grants students greater freedom than is offered in the traditional lecture with regards to time and place. Students can ask, give feedback, share their opinions, discuss, and offer suggestions in a wide area of freedom without any stress or pressure.

### C. Popup Action

The popup action is a kind of interactive question that appears spontaneously when the video clip is running. It is designed to make sure that the students are following the content of the lecture and concentrating carefully. This action will be delivered to an experimental group, the group will be trained on this action, but they will not be told about the exact time of the popup question 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. When the lecturer uploads the clip they can allocate the action according to the time scale of the clip, which means the lecturer could allocate one popup action or many according to the length of the clip and its contents. This is done by setting up the actions depending on the duration of the clip, between the start second and the end second. For instance if the lecturer wishes to ask the student many questions during a five minute clip, the first one (in this clip, Does the lecturer talk about the importance of religion to human life?) will appear from 10 to 30 seconds. This means that the student is given 20 seconds to answer the question, after which it will disappear. The second question (Does the lecturer talk about affective factors in human life?) will appear from 2 minutes 15 seconds to 2 minutes 50 seconds, giving the student 35 seconds to respond. The student is required to answer Yes/No by clicking on the popup question; the IELS will register the student's answer and save it in their record.

#### D. Click Action

The second interactive action is Click which will be delivered to another experimental group. 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 (Click Here) when the lecturer mentions each statement or talks about it. The lecturer will allocate the questions in advance based on the topic. Another important factor of this action is that there is a maximum number of times the (Click Here) button can be used. This will encourage the student not to use it indiscriminately but rather to focus on the statements and clip content and use it carefully. This technique will also distribute the statements according to the time scale of the clip. So, all the statements will appear at the bottom of the screen during the clip, but the first statement should be clicked from 15 to 28 seconds and the second one should be clicked from 35 seconds to 1minute 5 seconds and so on.

#### V. CONCLUSION

To conclude this paper covered three main areas of design the IELS. The first area was reviewed some issues such as the learning design model, interactivity definition, interactive lecture. The second area was explained what is the IELS system and how it was developed and designed. It also provides some storyboard and shot screen for the IELS system. The third area presented the interactive technology such as Popup and Click actions that will be used in the IELS system. In addition it was explained how that technology may improve the learning and communication process.

#### VI. REFERENCES

- [1] P.L. Rogers, Designing instruction for technology-enhanced learning, IGI Global, 2002.
- [2] S. Selander, Designs for learning: a theoretical perspective, Publisher, City, 2008.
- [3] W. Dick, L. Carey, J.O. Carey, The Systematic Design of Instruction, Pearson Education, 2014.
- [4] S. Domagk, R.N. Schwartz, J.L. Plass, Interactivity in multimedia learning: An integrated model, Publisher, City, 2010.
- [5] R. Steinmetz, K. Nahrstedt, Multimedia Systems, U.S. Government Printing Office, 2004.
- [6] S. Demetriadis, A. Pombortsis, e-Lectures for Flexible Learning: a Study on their Learning Efficiency, Publisher, City, 2007.
- [7] R. Harper, T. Rodden, Y. Rogers, A. Sleen, Being Human: Human-computer Interaction in the Year 2020, Microsoft Research, 2008.
- [8] A. Schmidt, Implicit human computer interaction through context, Publisher, City, 2000.
- [9] C. Royal, C.U.S.o. Education, Exploring the Use of Instructional Design Models for Web-based Instruction in Higher Education: A Modified Delphi Study, Capella University, 2007.
- [10] H.E.B. Aris, A Practical Guide To Instructional Design, Penerbit Universiti Teknologi Malaysia, 2000.
- [11] U.D. Ehlers, J.M. Pawlowski, Handbook on Quality and Standardisation in E-Learning, Springer, 2006.
- [12] D. Schröter, Sustainability Evaluation Checklist, in, August, 2010.
- [13] A. Miller, Mentoring Students & Young People: A Handbook of Effective Practice, Kogan Page, 2002.
- [14] B.C. Hodges, D.M. Videto, Assessment and Planning in Health Programs, Jones & Bartlett Learning, 2011.
- [15] A.M. Al-Khouri, Technological and Mobility Trends in E-Government, Publisher, City, 2013.



Althobaiti Ahmed, 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. Now he is a PhD Student in the School of Engineering and Computing Sciences at Durham University and a lecturer at King Abdulaziz University, Saudi Arabia. His research interests are focused on e-learning, develop 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.