Deanship of Graduate Studies

Al-Quds University

Design Principles of

Learning Management Systems

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Design Principles of Learning Management Systems

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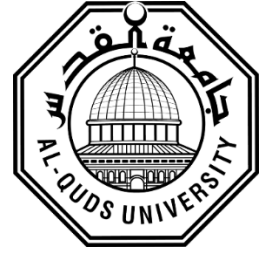
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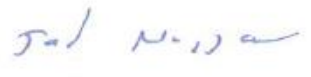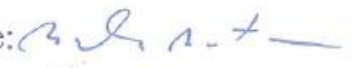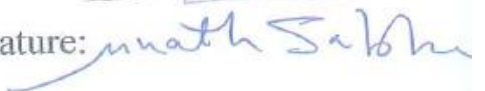**Design Principles of Learning Management System**

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1438/2016

Dedication

This work is dedicated to my family.

To my parents for their love, endless support and encouragement ….

Whose words gives me a motivation and inspiration to move forward….

To my brothers, sisters, friends and colleagues…

To all of you I say a big "Thank you" for being example of love and care.

Special dedication

To my grandmother, cousins, uncles and grandfather souls.

Ahmed Mohammed Dawod Raddad

Declaration

I certify that this thesis submitted for the degree of Master, is the result of my own research, except when otherwise acknowledged, and that this study (or any part of the same) has not been submitted for a higher degree to any other university or institution of higher education.

The work was done under the guidance of Dr. Jad Najjar and Dr. Badi Sartawi, at Al-Quds University, Palestine.

Signed…………………………………...

Ahmed Mohammed Dawod Raddad

Date: 25/12/2016

Acknowledgements

Abstract

Since the beginning of the twentieth century, learning management systems (LMS), student information system and virtual learning platforms (VLP) have become more and more popular research topics investigated by several researchers, because LMS's are so popular in large part due to what they promise and give; a shared and common understanding of a domain that can be communicated between application and end users (learners), this concept of LMS should provide an effective user interface design that enable learners to find relevant online learning resources.

Accordingly, in this work, we attempted building a learning management system prototype called "QLearn", that is an important technique to reduce the cost and risk involved in developing complex software systems. This work aims to develop effective learning object profile that will enable users to browse resources and interact with them as well. In current learning management systems, learners spent a lot of time and effort trying to find relevant and interesting learning resources. In most situations, learners do not find what they exactly want. One of the reasons for this, is that user interface of the system and its associated components are not presented appropriately to the learner and are difficult to use.

This thesis discusses this problem, by determining the suitable interaction design and styles for the different features of the learning management system. The goal is to facilitate user's activities when dealing with functions of the system in more efficient and effective ways. In this thesis, we focus on providing design user interfaces that matches users' desires, make flexible User Interface (UI) with learning objects and learning outcomes, enhance students' performance and stimulate them to do better.

مبادئ تصميم أنظمة ادارة التعلم الالكتروني

اعداد: احمد محمد داود رداد

إشراف: د.جاد النجار

المشرف المساعد: د.بديع سرطاوي

الملخص:

منذ بداية العشرينات من القرن الماضي اصبحت انظمة التعلم الالكترونية ومنصات التعلم الافتراضية الأكثر شعبية في مجالات البحث التي عمل عليها العديد من الباحثين، وذلك بسبب ما وعدت وما قامت بإعطائه وانجازه: كالفهم المشترك والمشاركة للمجال الذي يتم التواصل به بين التطبيقات والمستخدمين المعنيين (المتعلمين). هذا المفهوم لاستخدام النظم التعليمية بحاجة الى واجهة مستخدم فعالة تسمح للمتعلمين بايجاد موارد التعلم عبر الانترنت.

حاولنا في هذه الرسالة طرح واختبار نظام تعلم الكتروني اطلق عليه اسم 'Qlearn' ويهدف هذا العمل الى تطوير مواضيع تعليمية فعالة من شأنها تمكين المستخدمين من تصفح الموارد المتاحة والتفاعل معها كذلك، حيث يستنفذ المتعلمون الكثير من الوقت والجهد في محاولة العثور على مصادر التعلم ذات الصلة والاهتمام باستخدام انظمة التعلم الحالية، حيث أن المتعلمين لا يجدون - في معظم الحالات - ما يريدونه بالتحديد، ولعل احد اهم الاسباب هو أن واجهة المستخدم للنظام لا تعرض المكونات المرتبطة بهذا النظام بشكل صحيح مما يصعب استخدامها.

قمنا ايضا في هذه الاطروحة بمناقشة المشكلة من خلال طرح ادوات التصميم المناسبة لعديد من المهام، والتصميمات في محاولة ابتكار تقنيات جديدة تسهل للمستخدمين التعامل مع الوظائف الموجودة بكفاءة وفعالية أكبر، وقمنا أيضا بالتركيز على تصميم واجهة تلبي الرغبات وجعل واجهة المستخدم مرنة في ايجاد مصادر التعلم ومخرجاته، بما يؤدي الى تعزيز اداء المتعلمين وتحفيزهم للقيام بما هو افضل.

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ABBREVIATION	FULL NAME
SDQ	SERVICE DELIVERY QUALITY
ELS	E-LEARNING SYSTEM
TAM	TECHNOLOGY ACCEPT MODEL
LMS	LEARNING MANAGEMENT SYSTEM
HCI	HUMAN COMPUTER INTERACTION
UX	USER EXPERIENCE
UI	USER INTERFACE
UID	USER INTERFACE DESIGN
NV	NAVIGATION EXPERIENCE
VLE	VIRTUAL LEARNING ENVIRONMENT
ISO STANDARDIZATION	INTERNATIONAL ORGANIZATION FOR
UCD	USER-CENTERED DESIGN
LOM	LEARNING OBJECT METADATA
XML	EXTENSIBLE MARKUP LANGUAGE
LOMT	LEARNING OBJECTS MANAGEMENT TOOL
HTML	HYPERTEXT MARK-UP LANGUAGE
CSS	CASCADING STYLE SHEETS
EEG	ELECTROCARDIOGRAPHY
ECG	ELECTROENCEPHALOGRAPHY
BPM	BEATS PER MINUTE
URL	UNIFORM RESOURCE LOCATOR
PPT	POWERPOINT FILE
DOCX	DOCUMENT MICROSOFT WORD
TXT	TEXT FILE
CV	CURRICULUM VITAE
FAQ	FREQUENTLY ASKED QUESTIONS
SUS	SYSTEM USABILITY SCALE
IVR	INTERACTIVE VOICE RESPON

Chapter One

Introduction

Many e-learning studies have received considerable attention from researchers, educational institutions, and organizations for their anticipation benefits. The objective of e-learning systems is to provide students with educational services via electronic channels. User dissatisfaction is considered as the main issue facing universities in regards to e-learning systems. Service Delivery Quality (SDQ) can be deemed as an essential concern for management and customers [1].

A successful e-learning system should always take quality of platform information into account. Proper presentation of course information can significantly increase user satisfaction and their interaction while using learning system [2].

Based on the above, in Learning Management Systems (LMs), effective user interface design helps improve service delivery quality, user satisfaction and therefore enable learners to find relevant online learning resources and perform the learning activities more effectively and efficiently.

This chapter presents a brief outline of the scope, contribution, motivation and research objectives of this thesis. Chapter 2 provides the related work and the main concepts discussed in the thesis. In chapter 3, we present the system designs and case study. In chapter 4, we explain the evaluation process and results. Finally, in chapter 5, we present the conclusion and future work.

1.1 Thesis scope

Learning Management System is a computer system for learners. Many universities have employed Learning Management System (LMS) into their educational programs. It's important to design usable platforms for these institutions. According to the ISO 9221-11, usability is defined as "the extent to which a product can be used by specified users to

achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" [3].

In addition to usability's, some researchers [4] stated that some other factors are also deemed important to the e-learning users, which include program content, web page accessibility, learners' participation and involvement, website security and support, interactive environment, instructor competency, and presentation and design. Their research discovered that none of their participants consider program content, web page accessibility, participation and involvement, and presentation and design are important. Therefore, we agree that a successful e-learning system must at least be designed with good and adequate program content, which is presented well and can be accessed easily, and to allow high user participation and involvement in the virtual learning environment.

According to [5], the common step to start designing a successful LMS is to design usable user interfaces. Designing user interface is very important because it has a negative impact on user performance if it is not done correctly.

Finally, several criteria would affect the user navigation experience in Learning Management System (LMS), most of them mentioned by Lin, T., & Chen [2] as follows:

1. Confusing features – For example if two different features are given similar names, they can cause confusion.

2. A page that is packed with too many features – A page that is full of buttons, hyperlinks or information can cause distraction and difficulty in looking for the desired feature.

3. Inconsistent layout design – Inconsistent layout design will delay user's navigation. For example, a "save" button is placed on the left on first page, but it is placed on the right on the subsequent page. The user may need to spend extra time to look for the same button.

4. Unrecognizable hyperlinks/buttons – User will take longer time to recognize a hyperlink that does not appear like a link, or a menu button that does not look like a button.

5. Current location is not informed – User could be lost in the space after browsing a few pages when there is no hint on his/her current location and it can be even more frustrating if he/she does not know how to go back to the main page.

6. No explanation on "unpopular" features/activities – We cannot expect users to know every single feature on the website. When there is no explanation/tooltip given to describe the features, the users may need to try one by one until they achieve what they are looking for.

7. Ambiguous terms used for the features – The terms used to describe the features are confusing, or too technical and difficult to understand. This can be worse when no explanation is given.

This thesis focuses on three sub-area of HCI, UX, design, and evaluation, which are highlighted in Fig.1.
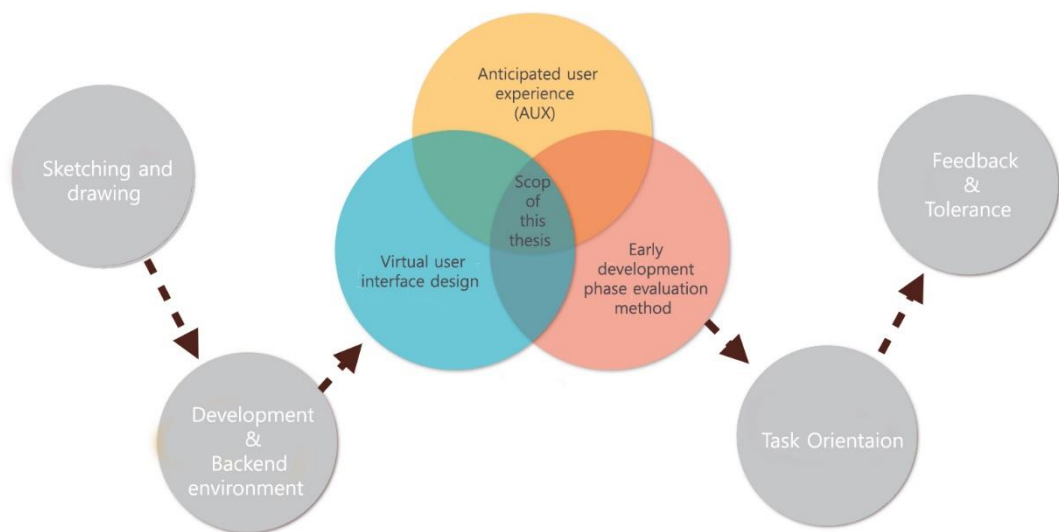
Figure 01-1: Sub-area of HCI elements in this thesis [adapted from [2] .

1.2 Problem definition

In current Learning Management Systems, learners spend a lot of time and effort trying to find relevant and interesting learning resources. In most situations, learners do not find what they exactly want. One of the reasons for this is that user interface of the system and its associated components are not presented correctly to the learner and are difficult to use.

For students, the main expected benefits of Leaning Management System (LMS) is to improve academic results, educational satisfaction. The issue of user dissatisfaction is related to lack of complete understanding of instructors' (teachers, lecturers or tutors) needs. The above problems needs for an answer to the following two questions:

- How we can build effective user interface for introducing learning experience?

- How users are really interacting with interfaces of metadata and learning objects?

It's necessary to study the different user needs according to different sociodemographic factors, such as gender, age, and experience and user role to understand their perceptions and tolerance levels of the system usability and design [2].

1.3 Contribution

Our contribution focuses on developing effective LMS that will enable users to browse resources and interact with them. Moreover, it contributes to:

1. Design UI, and UI frameworks that matches user's desires.

2. Make flexible UI with learning objects and learning outcomes.

This contribution will be demonstrated in a proof of concept prototype, implementing the major functionalities of an LMS with the most appropriate interaction designs for the LMS target users.

1.4 Motivation

In an LMS, a good UI design allows the target users to focus on their core teaching and learning activities and what is most important to them, rather than spending much time and effort in learning the system and its functionality.

Truly effective User Interface Design (UID) means that the user will only rarely need to look at assistant files, either online or written, because the UI is structured to respond -to a natural human thought process. Learners expect a similar outcome, regardless of the device they are using. Therefore, if a learner visits the website and it is not optimized for their machine, there is a good chance that he will end up leaving and not come back (Responsive design).

1.5 Summary

The implications of this study are noteworthy for academics and practitioners alike. Understanding the different users' perceptions and requirements will dramatically increase awareness of student satisfaction, ensuring motivation to continue using the LMS as a platform for teaching and learning.

This study provides insights for LMS developers to strengthen their LMS user interface design and to improve user satisfaction which is highlighted to the seven factors mentioned

before. These factors are proven to be correlated to navigation experience satisfaction (NV), otherwise frustration to e-learning users will be the outcome.

This study also focuses on providing design user interface that matches users' desires, make flexible UI with learning object and learning outcomes, enhance students' performance and stimulate them to do better. This study will enable us to access the learning resources in acceptably time and find the most relevant content, therefore increasing system usability and acceptable satisfaction level.

Chapter Two

Background

This chapter describe the component of learning management system by introduces the field of learning object and learning object metadata, then reviewing related and relevant work that covers an important aspects to the our research.

2.1 Terms definitions

2.1.1 E-Learning Environment

E-Learning provides a great opportunity for students to interact via innovative way, giving them many advantages over traditional learning. It is a web-based platform, usually within educational institution, allow participants to be organized into cohorts, group and roles, present resources, activity and interaction within a course structure [28].

The aim of this technique is to enhance student's learning experience by including computers and the instruments in the learning process. It's consists of two contributors, student and teacher mainly, the teacher observes what a student observes, but the teacher has additional user rights to create and modify curriculum content and track student performance.

The most striking feature is that the student can study at their own space where no need to adopt to class. Since course materials are available anytime, student will have the opportunity to run ahead and choose what they need to learn as desired and be assisted with an online materials achieving a proper understanding of the subject.

There are a number of commercial Virtual Learning Environment (VLE) software packages available, including blackboard, WebCT, Lotus LarningSpace, and COSE, Fronter and Saki. Fortunately, there are a variety of different open source Learning Management System that can offer the dynamic and flexible e-Learning platform needed without a need of high budget like Moodle, ATutor, Eliademy, Forma LMS, Dokeos, ILIAS, Opigno, OLAT. These system originally were found to support blended learning, which contains face-to face (video stream) classrooms and web based learning activities.

Open source Learning Management System can offer you the opportunity to create and deploy eLearning courses, especially if you are willing to take the time to master all of its feature resources.
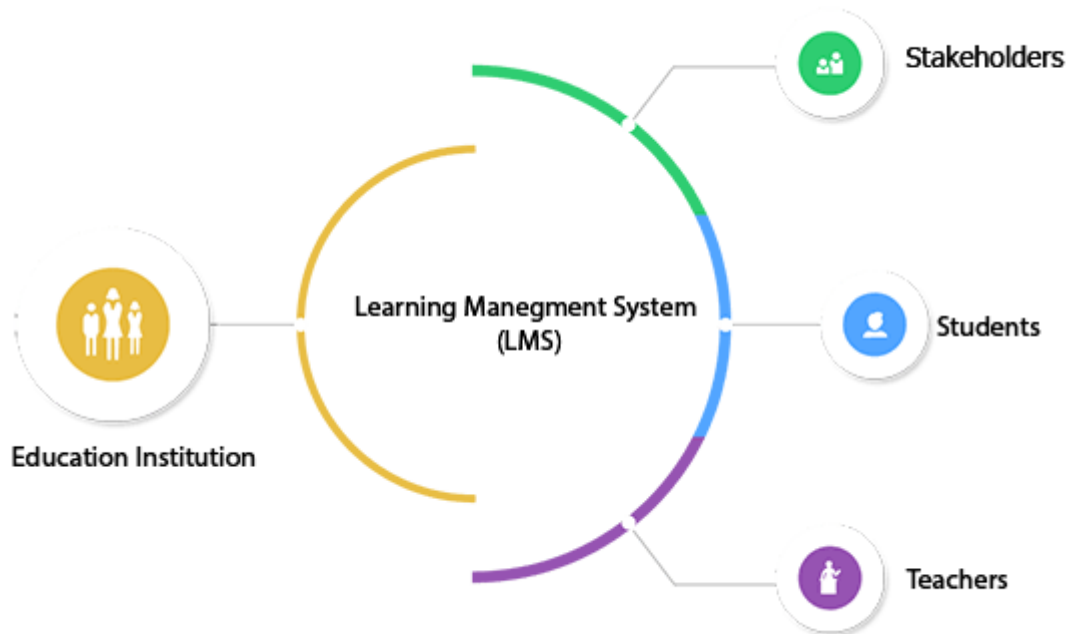
Figure 02-1: LMS elements.

With unique learning and design features, learning management systems can be implemented for a range of students at every grade level. Most learning management systems contain a standard set of tools that are used to facilitate learning and discussion in an online environment. Some tools, such as a threaded discussion forum, are used to foster communication and collaborative learning. Other tools, such as assessments and online grade books, are used to increase teacher productivity and track student performance while ensuring that the course is meeting curricular objectives [6].

Any Learning Management System (LMS) can be very useful for organizing and presenting digital content, if we consider at least the following benefits as 'A planning resource for personalizing learning' [6]:

1. Communication: LMS tools foster communication with students and parents outside of the classroom. This may include: Discussion forums, Real-time messaging, Videoconferencing, E-mail, Announcement posts

2. Accessibility: Web-based learning management systems are accessible to all students regardless of their location.

3. Time: Learning Management systems allow instructors to post additional content and resources to enhance the curriculum.

4. Flexibility: students learn at different rates, and learning management system provide the flexibility needed to meet their unique learning needs – students can go back and review content as needed.

5. Variety: Learning Management system support multiple learning modes. Students can learn the content through audio, video, articles, and interactive stimulations.

6. Collaboration: LMS tools foster student collaboration on group projects, Built-in features support group blogs and wikis as collaborative spaces for learning.

7. Community: An LMS platform supports a community to learners working together to build knowledge.

2.1.2 User interface

The user interface (UI) is everything designed into a machine learning device and the human being may interact with display screen, keyboard, lights, mouse, and sound, and how user can interact and get a suitable response. So, it designs a project, taking into account any user level, how to deal and interact with them. They also reflect the final product that is displayed and guarantees them, to use it easily without complications and in simple and effective way without requiring to do so much emphasis. The goal of design and the user interface is to try to understand the user as much as possible and stop on things that you should focus or the things that should be avoided to improve the interface is simple and effective and make it during use.
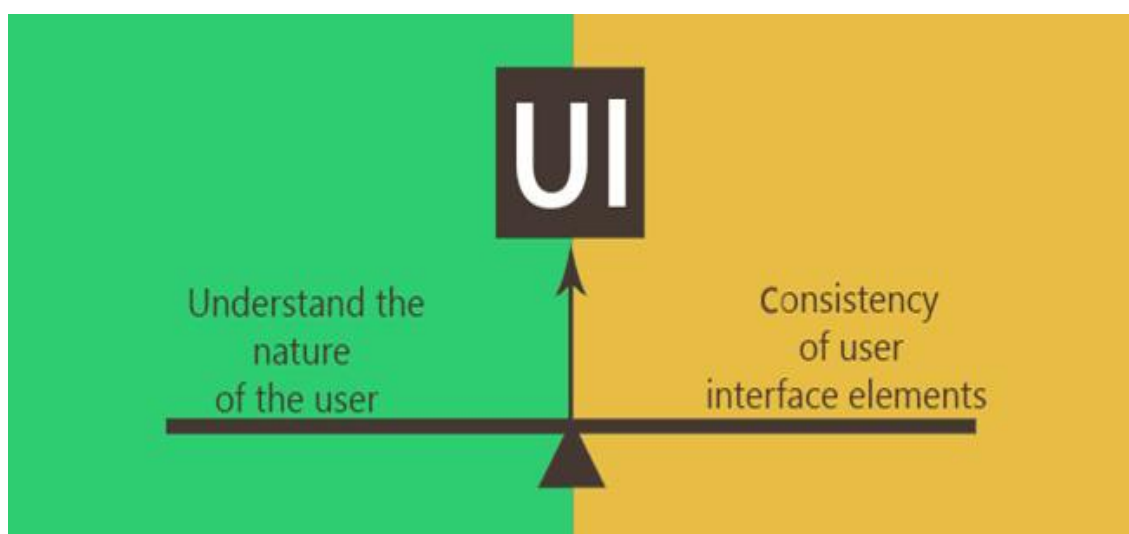
Figure 02-2: balance between consistency of user interface elements and understanding of the nature of users.

Many studies and articles dealt with the concept of user interface with regard to the field of web and questions around design boils down to: what kind of lines that should be used? And how to coordinate the information to become the design as close as possible to the nature of the user? So the design and user interface is attractive and simple to depend on:-

- Extent of balance and coordination between the interface element, including fonts, colors, and images.

- Understanding the nature of the users.

The user interface designer should take into account a specification of the system information and state the needs to be presented, and the commands to be made available to users. This specification captures the "content" of the interface, abstracting away from "style" details such as font, color, etc. [10].

So it is important for developer to understand the interface at this abstract level, for example, before worrying about style issue of display. Developers should understand whether the display presents the wrong amount of data at the right time to help users perform their task.

There are many stages and process that need to be made for the success of the design of the user interface, some of them are more important than the other depending on the quality of the project (I mean the project: site, program, application etc..):-

1- Collect the requirements: collect a list of the required function of site to achieve the potential user desires.

2- Mentality user analysis: by discussions and talks with potential users and with those likely to use the site through the following questions:

   a- What are the things that the user expected to be carried out by the site?

   b- How can the site be matched by the ordinary user's work and daily activity?

   c- What are similar projects that the user had used?

3- Engineering site and how to display the information: you must specify the manner in which information will be displayed on the site through the pages, do you will rely on a single page to show all what you have or will depend on several pages?

4- Build models of the site: build a sample for project as a form of a simple interactive pages free of all technical elements and content in order to better focus on the interface.

5- Test the model: selection of potential users of the site and display the experimental model of the site and gather their opinions about the experience and feedback for use in the interface development.

6- Design interface: this stage depends on the design of the interface through the information was collected and in the light of notes users during the experiment, and be a stage of cooperation between the graphic designer and the developer to get to the proposal of the successful user interface of the site.

2.1.3 User Experience

User experience research is built on the root of usability. It's a process to enhancing user satisfaction by improving too many things which are accessibility, usability, and interaction between the end user and the platform, it's based on user's observation, usability is described in ISO standard 9221-11:1998 (ISO 9221-210-2010) as:

Definition: "The extent to which a system, product, or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in specified use context" [8].

It was the most dominant topic in HCI research from the 1990s till now, user experience is seen as an umbrella term for presenting new ways of studying and understanding the quality of use, and it has even been used to define the design, use, interaction, usability, or even user-centered design (UCD) [9].

At least we can define the user experience simply as a project design, taking into account the wishes and needs of the user, so the main challenge for the designer user experience is the knowledge user expectations and to find effective solution to problems that occur, in other words diving into user mind to figure out what he wants and does not want'.

Figure 02-3: Five expert web users can detect approximately 85% of problem in yours platform (Faulkner Research). [25]

To explain this concept by an example: We find many and variable applications on smart phones, specially social applications, which are updated automatically once you navigate down which is a wonderful and smart idea that enable us update without the need for refreshing the page.

User experience take into account the expectations and wishes of the user to reach the goal without much effort and in a simple environment, easy and smooth, and can be summarized in six main points:-

1. Accessible: do whatever to make the site easily accessible to the user.

2. Connectedness: the site must be easy to access from various modern programs.

3. Reliable and desirable: Design a user interface that make the user confident and enable him to login consistently.

4. Easy to use: the site must be free of all possible mistakes that may hold or make it difficult to browse by the user.

5. Reflect the image of owner: the user must be convinced that he is in the right place to find the wandering and that reassures service site.

6. Effectiveness: the users can find answers to his questions with ease and without complications.

2.1.4 Wireframe

Wireframing is a way to design a website service at the structural level, known as a page schematic or blueprint. The purpose of wireframe is to arrange elements to best accomplish a particular purpose, it includes interface elements and navigational system, and how they work together.

The most critical part of the interaction design process is to use layout of content and functionality on a page which takes into account user needs, therefore; understanding of a page early in a project to get stakeholder and project team approval before the creative phase gets under way.

Wireframe can show the global navigation scheme as it appears on each page, text and media, and compatible design by Lopuck [20] as shown in figure 2.4.
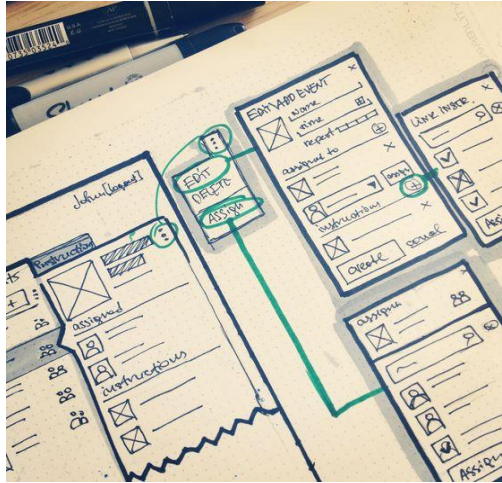
Figure 02-4: Sample of Wireframe

2.1.5 Learning Objects

Learning objects term is used to describe different types of learning material. Learning object concept was defined as "Any entity that may be used for learning". So Instead of creating instructional material from scratch, instructional designers can build teaching material by assembling and reusing available small instructional components (learning objects) [26].

The concept encompassed by 'Learning Objects' is known by numerous other terms, including: content objects, chunks, educational objects, information objects, intelligent objects, knowledge bits, knowledge objects, learning components, media objects, reusable curriculum components, nuggets, reusable information objects, reusable learning objects, testable reusable units of cognition, training components, and units of learning.

Learning objects are a new way of thinking about learning content. Traditionally, content comes in a several hour chunk. Learning objects are much smaller units of learning, typically ranging from 2 minutes to 15 minutes.

2.1.6 Learning Object Metadata (LOM)

Learning Object Metadata (LOM) is a data model, usually encoded in XML, used to describe a learning object and similar digital resources used to support learning. The simplest definition of metadata is that it is data about data – in other words descriptive information (data) about content (data) [27]. For instance, in the context of a library, metadata about a book may include its title, author, publication date and some general

description about its content. In the context of music, metadata about a musical track may include the title of the song, the artist, the album and the release year. In the learning object context, metadata may include the title of the object, a description of its content, the subject it covers and maybe the type and name of the file.

The main goal of metadata is to enable the discovery and re-use of the objects described. Based on the instructional and other properties of the object like title, target and user group.

2.1.7 QLEARN

QLEARN is a projects developed at the Computer Science Department of Al-Quds University, which created tools and methodologies for producing, managing and reusing computer-based pedagogical elements and telematics supported teaching curricula.

The architecture of the QLEARN learning objects is shown in Figure 2.5, at the bottom, a repository of learning object either was online or local repository that enable searching, publishing and retrieving learning objects.

One of the core tools of QLEARN is the Learning Objects Management Tool. LOMT allow users to upload, describe and publish learning objects. Only users that process and have QLAEARN account can publish learning object throw LOMT. After they have selected and submitted a learning object, the tool will present the users with metadata that have been generated with the automatic metadata generation framework. Doing so, the burden of users having to manually fill in all metadata fields is lowered. Searching is not restricted to authenticate users. However, anonymous users can only download learning objects that have no restrictions on usage rights; some objects may only be downloaded after granting a permission from authors or can only be downloaded by a particular group of users. Search Engines offers 2 search methods:

- Simple search allows users to specify some search terms that will be used to search on textual metadata fields.

- Through advanced search, users can search in metadata fields. Users can for instance search for all learning objects that have 'English' as document language and have a file size lower than customized KB.
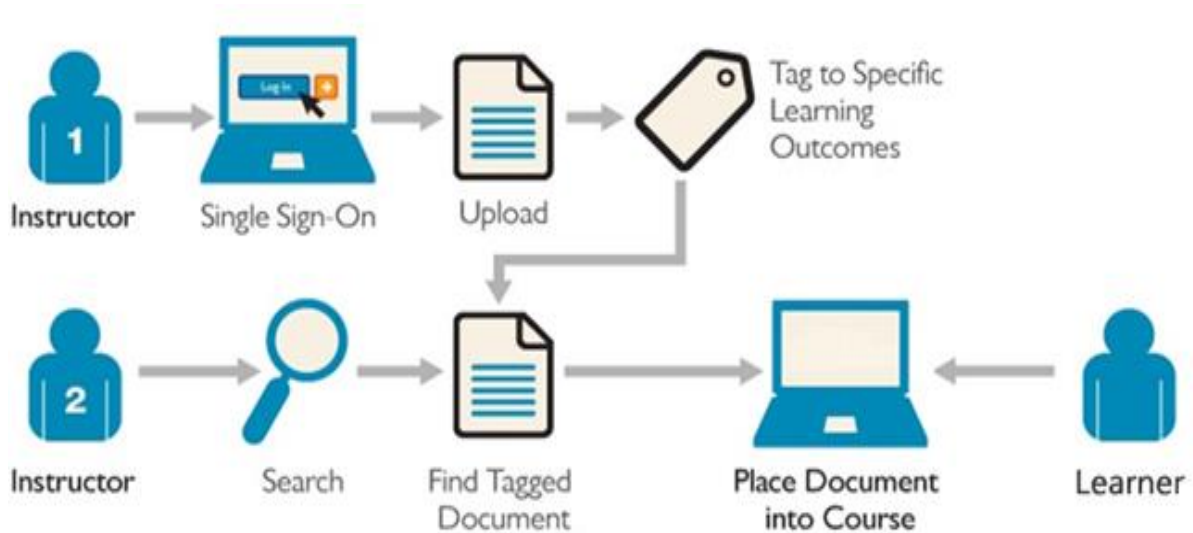
Figure 02-5: Architecture of QLEARN Learning Object.

2.2 UI Design Principles for Learning Management System

In today's world of population explosion and rapid technological advancement, people are required to be educated, while universities and educational institutions do not possess enough space to allocate all learners. Thus technology plays a prominent role as an optimized learning medium, and Web would be of great communication channel for transferring knowledge. In modern world, the same amount of attention for quality of education that has been given in universities and educational institutions in past should equally be provided for the technologies of today, owing to the fact that they are as crucial as the physical learning institutions [7].

Learning Management Systems are technologies running on web browsers, and the quality of presenting and interaction of them affect directly on learning quality, subsequently their presentation and user interaction should be established as flawless as possible.

This study has dealt with assessment of LMS in terms of conceptual interface design and interaction design by our design team, Furthermore we will highlight to create a new course by tutor as indicated in chapter 3 and what that affect to student profile.

According to [10], Interface prototypes can be built with a large variety of tools, ranging from paper and pencil to draw mockups of displays to sophisticated interface construction toolkits, the author mentions 3 categories of tools that can be used:-

Paper and pencil: Paper and pencil are prototyping tools with many strengths. They are easy to use: most people can draw boxes with buttons, menus and scribbles representing the objects in an application domain.

1. Facade Tools: Facade tools are essentially drawing editors with an ability to specify input behavior. We call them facade tools because they allow developers to construct screens that look and behave like the screens of the real application.

2. Facade tools retain most of the benefits of paper and pencil, while adding the ability to describe behavior and to execute the prototypes. Many facade tools can give end-users the illusion of interacting with the real application, so they can be used to get very reliable feedback from end-users.

The tool sketch avoids details, and allows designers to focus on issues such as: will users want this capability? Is this a collection a group? How should the user specify moving an individual item versus?

In our project, we used the wireframe to build the sketches, we used the website called "Mockingbird"[11] which can offer the drag and drop UI elements to the page, then rearrange and resize. Link multiple mockups together and preview them interactively to get a feel for the flow of your application. Share a link, and clients and teammates can edit wireframes with you in real time.
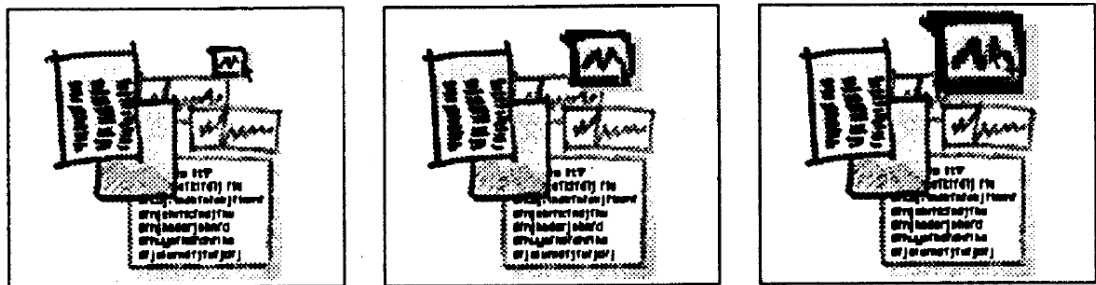
Figure 02-6: wireframe sketches

Figure 2-6 shows the sequence (albeit in static form) how a user might interact with a proposed system. The user drags a movie (box with the 'M' in it) to a group of diverse documents, while controlling the resolution of the movie by zooming it up or down.

3. Interface Builders: Interface builders, unlike facade tools, are interface construction tools rather than interface prototyping tools. Their main strength is that, like facade tools, they give interface developers a drawing-like interface to specify the interface, unlike facade tools, generate executable code that can be linked in into an application to produce an industrial strength implementation.

During the design stage to build, there are many software's that can be used, Photoshop and illustrator are the most popular products that can facilitate the design, I used Photoshop to

design the project and I have some good reasons to keep using it in the near future, here is why…

1. Everyone asks for PSDs file, actually; as a designer, don't really have a choice when it comes to choosing design software. It all depends on what your client and developer requires from you. Even if I really wanted to try some alternatives, most of the teams I have worked with have asked me for PSD files.

2. Adobe wants us to keep using Photoshop, there is a huge demand for making the PSDs responsive. There it is: [12] Adobe edge reflow, it's still new and fresh that may go from static design to responsive comp in just one click.

   It's good to know the Photoshop, Illustrator, et. Al. Are used for supporting web assets and not for full page/site mock up. From the long time Photoshop was a good choice when one would build web interface, Slice it up, and then export the slices in order to reconstruct them in HTML. And this way was traditional way before Cascading Style Sheets (CSS2) and CSS3. At this time you can use them to create a gradient, a round coroner, or a small shadow. So we can use Illustrator instead of Photoshop science CCS2 and CSS3 supported by most browsers available, and we decide use Photoshop for design if needed or for actual photographs.

2.3 UI Design Tools

In our study, a way to implement ideas to scheme design need be supported by distinct functional tools that were decided by different design stages. One of the most significant tools is GOMockingbird [11].

2.3.1 GOMockingbird Tools

GOMockingbird as shown in figure 2.7 is an open source web developer, built by an American based company 'Some Character' in 2010. It's a Mock up an application and show what's important like Mockup your idea fast so you can drag and drop UI elements to the page, then rearrange and resize. Go from idea to mockup in minutes.

Also you can Link and click between pages by Link multiple mockups together and preview them interactively to get a feel for the flow of your application and finally it allows you to share a link, clients and teammates can edit wireframes with you in real time. No more emailing images back and forth.
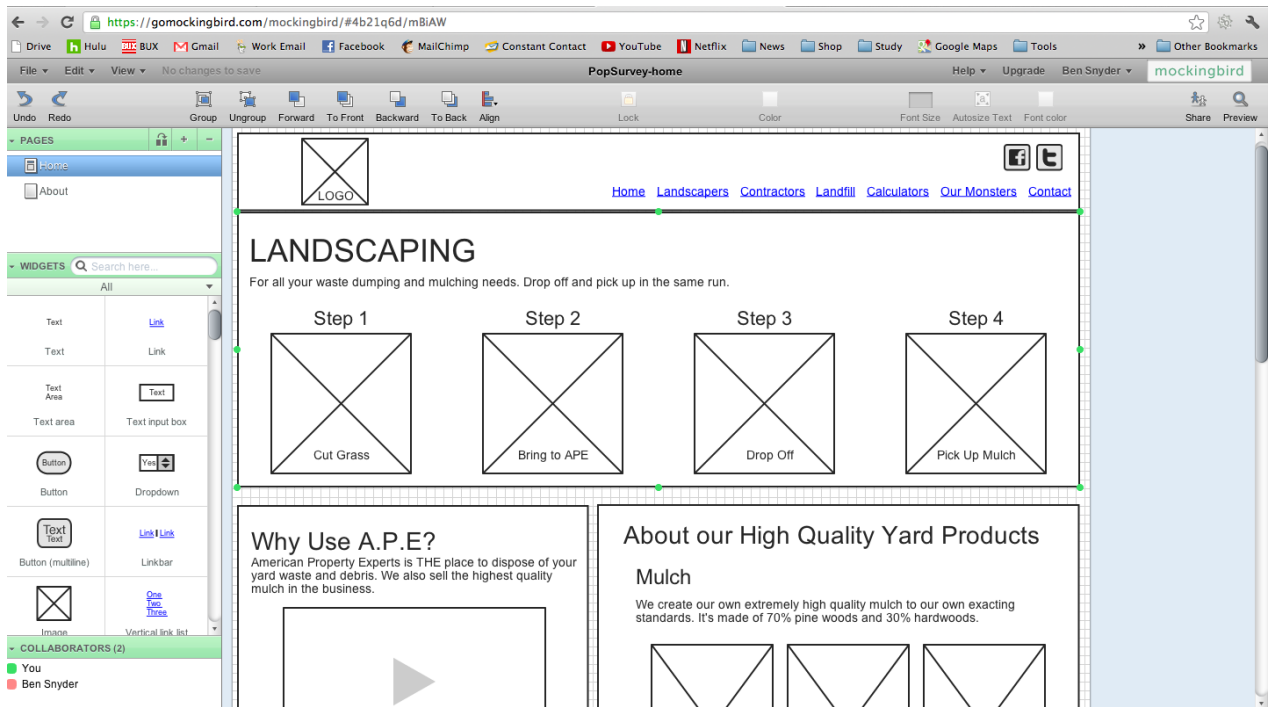
Figure 02-7: Design tool of GOMockingbird

The Wireframe layer may consist of images, text, brush strokes, background colors, patterns, and we can achieve this component by using one of Adobe programs called Photoshop as below.

2.3.2 Adobe Photoshop

Photoshop as shown in Figure 2.8 is a graphics-editing program issued in 1987 by Adobe Company - American brothers Thomas and John Knoll (Wikipedia the Free Encyclopedia 2016). Since it was adapted to develop web user interface design, we implemented this software to improve mock-ups in this thesis.
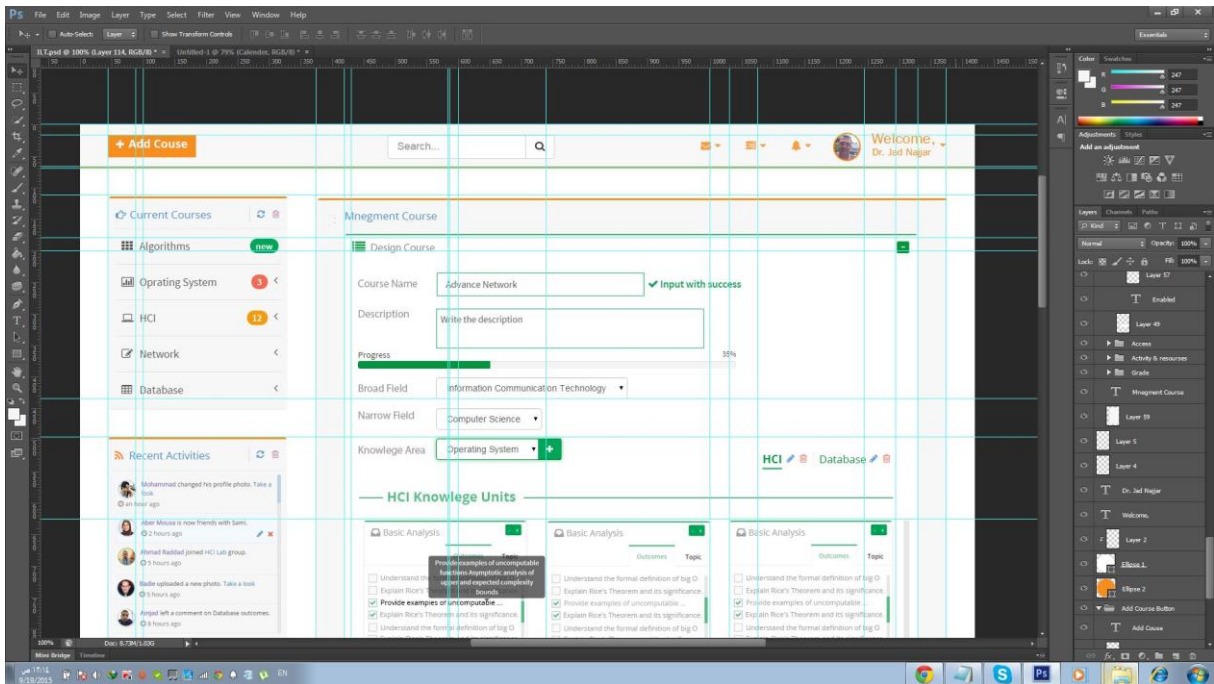
Figure 02-8: Photoshop CS6

We use the Photoshop because the designer can use the Grid systems can save a lot of headaches in web design, Place all your elements on your Photoshop canvas before you start getting dirty with design, custom document presets, customize default type like font family weight, spacing, and color.

2.3 Related work

In this sub-section, we go through related works to current work, describing main points in addition to main findings of this work.

In Saromporn work [13] according to this paper other researchers focus in their work on a first attempt of designing an e-learning system that focused on emotional aspects. That show learners emotions might evolve during the learning process trying to get a good feedback could be used to improve learning experiences.

Learners themselves can express the positive and negative emotions that significantly influence their learning.

So it's clear that the biological signals is very promising, Therefore, they present a LMS that avoid an affective emotion like boredom, anger, they try to detect and analyze user emotions. He used Biological sensors to detect the learner emotions (electrocardiography) EEG, (electroencephalography) ECG, and eye tracking.

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ECG sensor measure the voltage using electric ions within the brain's neurons, classified into four types 14-30 Hz indicate to normal, 8-13 Hz relaxed state, 4-7 Hz during slumber, the second technique 'ECG' sensor measures the heart's electronica activity over a specific period of time, it's can interpreted the heart rate in beats per minute (BP). The last technique 'Eye tracking' method measures a person's point of gaze, which focuses on what most thing's person looking at and locates the eye spot.

The new direction was toward designing system which would be user friendly and could bring the vast of biological signals and get the result, their contribution goals for future work to improve the learning management system by conducting further research on more complexities and identify what is the most effective design for student learning.

While in the research of (Thuseethan et al, 2012) [14], the authors conducted a study to proposed a framework that can facilitate and indicates the overall level of the effectiveness of learning management system based on students' perspective, they used different approaches to evaluate usability, mainly in technical parts, their technique for evaluation depends on the complexity and functionality rather than simple checklists standardized questionnaires, there is:

Approach 1: selected group of students with advance proficiency, they decide to do survey during the last few day of semester. Because in last few days of the semester the usage of LMS is high comparing with normal days, so; they used five-scale liker scale (Strongly Agree {4}, Strongly Disagree {0}), Other new questionnaire was constructed based on two standard questionnaires which are mentioned by (Zins et al., 2004)[15] and web-based learning environment. System layout design, System functionality, Ease of use, Learnability, Satisfaction, Outcome/future use, System usefulness.

Approach 2: This approach involves the testing on the effectiveness of the learning management system as the major study, he used the approach based on the Shackel"s (1991) four factors on usability four questions were used to evaluate usability. Figure 2.9
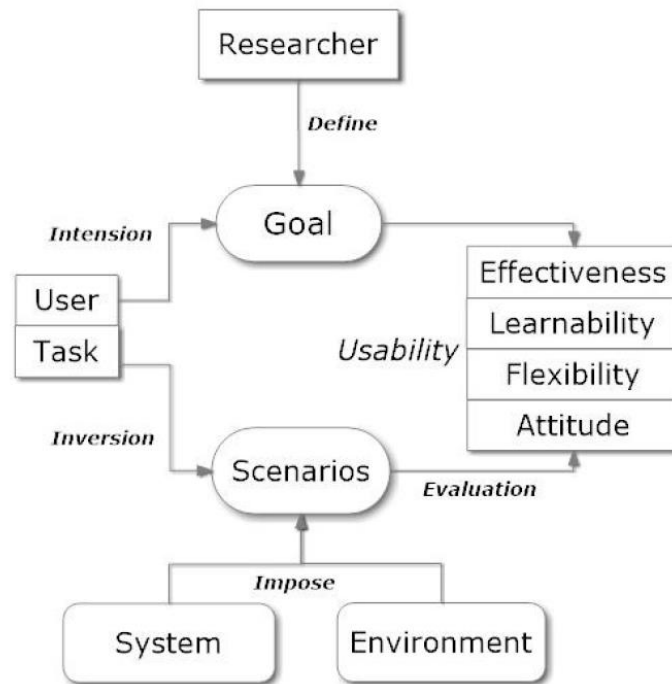
Figure 02-9: research theoretical Framework [14]

Four major questions about (to measure the effectiveness, learnability, flexibility, and attitude) were formulated by dividing those into sub tasks based on the three main features or functions of the system mentioned in approach 1.

The result was formulated after crowd of 201 students, the students found the current learning management system easy to use its functionalities were designed properly and well integrated. Despite that; they discovered that even though the current LMS was user friendly and easy to use, it still has some inconsistency, complexity and irregular actions in its functionalities.

Whereas in the study of (Brandl Zou et al, 2005) [16] the authors present Model has great potential to create a successful e-learning experience by providing a plethora of excellent tools that can be used to enhance conventional classroom instruction.

He mentioned some sample learning tasks and described their implementation within a Model environment.

Layout and organization: Model presented in a "flat view" format. It is laid out in small blocks and organized interface very intuitive and allow for easy navigation. All blocks on a page can individually arranged, easily moved around or be hidden. Figure 2.10 shows an example of a course setup in the topic format.
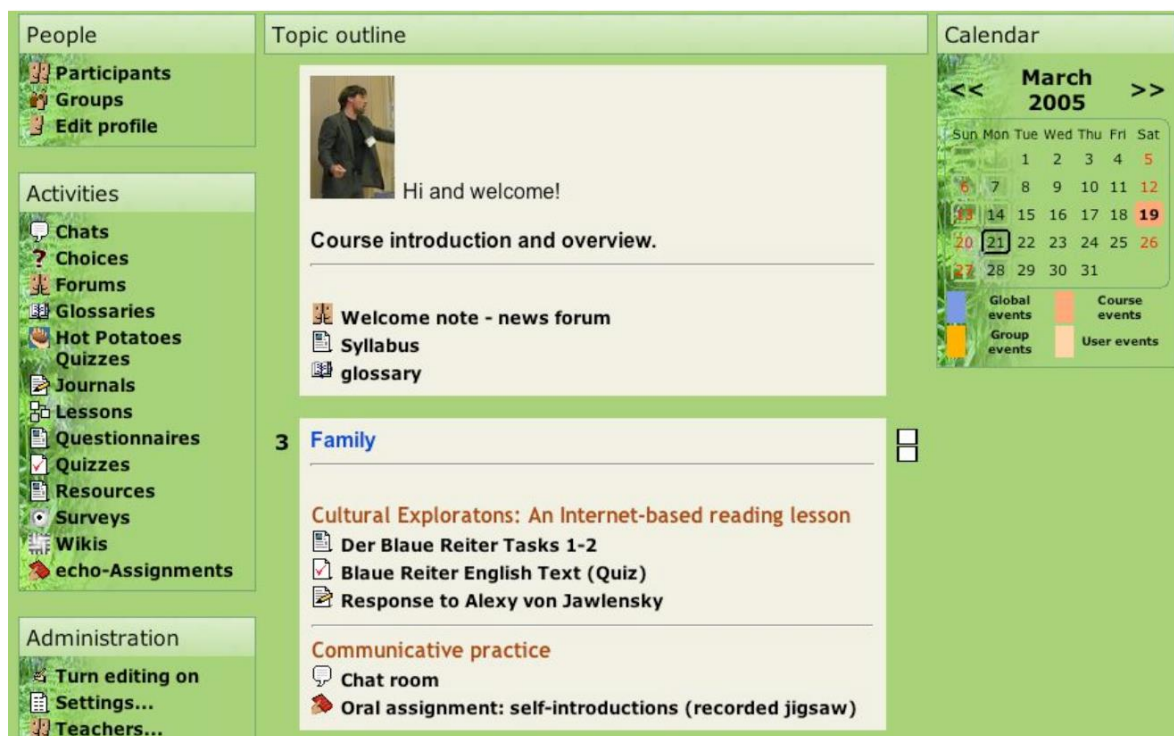
Figure 02-10: Sample of a course setup in the topic format

Course Management: it's a management feature, provide a lesson assignments, this means that the teacher can monitor the students who have completed and uploaded assignment, quiz and time elapsed and remaining time when quiz must be completed. Access restriction tasks. Students can look up their grades themselves. Teachers have option to download student grades, also calendar can be displayed on the front page.

Furthermore, in the research of (Thuseethan, 2014) [17] the objective of the study was to present a technological matters like interaction style, and they searched for better interaction styles among the existing ones, effective and user-friendly interfaces for an academic supportive device, several disputes have were considered, they suggests a theoretical support in the area of human computer interfacing in designing academic supportive devices.

They concluded that to design a worthy human computer interaction, we have to appropriately elect the suitable style of interaction, kind of interface to adequate with the class of group of users it is intended whereas the human issues must be taken into account (Fetaji, M., at al., 2007)[18].

They analyzed all existing techniques in human-computer interaction, in order to increase the efficiency of academic supportive devices. However, the implementation of suggested interaction styles and models offer a sound basis for the future research.

The primary goal of HCI of their study is to improve the interactions between users and computers. HCI develops or improves certain goals in designing devices. Five important goals are: Safety, Utility, Effectiveness, Efficiency and Usability, This work shows a structure of HCI, comprises three major parts within the framework: the user, the computer, and the interaction, they work together to achieve goals. Figure 2.11 shows the main component of HCI.
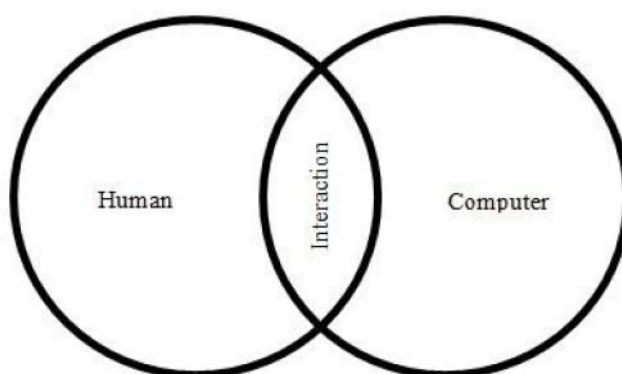
Figure 02-51: Three components of HCI

Also in the domain of course behavior, (Eduardo Hamuy et al, 2010) [19] presented a non-experimental, of descriptive nature, and analyzed correlation of some variables. A simple random of 70 Virtual classrooms (63.06%) without distinction of the fields of study were extracted. The study population was defined as 111 courses, since other 82 did not fulfill their filtering criteria—thus qualifying as a real course—of having teachers and students.

During their research on course behavior, they found that the motivation during the first half of year, after vacations, where teachers and students spend more energy in their academic tasks.

Also shows higher values, more intensive use of the LMS in the first semester, more than in other of the studied semesters, particularly with teachers. It would be interesting to know if a loss of motivation happened to teachers and to investigate which would be the causes.

Chapter Three

Background

3.1 Introduction

This chapter describes the components of learning management system and explain how we can use design interface to implement the LMS, we will go through all parts of framework starting with a description of the input, processing, and presentation results.

General framework shown in figure3.1 consist of three main parts:
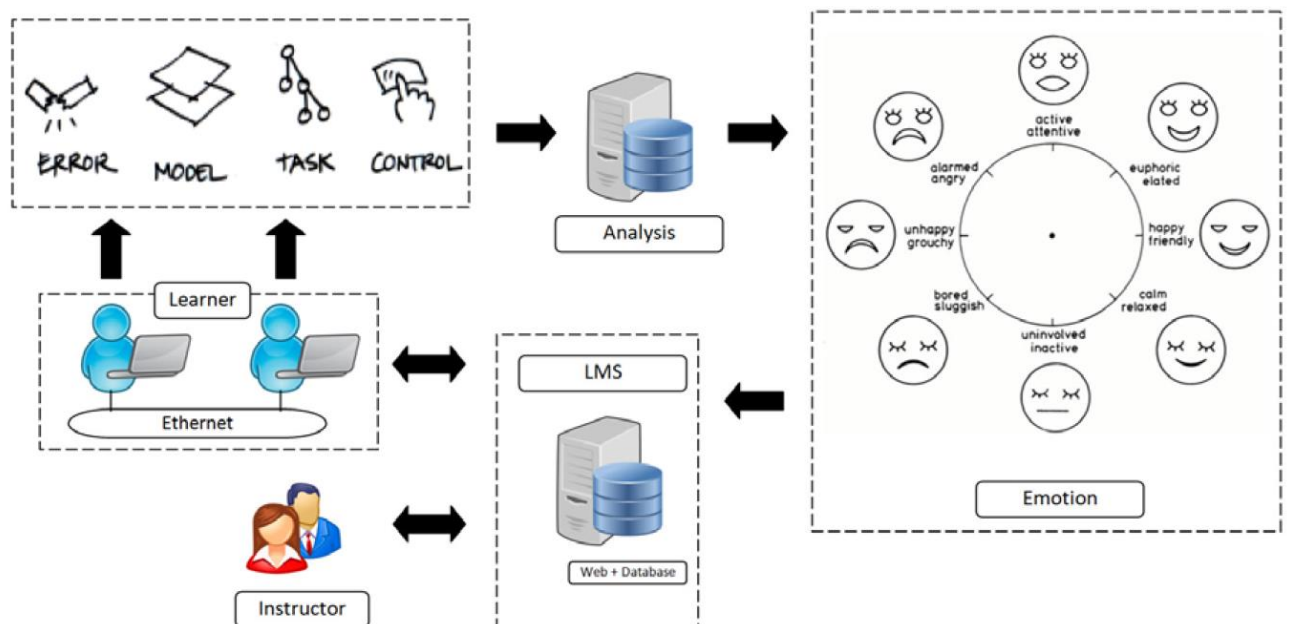
Figure 03-1: Architecture of LMS and analyze user emotions

Part 1: Data gathering from the teacher level such as assessments, book, forum, questionnaires, surveys, books, files, labels, URL's, etc.., we can put all of these under the activity and resources elements.

Part 2: Data analyses and pages system: The e-learning environment provides the input for proposed framework, which use LMS for delivering, tracking, and managing education

courses with easy access by web browser on a personal computer. Learner can interact with system to analyze the learning object.

Part3: while students use our system, the learners can express positive or negative emotions that significantly influence learning by the system.

We have many stakeholders and we focus on our research at students, teachers and generic guests – Guest will not give it much attention, the other stakeholders components will not take at this research and will cover in other projects.

In any learning management system, there are three user categories: -

Teachers: Can do these activities.

- Creating new course – syllabus.

- Linked learning object and learning outcomes.

- Create new assessments and assign questions.

Students: Can do these activities.

- Find relevant learning objects.

- Able to view assessment results.

Guest: Can do these activities.

- Browse the default page.

- Search activities.

- The ability to register users into a system.

3.2 Methodology

In this research, our goal is to answer the following questions:

1- How every activity does help the end user to interact with learning experience and how can we improve the design?

2- Dose the component we use matches user's desires?

Example of questions on appropriate designs include:

a- What are the design options in linking learning objects and learning outcomes?

b- How popup page may help teachers to configure assessment?

c- Does the navigation help the learner navigate recommended object easily?

We used the following techniques in an iterative approach to come up with the proper options of the relevant interaction designs for the different functionalities of the learning systems. In each phase, we used participants from the target groups, including learners, teachers and decision makers.

- Focus groups: reflections on the requirements and the relevant designs.
- Participatory design: selection of the alternative designs.
- Evaluation prototypes: early evaluation of paper prototypes and sketches.
- Discount usability: 3-5 participants using the functionalities of the system; taking notes and thinking aloud.

The early designs of the system and the evaluation sessions documentation are available in the appendix of this thesis.
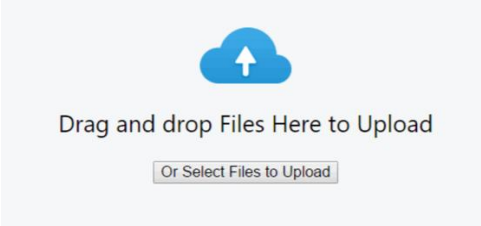
3. 3 Interaction Design Components

As far as the design of the functionalities of the three user groups listed above is concerned, the following popular interaction design features can be used.

3.3.1 Input Components
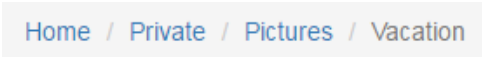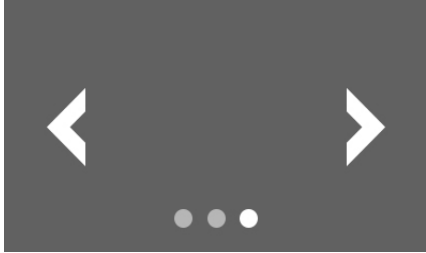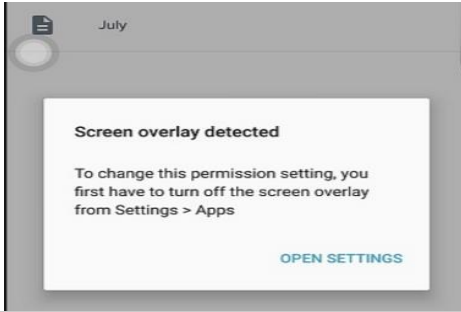
Table 03-1: The following is a summary list of main attributes of input components.

Attribute	Description	Figure
Buttons	The <button> tag defines a clickable button.	Click Me!
Text fields	The <input> tag specifies an input field where the user can enter data.	First name: Ahmed
Checkboxes	The checked attribute is a Boolean attribute, when present, it specifies that an <input> element should be pre-selected (checked) when the page loads.	☐ I have a care ☑ I have a job

Dropdown lists	A dropdown menu is a toggle able menu that allows the user to choose one value from a predefined list.	
Date field	The <input type="datetime-local"> specifies a date and time input field, with no time zone.	
Password	The Input Password object represents an HTML <input> element with type=password.	
Radio	Radio buttons let a user select ONE of a limited number of choices.	
Drag and drop	Drag and drop is a very common feature. It is when you "grab" an object and drag it to a different location.	

3.3.2 Navigational Components
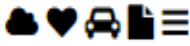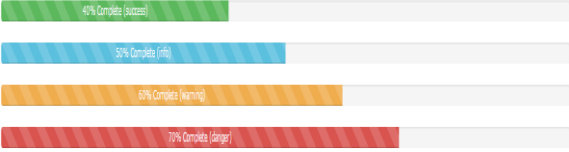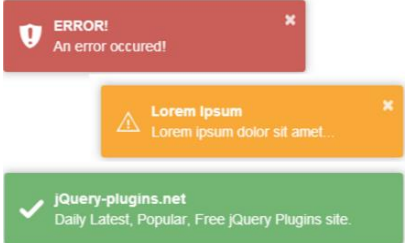
Table 03-2: summary a list of main attributes of Navigational components.
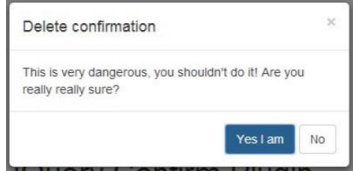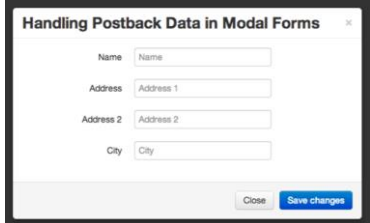
Attribute	Description	Figure
Breadcrumb	Breadcrumb class indicates the current page's location within a navigational hierarchy.	Home / Private / Pictures / Vacation
Slider	The Carousel plugin is a component for cycling through elements, like a carousel (slideshow).	
Search field	Search field allow user to locate items in the web site.	Q Search..
Pagination	when your website has a lots of pages, you may wish to add some sort of pagination to each page	« 1 2 3 »
Tags	The <nav> tag defines a set of navigation links.	Home News Contact
Bar	Having easy-to-use navigation is important for any web site.	Home HTML CSS About
Screen overlays	Allow users to get focus on certain subject.	July Screen overlay detected To change this permission setting, you first have to turn off the screen overlay from Settings > Apps OPEN SETTINGS

Scrolled overflow	This property specifies whether to clip content or to add scrollbars when an element's content is too big to fit in a specified area.	
Navigation menu in flat style	Having easy-to-use navigation is important for any web site.	

3.3.3 Informational Components

Table 03-3: The following summary a list of main attributes of informational component.

Attribute	Description	Figure
Tooltips	Tooltip is often used to specify extra information when the user moves the mouse pointer over an element.	
Icons	Icons is often used to inform end users the type of files or content conceptual.	
Progress bar	A progress bar can be used to show a user how far along he/she is in a process.	
Notifications	An alert box is often used if you want to make sure information comes through to the user.	
Tags	You can bulk tag a large number of related components using the tagging.	

Message dialog	The confirm method displays a dialog box with a specified message.	
Modal windows	The Modal plugin is a dialog box/popup window that is displayed on top of page.	

It is not straight forward to design a user interface that cover everything related to learning activities and objects. Usually many developer's only use default attributes of interaction design, and this does not user engagement and satisfaction. In this thesis, we will discuss the best method to design a usable interface that suites target user needs and behavior.

During design of the user interface, we work to be consistent and predictable when choosing the relevant interface elements for each functionality. Whether they are aware of it or not, users have become familiar with elements acting in a certain way, so choosing to adopt those elements when appropriate will help with task completion, efficiency, and satisfaction.

In the coming sub-sections, we introduce the design of the appropriate user interface for teachers and students functionalities.

3.4 Teacher Activities

3.4.1 Creating new course – syllabus.

What is this activity?

Figure 3.2 shows detailed description of the design course, first teacher can insert the course name for new one, select weather was predefined before. The second option is to 'add description' of this course and during creating the design and after being done every stage will reflect to the progress bar. Teacher can select 3 stages to get the knowledge units. Let's explain more:-

Figure 03-2: Content of teacher – First step of create course.

What is the properties of this task?

- Broad, Narrow Field, knowledge area: As ACE knowledge tree UNESCO there is 14 types of Broad field of science, teacher can locate where his course inside, For example; If I want to create course under name advanced operating system, so we can find the knowledge units under broad field called information communication technology then computer science as a narrow field and at the end is operating system as knowledge area.

- Knowledge Units: Figure 3.3 shows the content of broad field, Narrow Field, Knowledge area.
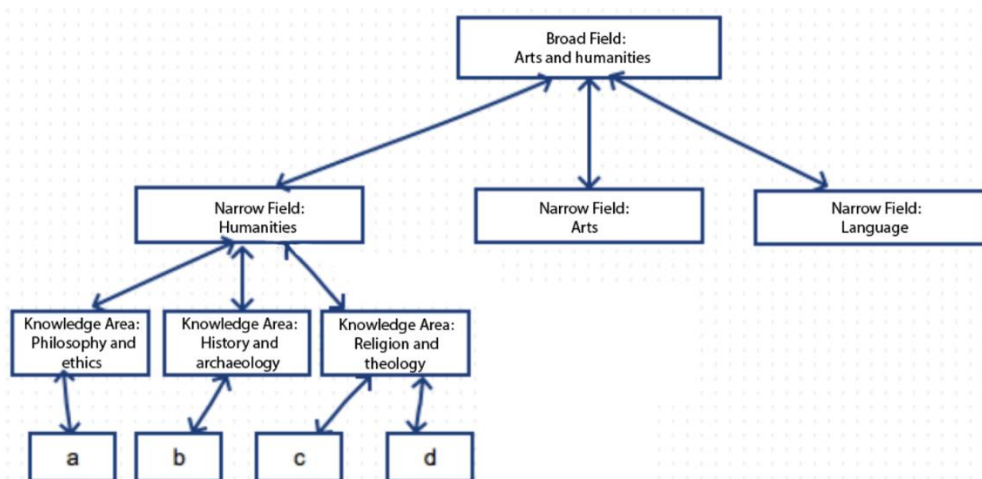
Figure 03-3: Basic navigation structure of ACE knowledge tree UNESCO.

How to design this activity?

As a preliminary plan, it's important to get feedback from teachers to revise the design properly under customized criteria. However, teacher's figures that if we use the traditional criteria – Treeview - to choose Learning outcomes and topics, an item can be expanded to reveal sub items, if any exist, and collapsed to hide sub items. Therefore, Teacher should expand five level to choose the outcomes needs, and this way was unreliable and hard to choose, moreover; he must expand every Knowledge units – such as operating system – to observe the outcomes and topics relevant. As shown in Figure 3.4 the first level its broad field e.g: Information Communication Technology, Second level is narrow field e.g: Computer Science, Third is Knowledge area e.g: operating systems, Fourth is Knowledge Unites e.g Memory Management, and the last level is to select outcomes and topics targeted.

- 📂 Information Communication Technology
  - 📂 Computer Science
    - 📂 Operating Systems
      - 📂 Memory Management
        - 📂 Outcomes
          - 🖼 Explain the relevance of the terms fault tolerance..
          - 🖼 Outline the range of methods for implementing ..
        - 📂 Topics
          - 🖼 Examples of OS mechanisms for detection
          - 🖼 Analyze the tradeoffs inherent in operating system
    - 📁 Information Systems
- 📁 Business, administration and law
- 📁 Health and welfate
- 📁 Generice programmes and qualification
- 📁 Education

Figure 03-4: Treeview – Select outcomes and topic subitems.

Our study focuses on making Treeview to satisfy the interface and functionality display, imagine how it's hard when a teacher want to select many outcomes from different knowledge areas, must expand more to select which outcome need to presents, therefore; We conclude a new technique using a combo box for first three level – no huge data – to present, and beside the level three – knowledge area - teacher can add a lot of knowledge area by the plus button as showed in figure 3-5.

We use the experiment technique and tested this technique by randomly assign orders into two groups. The Treeview group is a group of 2 teachers. The widget group is 3 teachers, on the other hand. We required that the Treeview group doesn't use Treeview before at all, but that our widget group has to study Treeview technique and understand it, we then determine which group has the higher comfortable using learning experience. The result was widget group has a higher comfortable, so we can assume our hypothesis is correct.

The interaction design components used:

Buttons, text fields, check boxes, dropdown lists, Breadcrumb, navigation bar, tooltips, icons, progress bar, modal windows.

Why we choose this design?

Using each selected Knowledge area, teacher will see all knowledge units as isolated widget which is related to this knowledge area, the knowledge unit content box have .

Every single knowledge unit has many outcomes, teacher can select which outcome should be covered in the course, also the topics tap helps teacher to select the main topic. This design allows teacher to choose knowledge units from different knowledge areas and different broad fields as well, and teacher can select the outcomes by checkboxes as shown in figure 3.5.
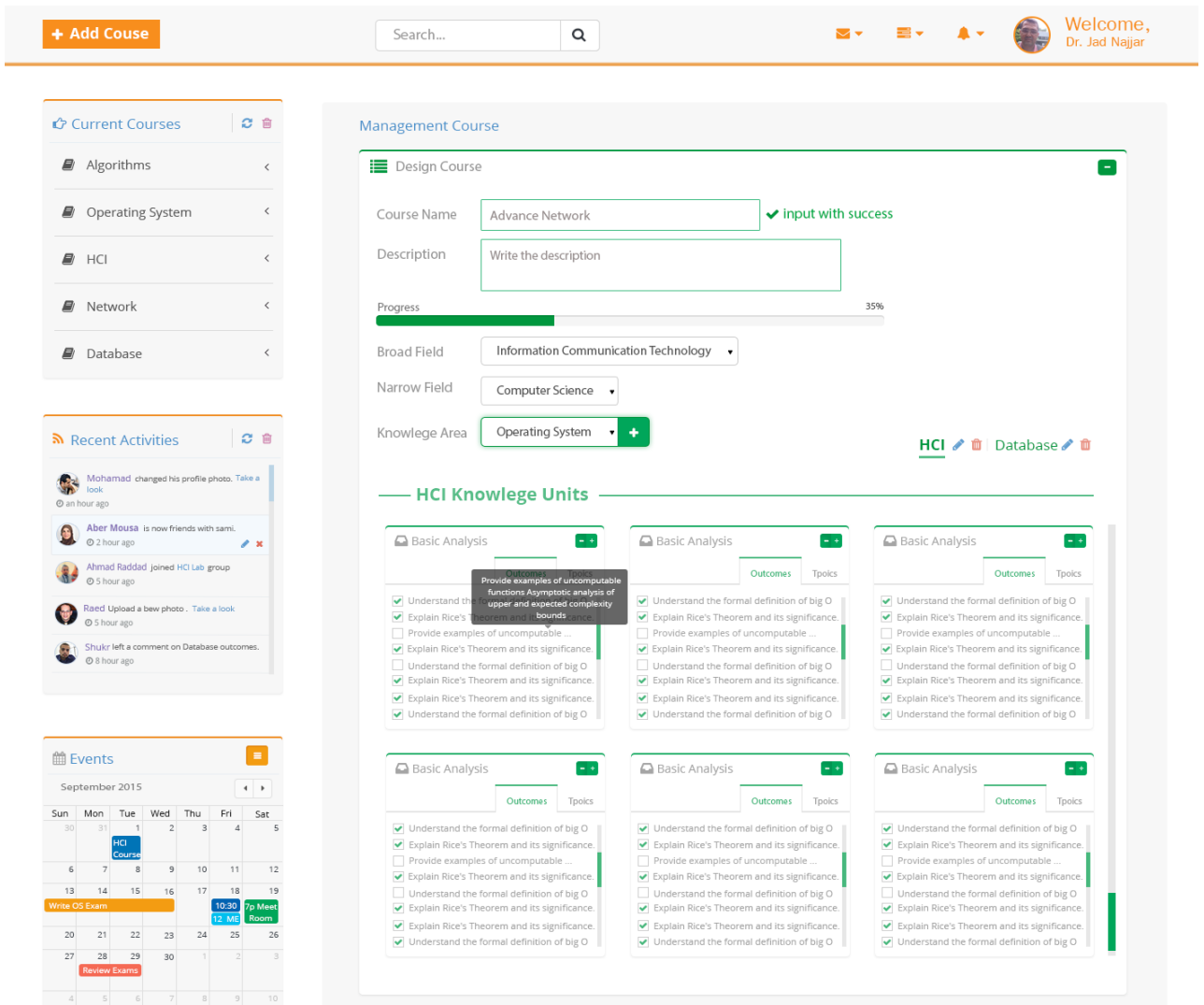
Figure 03-5: Content of teacher – create course

3.4.2 Linked learning object and learning outcomes.

What is this activity?

It's not expected from teacher to know all outcome's details so we design every outcome independently, so when teacher want's to review if this outcome it is necessary to teach or not, by clicking on one outcome will show the content overflow dialog as in Figure 3-6, this illustrates the navigation bar to help teacher to recognize which knowledge unit need to be selected.
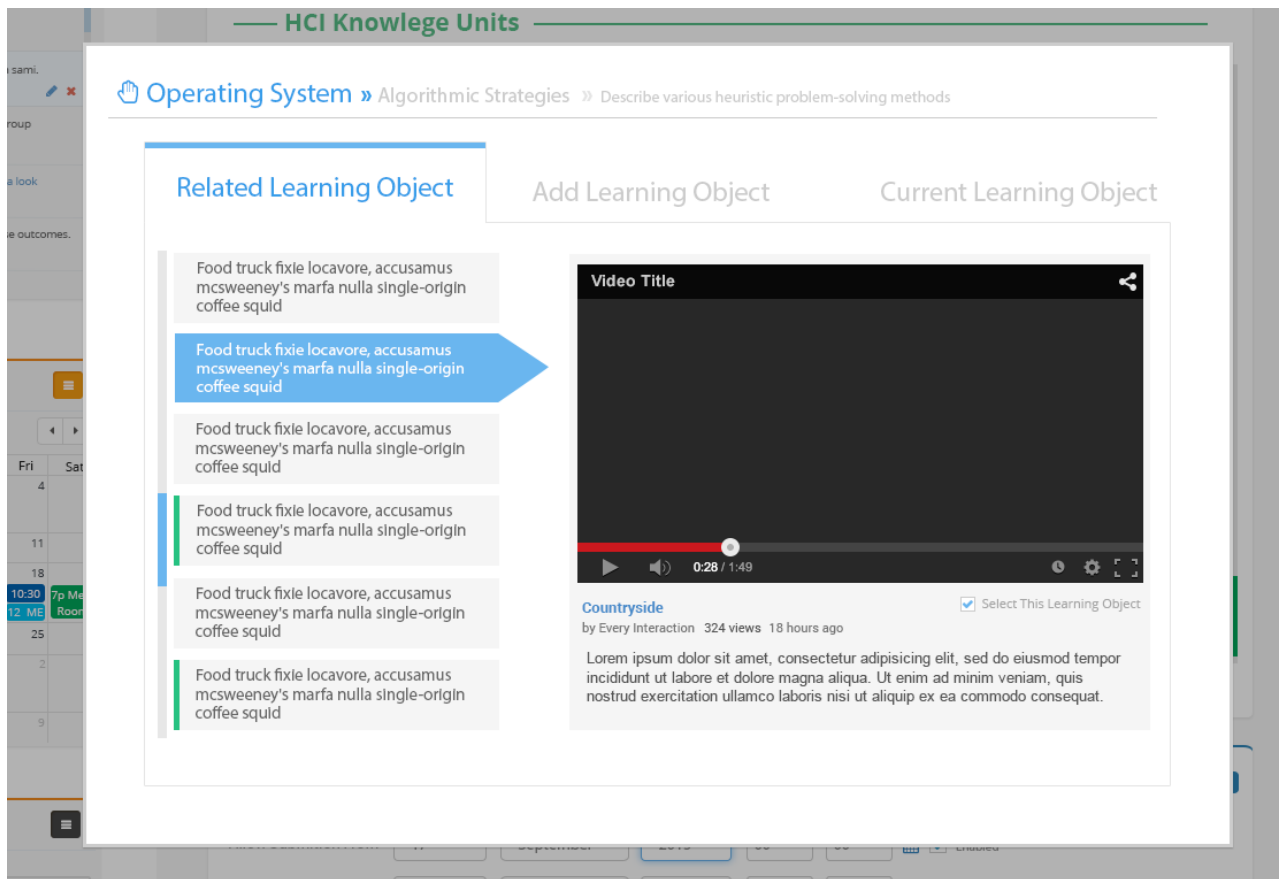
Figure 03-6: Review of one outcome scheme

Figure 3-6 showed a customized header, enabling teacher to explore the outcome by clicking on related Learning Object will present all most related Learning objects – it's important to know related learning objects that algorithm get resources from the internet – YouTube, Vimo, learning websites, and this automated service auto updated to get the relevant learning objects.

What is the properties of this task?

- Learning object: every learning outcome have many learning objects, in our research as showed in Figure 3-6 in related Learning object tap the service will retrieve all relevant learning objects, and the teacher should explore them to select which learning object suitable to teach.

- The third tap represents current Learning objects which existed by ACM Unesco Learning Tree, in addition the selected learning object on tap one (related Learning object). At last the teacher can upload learning object if he does not find any relevant learning objects, as showed in figure 3-7 system allow teacher to upload any learning object by drag and drop feature from your videos or any eligible

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extension file such as ppt, docx, txt etc., this learning objects should have at least title and description, this information helps learner to identify the learning objects, keywords will not appear for student, It use for search purposes by writing many words, words are categorized in databases to get search results as accurate as possible.

Figure 03-7: Upload Learning Object

How to design this activity?

- Indexers only index very similar learning objects [33]. However, the manual investigation for more than 30 learning object randomly selects learning objects from the repository revealed that some indexers keep using the same objects even when the objects are clearly different. This may be related to indexers understanding of the meaning of the different values. This behavior was clear that we need to design interface present the predefined selected learning outcomes as shown in figure 3-8 by checkboxes.

Our analysis revealed that around 15 learning outcomes selected by 5 indexers of learning objects. Those indexers probably based their decision on the fact that a diagram of object is use it in their lectures, as a result we decide to present these activity in same page at different boxes.
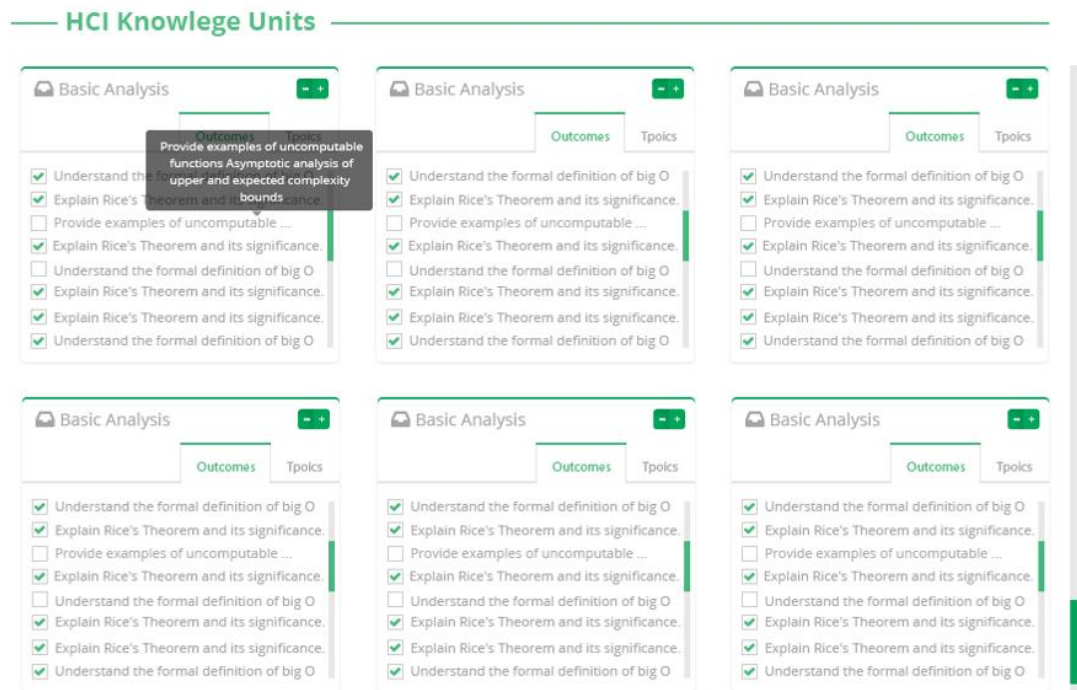
Figure 03-8: Select learning objects from knowledge units.

The interaction design components used:

Buttons, text fields, check boxes, dropdown lists, breadcrumb, navigation tags, navigation bar, tooltips, icons, progress bar, modal windows, message dialog, drag and drop, scrolled overflow, and screen overlay.

Why we choose this design?

- Indexers may just accept the default learning object presented to them by the selecting tool. Indexers can set a default values for some elements in their user profile. The data of the user profile appear by default to the indexer every time he indexes a new learning object as shown in figure 3-6. However, indexers are able to change those learning object selection whenever is appropriate In order to determine whether indexers keep on using the same learning objects every time. So we chose the design as showed in figure 3-6 which consist of a dialog appear after clicking to the learning outcomes, therefore, this screen overlays will assist teacher to keep at the same page with more focusing on the new task.

- The teacher's deals with learning objects in a particular way. By capturing and generalizing his behavior, patterns of his behavior can be detected. For instance, such patterns can be derived from observing how the teacher's obtains the objects. For example, a teacher's may receive the objects by notifications tag, selecting tools, recommendation system or a web search service. His behavior while working with the objects provides further data such as what actions he has performed on the object by storing it, copying it or indexing it into a repository, so we need to design interface as show in figure 3-6 to allow teacher to choose from recommended learning objects system, then index the important learning objects.

3.4.3 Create new assessments and assign questions.

What is this activity?

During the design of course, it's important to evaluate students or to get opinion about the course etc.

Activity and resources consist of many activities help teacher to use them during the course as shown in figure 3.9 and we will present to most uses on LMS as:-
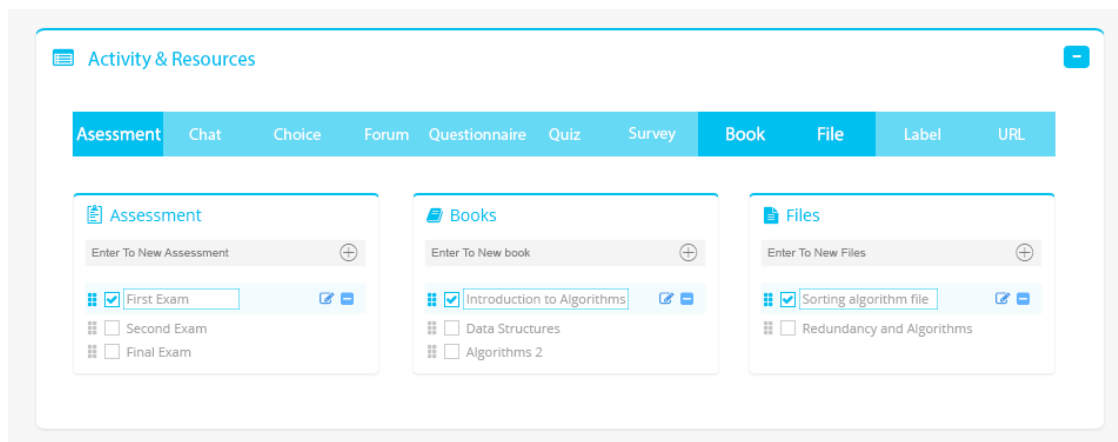
Figure 03-9: Activity and resource

Assessment: The assessment activity module enables a teacher to communicate tasks, collect work and provide grades and feedback.

What is the properties of this task?

- Students can submit the assessment either as hardcopy or softcopy, such as word-processed documents, spreadsheets, images, or audio and video clips. Alternatively, or in addition, the assessment may require students to type text directly into the text editor. An assessment can also be used to remind students of 'real-world' assessment they need to complete offline, such as art works, and thus not require any digital content. Students can submit work individually or as a member of a group.

- When reviewing assessment, teachers can leave feedback comments and upload files, such as marked-up student submissions. Assessment can be graded using a numerical or custom scale or an advanced grading method such as a rubric. Final grades are recorded in the grade book (Model).

Figure 3.10 represents the grading system that allows teachers to manage class grads and submit grades, they can access list of student's for each class teaching such as submitting final grades, incompletes and failed by using percentage score, this information is stored in the database, this will be shown in academic student transcripts.

		Student ID	Student Name	Q1 A(3)	Q1 B(2)	Q2 (10)	Q3 (5)	Q4 (5)	Total	Grade
	✏ 🗑	1310910	Ahmad Raddad	8	8	36	20	16	88	22
	✏ 🗑	1410910	Mohammad Husni	12	8	40	20	20	100	25
	✏ 🗑	1020123	Diya Raddad	8	8	36	20	16	88	22
	✔ ✖	1109362	Arwa Ayman	6	8	38	20	10	80	20
	✏ 🗑	0709265	Sojoud Mohammad	8	8	26	10	16	68	17
	✏ 🗑	1406325	Nadem Rani	8	8	36	20	16	88	22

Assessment First Exam Grade 100 Weight 25 % AVG 18.55 %

Page 1 of 3 10 View 10 - 1 of 30

Figure 03-10: Grads tools

How to design this activity?

In current work, we figured out that to do assessment you need five levels as in figure 3.11, the first step to configure the assessment is click to pen (edit) at assessment activity, then new popup revealed allows teacher to write the assessment name, description and percentage grades, after adding the information it was saved and moved automatically to assign outcome level.
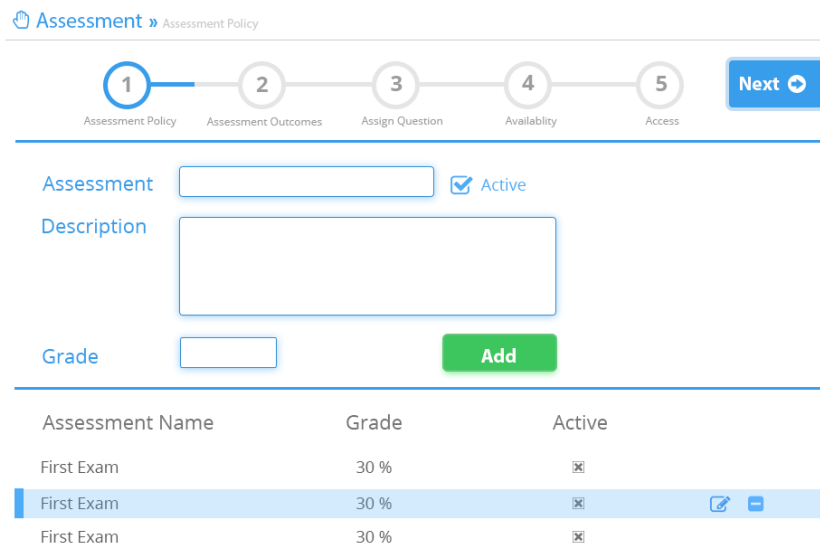
Figure 03-11: Assessment Policy

The second stage to configure an assessment is to assign outcome, design the course requires the teacher to select the outcome from knowledge units, so we design 3.11.

The outcomes presented in this stage, the teacher have to configure the assessment needs to cover the main outcomes, he can select what the outcomes need by selection tools. therefore, we design figure 3-12.
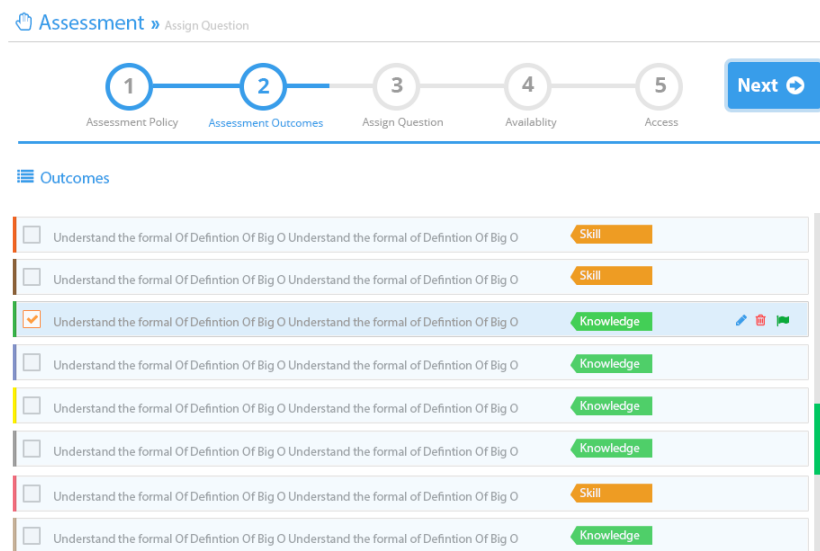
Figure 03-12: Assign Outcomes.

The third stage is assigning questions, every outcomes was selected in stage two will appear in the right widget, so the teacher have flexibility to add question and mapping with outcomes, one question cover one or many outcomes, so we design the figure 313.
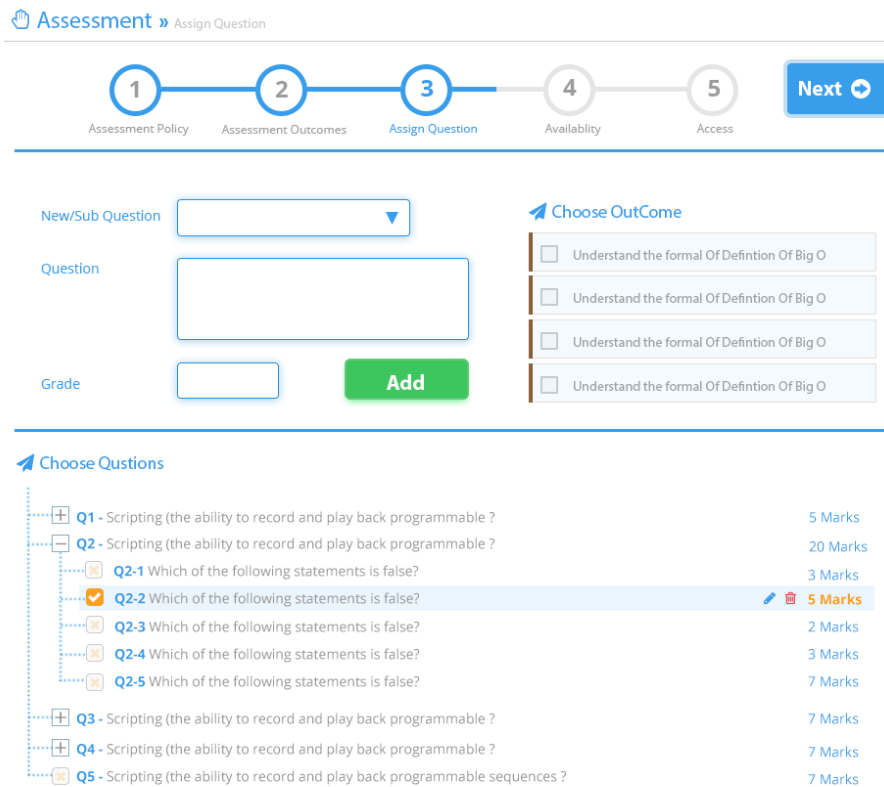
Figure 03-13: Assign Questions

The fourth step is availability of the course witch any LMS is used to extend the classroom, by providing learners and teachers alike with a secure and easy-to-navigate interface for the distribution of course materials, represent the correlation between them, LMS's must provide available duration to end this course, thus; the learning object will not available to present at the end of time.

So availability definition is whether this course is available now? Does the teacher allow the student to explore learning objects at that time? So the teacher after submitting the designed course, it's necessary to add available duration of time to present, all contents of course are denied after the time elapse. To make it more flexible, the design allows the teachers to cut off time during the semester, for examination purposes and others.

Figure 03-14: availability course

The fifth step is reachability – access course as in figure 3-15 shows that the teacher can manage who can have access to the course, give teachers a full manage of restrictions, such as student should or must match all or some of the restrictions, such as first or second exams should completed and marked, date access, grade access, for example; the students who gets less than 50 % system will not allow him to access, and at the end users location purposes.

Figure 03-15: access to course

The interaction design components used:

Buttons, text fields, check boxes, dropdown lists, breadcrumb, navigation tags, navigation bar, tooltips, icons, progress bar, modal windows, message dialog, date field, Navigation menu in flat style and screen overlays.

Why we choose this design?

- We choose the design that consist of a dialog that appear when clicking the assessment activity, therefore, will assist teacher to keep in the same page.

- We choose to present first the assessment name and description with grade to preface and index metadata.

- Any assessment should cover specific outcomes either was skill or knowledge, therefore we design the select LO as shown in figure 3-12.

- We need to design the assessment questions, as we configured the linked learning outcomes with object during the course, every outcomes was selected in step two will correlate with many learning objects, Teacher will be able to choose the covered learning object as design at figure 3-13.

3.5 Student Activities

3.5.1 Find relevant learning objects activity.

What is this activity?

This activity allow students to join available course, and the teacher will allow him to join or not.
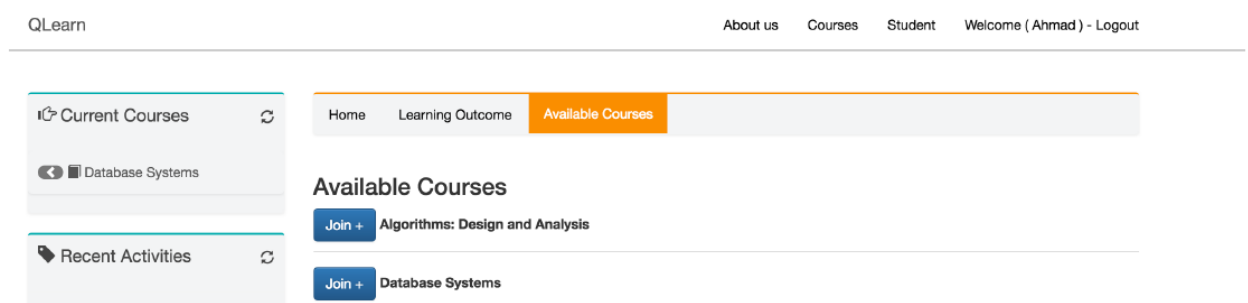
Figure 03-16: knowledge outcomes in one knowledge units

Figure 3-17 show the student page, where the system recommend learners what to learn based on his pervious history using QLearn recommendation algorithm, Also we show Learning outcomes progress and how he perform in different courses.
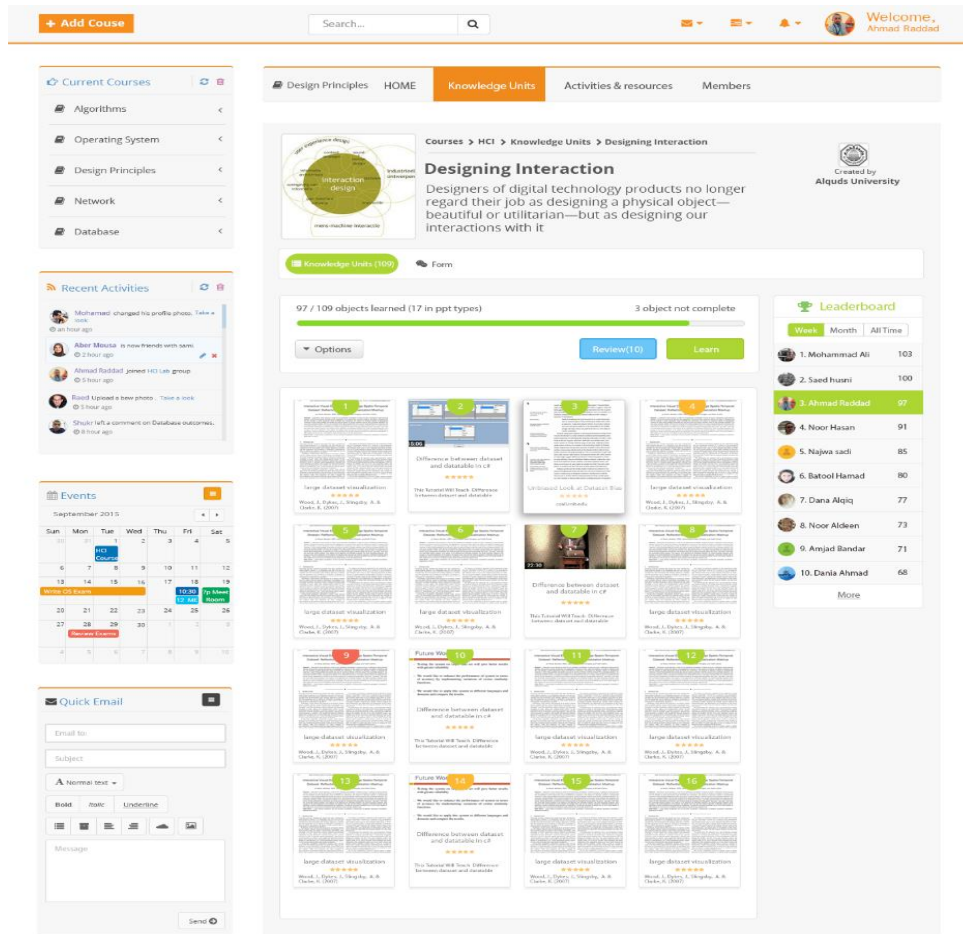
Figure 03-17: knowledge outcomes in one knowledge units

What is the properties of this task?

Figure 3-18 presents the video stream and able to display other file types such as PDF, PPT, DOCX, etc. it give learner a powerto vote and leave a comments for this learning object, and at the right part details about video, and related learning object (admitted by teachers).
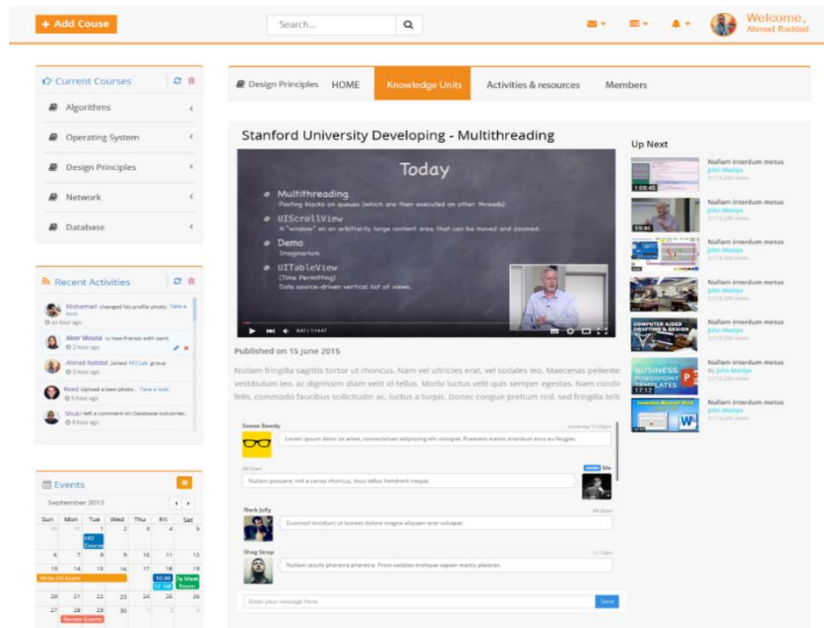
Figure 03-18: Many Learning object in one outcome

How to design this activity?

Any learning object as shows in figure 3-17 consist of one small picture (thumbnail picture) reflect to learning object, this design should extend to another page contains all details about that learning object, so we decide to design spirited page consist of learning object, evaluation system (vote and comments), and recommended learning object as illustrated in figure 3-18.

The interaction design components used:

Buttons, text fields, check boxes, Breadcrumb, navigation bar, icons, progress bar, modal windows.

Why we choose this design?

It is important to get feedback from students to revise the design properly under customized criteria. However, students figure that if we use a boxes to indicate of learning objects that will help him to find relevant learning objects. Learning objects contains relevant small picture and brief description

3.5.2 Able to view assessment results.

What is this activity?

Figure 3-19 shows the content of student page, and all detailed information were categorized to four main stages, and displayed every one by clicking on the title at the navigation bar, so that student can view contents depending on their own needs. Each component mapped with subpage details. The progress bar represents the grades the student achieved.
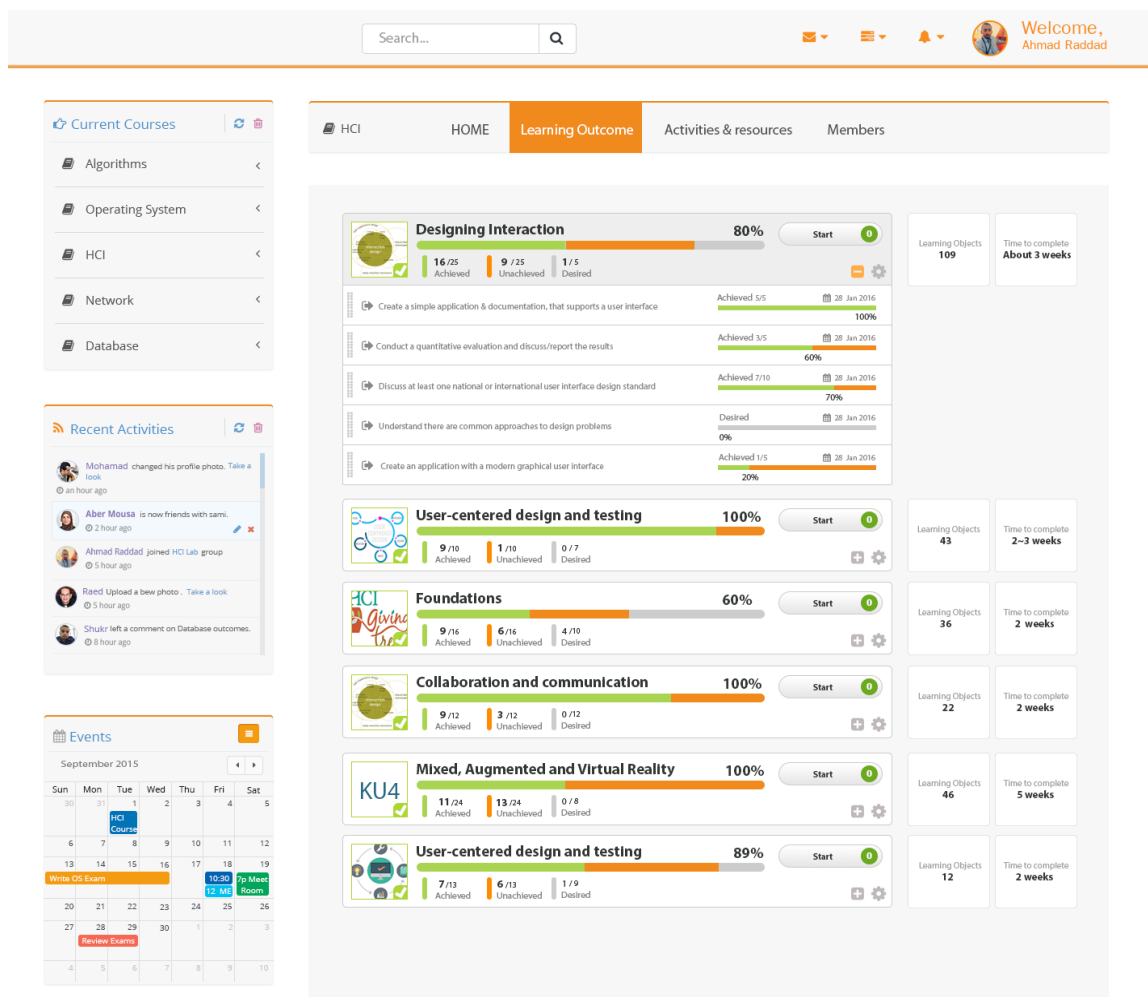
Figure 03-19: assessment results

What is the properties of this task?

Student can display their achieved grades from progress bar, as shows in figure 3-19 progress bar consist of three colors: Green, orange, gray.

Each color represent achieved grads of this learning outcomes, like green represent to achieved, orange unachieved, gray for not covered yet.

Every outcomes consist of many learning objects, and every learning object have a score when designing the assessment, so overall learning objects score will consist the learning outcomes score.

How to design this activity?

We need to design this activity to use it at the process of CV's making, so the job matching system can analyze or determine the CV's of applicants based on the content (achieved learning objects) and recommend set achieved outcomes.

We decided to design user interface that contains all learning outcomes of the course, every learning outcomes should content many learning objects.

The interaction design components used:

Buttons, text fields, check boxes, navigation bar, icons, and progress bar.

Why we choose this design?

There are a few attempts to develop tools that help system in building assessment design, either if the learners are computer professionals or not, and embedding the learning outcomes data in the LOM record, in the classification category above, this technique enable us to linking learning object with learning outcomes with grading them.

3.6 Guest Activity

3.6.1 Browse the default page.
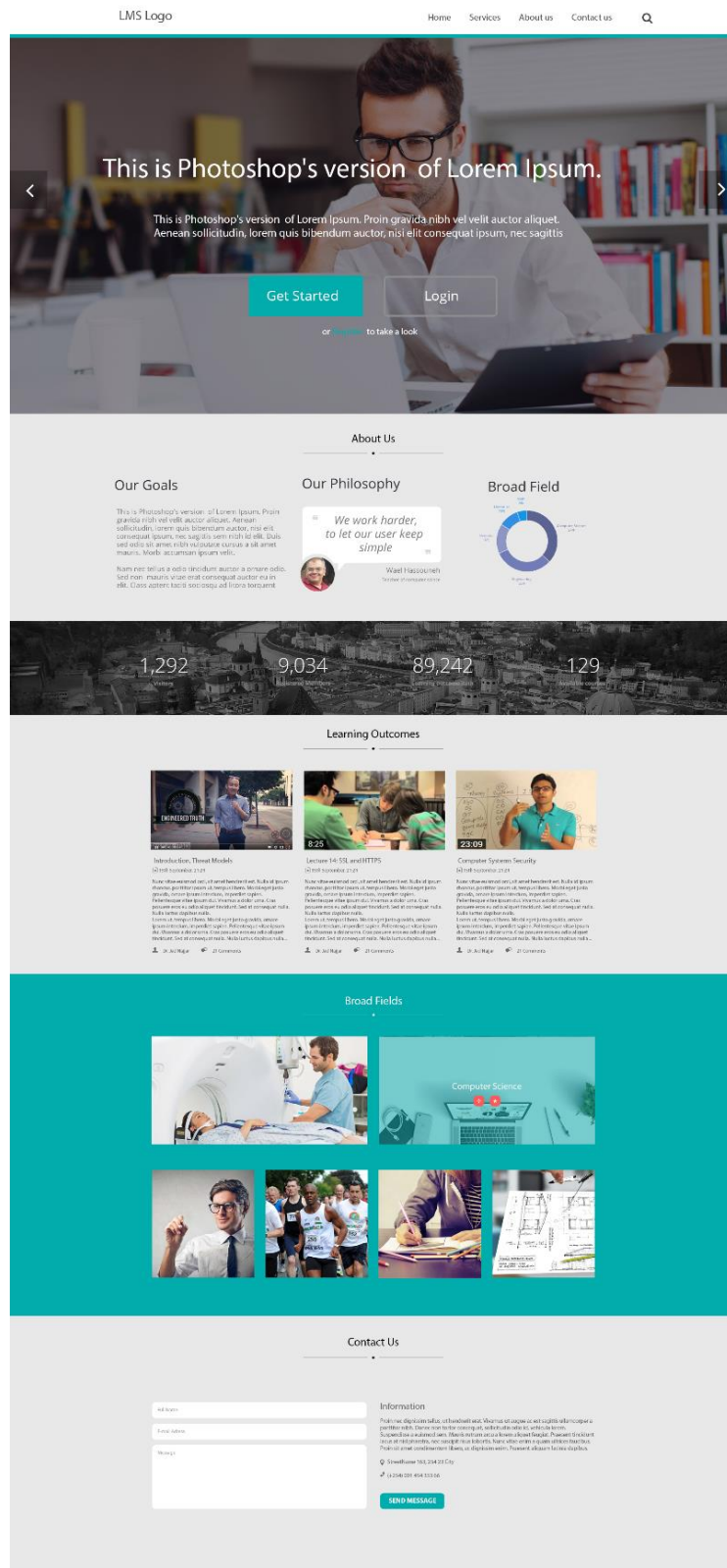
Figure 03-20: Home page design using Photoshop.

Figure 3.20 shows the content of homepage, comprehensive overview of learning knowledge area, a header on homepage have a login button for current user – login dialog , forget a password dialog, new user registration . After that, a four navigation bar consists of Home, about us, FAQ (Help service), and contact us.

The second frame presents the image slider (also known as image carousels or slideshow) can be convenient way to display multiple images, video, or graphics on your website, slideshow allow web designers to display more than one image in what is usually important design – instead of reserving the best spot on the page for just one image. So before you install and active any of the image sliders, consider carefully whether you need a slider at all. And the content should be reflect the lean of the website.

The third frame represents the 'about us', which contains our goals of LMS, present why we built this project and who is the targeted cycle, the second is our philosophy that the shortest sentence which represent LMS, the third field is broad field, we will present it as sector cycles each part of cycle present to percentage of learning objects.   Figure 3.20: Homepage by Photoshop

The fourth bar is a statistical number that shows how many visitor per week, and how many number of participated users that can access the system with username and password, the third number shows the total number of learning objects, and finally; the number was found to represent the total number of available learning experiences.

The fifth bar represents the recommendation system of top related objects voted by the users and achieved the higher views during short period.

Board field sector was created to show most top 6 of broad field, every widget after clicking it will open a new page presenting all learning objects.

Figure 3.20 shows the content of the contact us form, you can use this form to contact the Public Inquiries team regarding general questions about the LMS or the Web Services team regarding technical issues with the website.

3.6.2 Search activities.

Search engine can improve navigation, it's allow learners to locate items on a LMS, thus, increasing the likelihood that they will find learning objects. To do this, search engines placement should be easy and obvious for learner, so we decide to put it at top of page.

Figure 03-21: Header of webpage

As shows in figure 3-22, it's obvious that a system retrieve all learning object related to search query which is -Data Set – as example. Due to huge of data, learner can customize the search results by time, category and type.
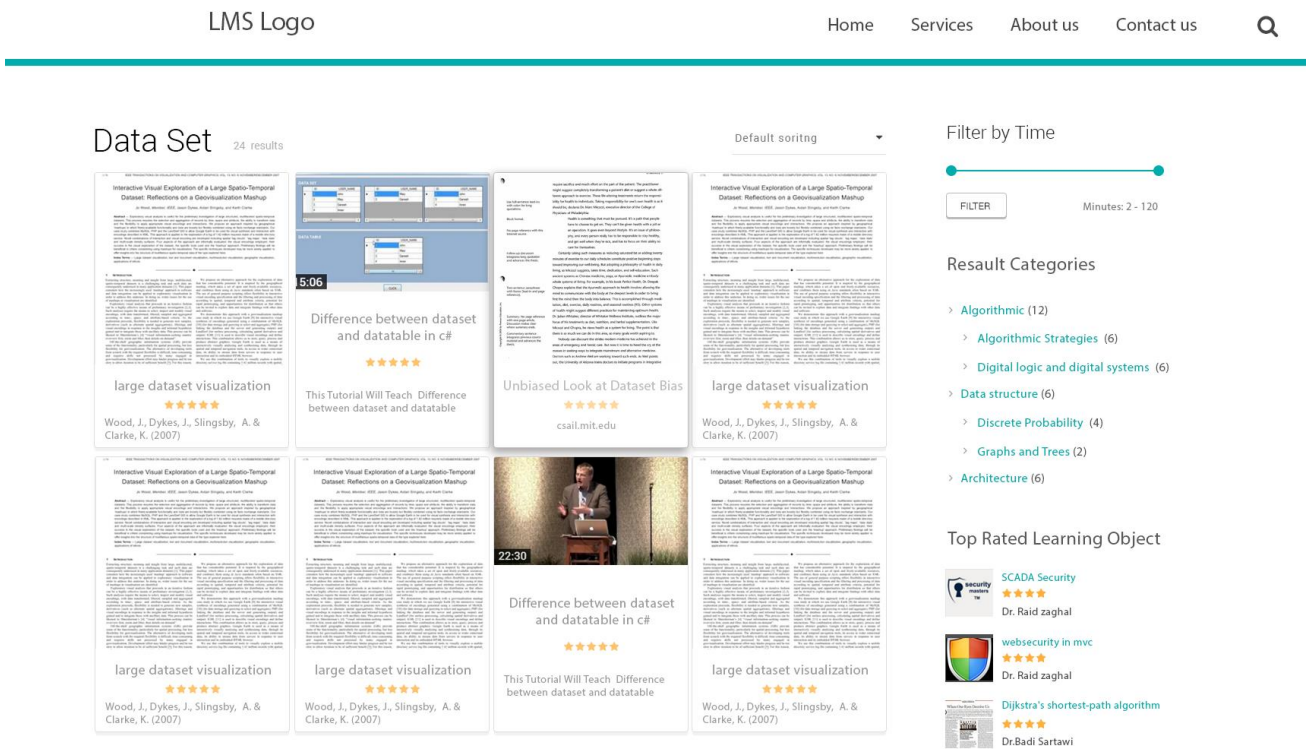
Figure 03-22: search results

Search engine can improve navigations, it's allow learners to locate items on a LMS, thus, increasing the likelihood that they will find the learning objects. To do this, search engines placement should be easy and obvious for learner.

Figure 03-23: search engine

As shows in figure 3-24, it's obvious that a system retrieve all learning object related to search query which is -Data Set – as example. Due to huge of data, learner can customize the search results by time, category and type.
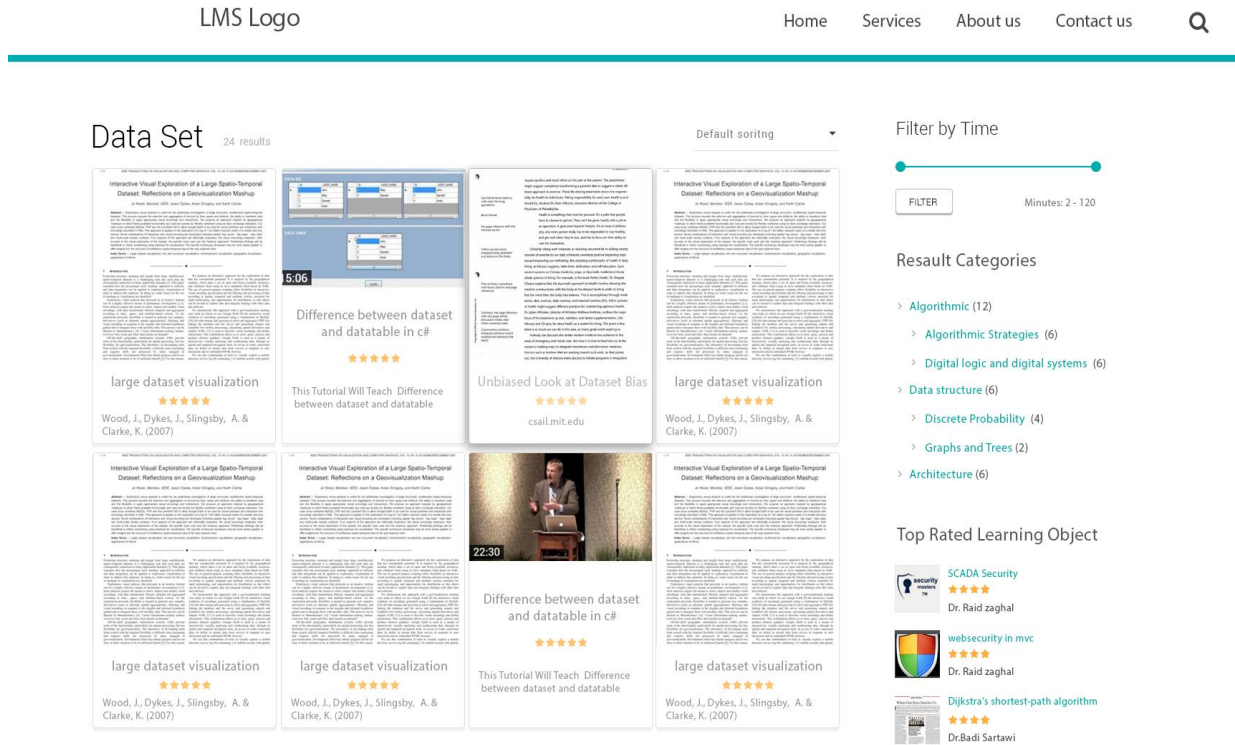
Figure 03-24: learning objects search results

After we indexing all queries we can measured the number of occurrences each metadata element is included in the indexed metadata instances. The values that are frequently used by indexers were also identified.]

For every searcher activity in the Qlearn repository, the following information is logged in search log file of the search tool; note that the logging service is Qlearn search tool:

- User IP address

- User Name – if enrolled users.

- DateTime

- Metadata elements (including their values) query, such as: title, science type, main concept, etc.

- Number of learning objects that satisfy the search criteria.

```
Date              : Thursday, September 01, 2016
Time              : 1:41:11 AM
MyMessage         : Search Page, Data set key word , without login
Priority          : Low
Severity          : Critical
Category          : Info
Source            : mscorlib
Message           : results duration time 0.12 sec.
Method            : AbortInternal
Classes           : System.Threading.ThreadAbortException
Computer          : PC1
LoginName         :
LoginIP           : 192.168.1.22
StackTrace        : System.Threading.Thread.AbortInternal()
```

Figure 03-25: Data logger file.

The results will reveal elements that are rarely used were made less visible or hidden from the interface.

3.6.3 The ability to register users into a system.

The login screen, where the learner can login to QLearn using his email and password as in Figure 3-26
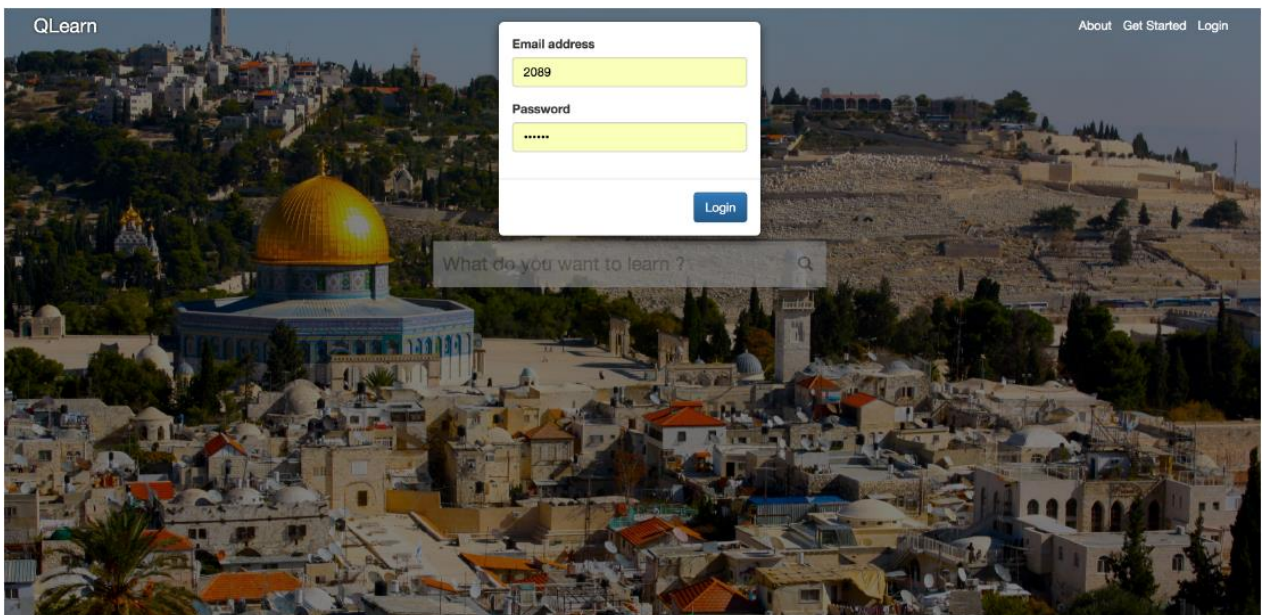
Figure 03-26: login using username and password.

The registration page, where the learner can register for new account is given in Figure 3-27
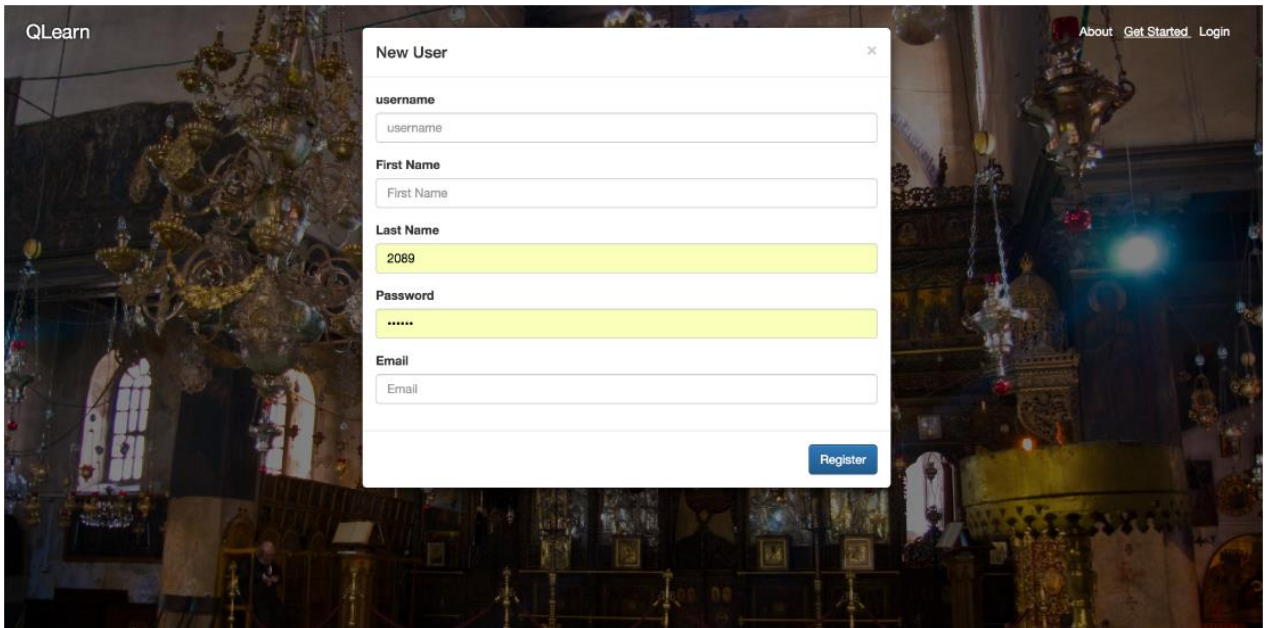
Figure 03-27: registration new users.

3.7 Comparison between Qlearn and other LMS's.

At the eLearning Industry, we see an increasing number of LMS vendors that continuously strengthen and improve their LMS solutions. However, with some many LMS providers and 1000+ of LMS solutions at the global eLearning market it is really hard to find the requirements LMS solution that fits our specific requirements [30].

What are the most important features in a Qlearn System?

As description at the beginning on chapter 3 we focuses at four new ideas that never existed at other learning management systems which is:

1- Create a new course activity, where linking learning outcomes with learning objects and assessment is the center of the course design.

2- Recommended learning objects based on learning outcomes.

These activities focus on introducing a learning experience that matches users' desires, make flexible UI with learning object and learning outcomes, enhance students' performance and stimulate them to do better.

The unique activities listed above enable us to access the learning resources quickly and find more relevant object. Therefore, increasing system usability and high levels of user satisfaction.

Chapter Four

Evaluation

In this section, we go through the evaluation process of the design of learning management system. As technology deepens and mainly in learning domain, and more and more systems are engaged in the learning ecosystem, the human computer interaction (HCI) domain adds new horizons in evaluating the learning systems and user satisfaction. HCI domain usability experts with tools and techniques that help them to arrive at the most usable learning software with increased system efficiency and effectiveness before putting the systems in an actual learning environment (Melton, 2008) [21].

This Chapter is structured as following: in section 4.1 usability concept is introduced briefly. Section 4.2 present a methodology used in usability evaluation for current framework. In section 4.3 present a web page analytic. In section 4.4 present a Mouse Tracking technique that used in out evolution process in section 4.5.In section 4.6 present SUS results and then compared results with SUS scale in section 4.7.

4.1 Usability Evaluation

pagesIn each usability session, participants were given the chance to express their opinions about the interaction and the behavior of the designs and functionalities. Users participated in this evaluation are students and teachers mainly from AL-QUDS UNVERSITY who took part in an e-learning course selected for implementation of our study dataset.

In the evaluation process, we try to view the most important part at the user interface, and how the pages user interface present the information, and whether the users may are able to finish their tasks with the system pages.

4.2 Usability methodology

A usability test was performed on the teacher and the student pages alike. The participants covered students and teachers participating in learning and teaching of courses at the current semester and who have experience with the use of an LMS. In our evaluation, seven teachers and twenty one students were selected to participate as shown in Table 4-1.

In this work, as far the user satisfaction is concerned, the System Usability Scale (SUS) surveys are used. Usability evaluation becomes an imperative for educational software. We invited all teachers to participate in the evaluation process, only five of them agreed to participate. On the other hand, all student responded.

Table 04-1: The study population

	Population	Sample	Sample %
Teachers	7	5	71.4%
students	21	21	100%

Participants had enough time to review system pages and they were asked to perform a predefined set of tasks, captured data gives us the ability to study users' experience and specify areas of user's interests within the LMS. In addition, participants were requested to fill-in a post − test online survey measuring main desired usability goals from current system, as shown in Appendix 1: online SUS survey form.

4.3 Web Page Analytic

Web page analytics is a method of tracking webpage users experience as shown in figure 4.1. Using special tracking script embedded in the web page, tracking script can be a client-based JavaScript code. This script is executed on client browser request the tracking script from the server registering user experience (European Patent Office paltent No.WO20080222706 A2.2008)
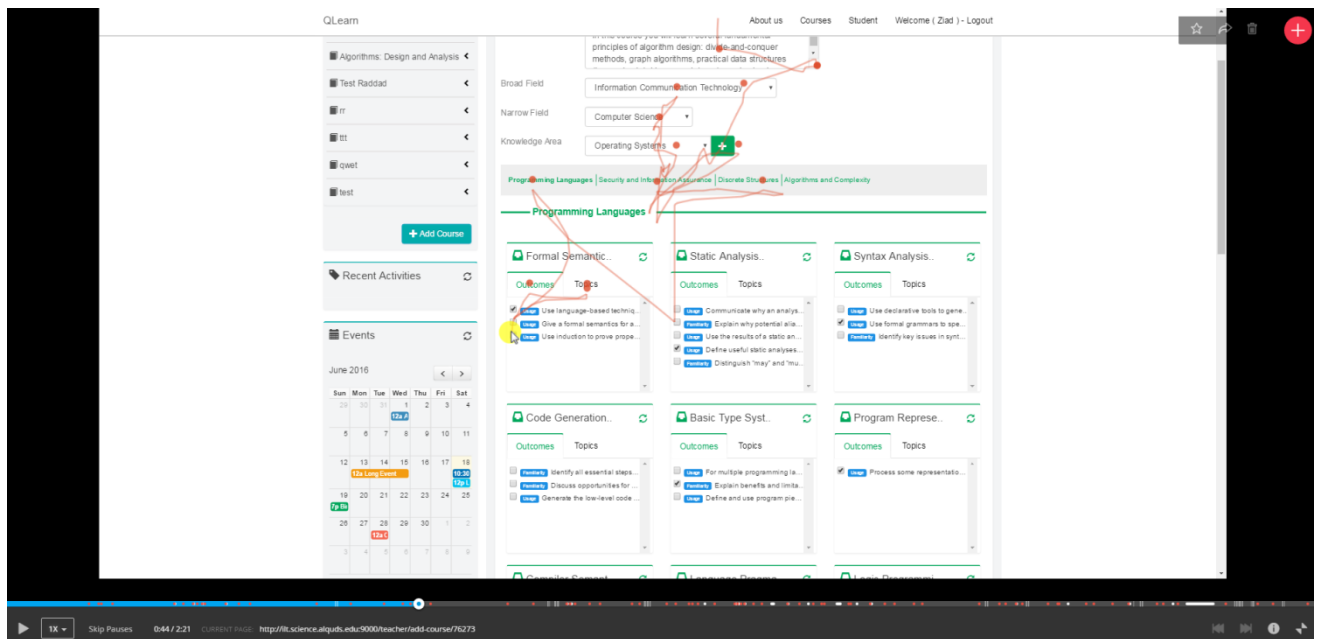
Figure 04-1: Tracking Webpage users experience.

4.4 Mouse Tracking

The mouse tracking system draws a heat map to show areas of user focus on web pages. This can show us a heat map for mouse scrolling, mouse movement, and clicks density alike. Heat map are great for analyzing user behavior. This gives actual information of user experience on system ignoring the impact of surrounding environment, contrary to eye tracking system (Lillevalja, 2013)[22].

Mouse tracking techniques enable to infer a user's intent and focus while using current system. Moreover mouse tracking can be useful to determine if a user is confused, if user's expectations are met, where user's attention, is more focused.

4.5 Evaluation

In the current section, we will describe the evaluation 'Qlearn' Demo system. After we identified the usability sessions participants as shown in Table 4-1, two group of participants (teachers and students) both of them. We prepared the following evaluation process and tasks for each group:

1. Teachers Group:
   1- Brief description about system and pages functions.
   2- Give users tasks to perform using pages and take notes about the complexity:
      A. Review Home Page and give the feedback.
      B. Create a new course.
      C. Add new assessment and edit a previous assessment.
   3- Then fill-in an online post usability survey.

2. Students Group:
   1- Brief description of current system and pages functions.
   2- Give users tasks to do using pages design and take note about task complexity:
      A. Review available course.
      B. Show course grade and evaluation process.
      C. Review the Learning Management system and recommendation learning object.
   3- Finally fill-in an online post usability survey.

This part of evaluation is to motivate users to interact with the pages and brings to light information provided on the pages, Moreover, this part shows us how easy it is for users to reach desired information on the pages.

After completing first task, participants filled in SUS evaluation survey, which consists of ten question shown in Table 4-2 below.

Table 04-2: SUS – The System Usability Scale.

#	Question
1.	I think that I would like to use this system frequently.
2.	I found the system unnecessarily complex.
3.	I thought the system was easy to use.
4.	I think that I would need the support of a technical person to be able to use this system.
5.	I found the various functions in this system were well integrated.
6.	I thought there was too much inconsistency in this system.
7.	I would imagine that most people would learn to use this system very quickly.
8.	I found the system very cumbersome to use.
9.	I felt very confident using the system.
10.	I needed to learn a lot of things before I could get going with this system.

The SUS scale response takes the format as shown in Table 4-3

Table 04-3: Sys Response format.

Strongly Disagree 1	2	3	4	Strongly Agree 5

4.6 SUS Scale

Using a standard letter grade scale from A to E, items that scored in the 90s were excellent and scored A, items that scored around 80s were good and scored B, and items that scored in the 70s were acceptable, anything below a 70 had a usability issues. As shown in Figure 4-2
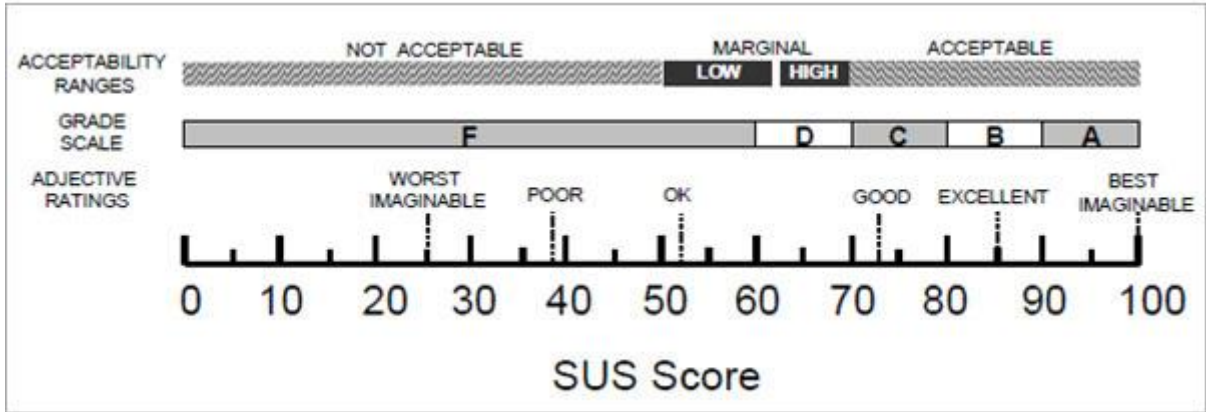
Figure 04-2: A comparison of the adjective rating, acceptable scores.

4.7 SUS Results

The current section will present results of our evaluation, for each group of participants as following:

4.7.1 Teacher Group

Teachers' pages was designed to satisfy teacher's needs of information about course and assessment activity. Our goal is to evaluate and find whether desired goals were achieved.

Our participants in the first group performed predefined tasks in Table 4-4, based on what we calculated time required to complete each task.

Table 04-4: Task required from teachers and completion time.

#	Tasks	Mean Time
1	Create new course.	15 sec
2	Select outcomes from different knowledge area.	50 sec
3	Select learning objects for one learning outcomes.	35 sec
4	Create new assessment and assign questions.	40 sec

The next task in the evaluation is analyzing participants' response on the SUS survey. Based on the distribution of all scores, A SUS score of 83 is the point where users are more likely to be recommending the product to a friend. And graded A next score 74 graded to B.

First, we will review user option on each item of survey as shown in Table 4-5, the responses were, first of them was, "I felt very confident using the system", with mean 84.00. Then "I thought the system was easy to use", with mean 81.50, followed by " I found the various functions in this system where well integrated", 78.50, on other hand less agreement was on "I found the system very cumbersome to use", "I found system unnecessarily complex", and "I thought there was too much inconsistency in the system".

Table 04-5: Survey questions with descending ranked by mean of user view for test group of teachers.

Question	Means
I felt very confident using the system	84.00
I thought the system was easy to use	81.50
I found the various functions in this system were well integrated.	78.50
I think that I would like to use this system frequently.	78.00
I would imagine that most people would learn to use this system.	62.50
I need to learn a lot of things before I could get going with this system.	31.25
I thing that I would need the support of a technical person to be able to use this system.	25.00
I found the system very cumbersome to use.	20.00
I found the system Unnecessarily complex.	12.50
I thought was too much inconsistency in this system.	03.00

This result shows that users got positive impression on our pages and have a positive appeal on it. In addition it covers their needs of information from current system. Despite these result, we calculated allover survey total 77.50 which shows a good agreement among participants to the system and suggest using for teachers as shown in Table 4-6 bellow (Sauro, 2011) [24].

Participant	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	SUS Score
P1	5	1	4	1	4	1	4	1	5	2	90.0
P2	3	1	3	3	5	2	5	1	3	2	75.0
P3	5	1	5	1	3	1	3	2	5	4	80.0
P4	3	1	2	1	5	2	5	1	1	2	72.5
P5	5	1	5	1	5	1	5	1	5	1	100.0

Table 04-6: SUS Calculation.

Table 04-7: Total survey mean for teachers evaluation group.

	N	Mean	StDev
Total	5	83.4	11.52

The following step in evaluation of teachers group result from mouse tracking system based on data captured using Hotjar service, during participant's interaction with pages system.

At first, mouse clicks tracked through Hotjar system [28] shows participants were actively using pages trying to explore whole parts of pages, participants were more interested to select different knowledge area during create course in teacher's pages as shown in Figure 4-3, and Figure 4-4, in addition, to their interest into other pages components, The red line shows the move track of learner mouse, and the red circle is to click places.
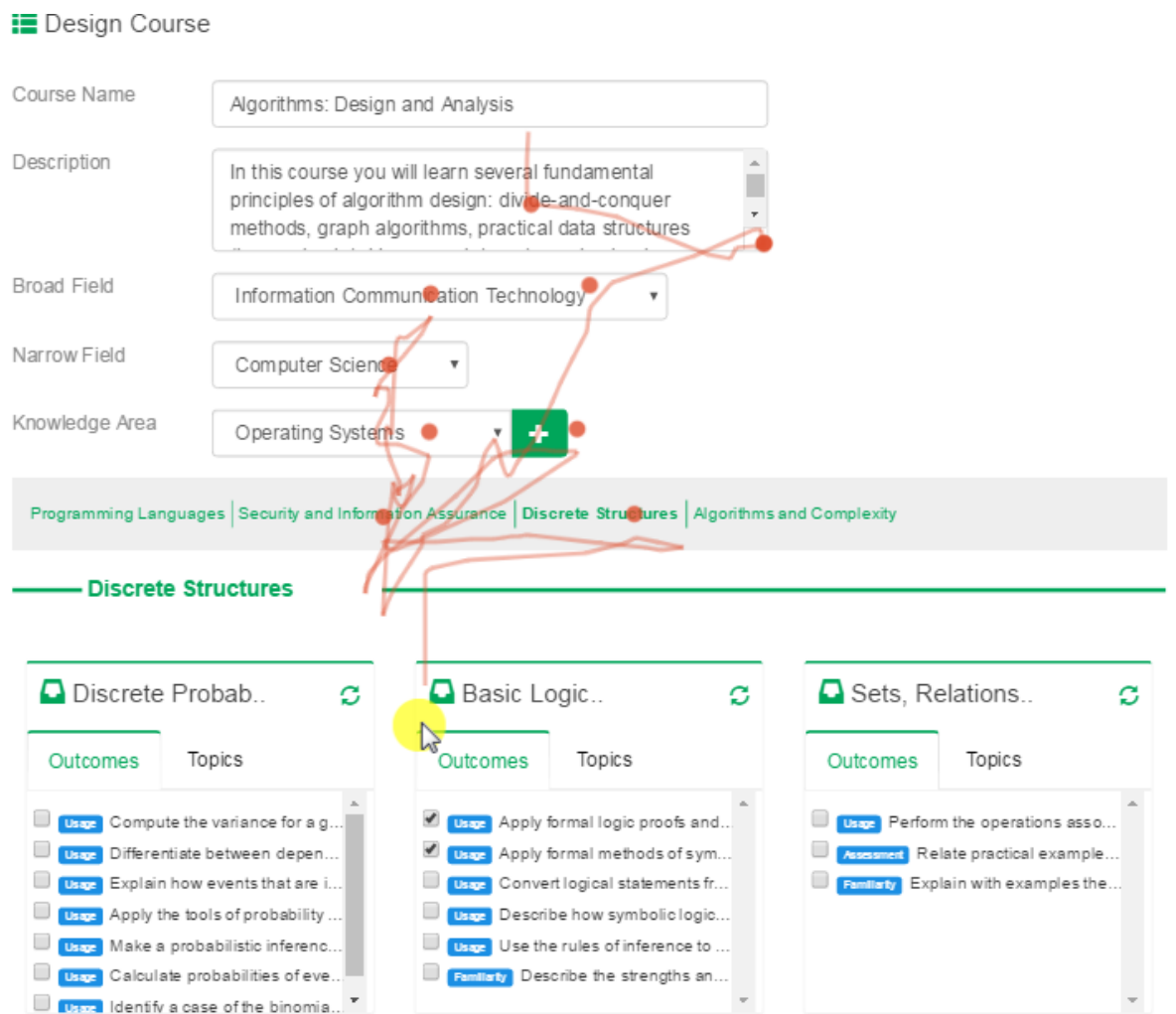
Figure 04-3: Clicks captured on teacher pages generated by Hotjar system.

This option from Hotjar system gives us the areas of interest by user providing heat map images using a gradient areas where user interaction area highlighted from cold color "less

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interactive" to a hot color " Heavy user interaction", as shown below to Figure 4-5 shows heat map for out pages generated from users clicks density where participants focusing on main parts of pages component.

Figure 04-4: Heat map for user interaction on teacher pages generated by Hotjar system.

From Figure 4-3, and Figure 4-4, we can see that participants were activity interacting with pages system and they used all option available in the pages. This confirms to SUS survey findings.

The scroll map provided by Hotjar system presents another proof of participant's interest in system as they continue using pages and increase of using scrolling to explore next parts of system.

Figure 04-5: Scroll heat map for user interaction on teacher pages generated by Hotjar system.

The scroll map in Figure 4-5 shows that participants were interested in information provided by teacher activity to create course.

4.7.2 Students Group

Similar to teacher pages the student pages will be evaluated for usability by student's participants. To measure pages usability students were requested perform a predefined group of tasks as described in Table 4-8 , this table also shows the mean time require to complete each task from participants.

Table 04-8: Task required from teachers and completion time.

#	Tasks	Mean Time
1	Review course available	25 sec
2	Review learning objects for each learning outcomes	50 sec
3	Show course grad	30 sec

Time spent on each task is less than one minute, this shows that is was easy for students to reach information on the pages and the current system was simple to them.

Table 4-8 shows participant's response to SUS on each point separately as in table 4-7 to view their opinion on each point, in table 4-8, we descended participant's response on each question. When means increase, it increases level of acceptance to point and vice versa.

Table 04-9: Survey questions descending ranked by mean of user view for test group of students.

Question	
I think that I would like to use this system frequently.	86.37
I felt very confident using the system	83.23
I would imagine that most people would learn to use this system.	76.12
I thought the system was easy to use.	78.12
I found the various functions in this system were well integrated.	60.50
I thing that I would need the support of a technical person to be able to use this system.	31.25
I need to learn a lot of things before I could get going with this system.	25.00
I found the system very cumbersome to use.	21.87
I thought was too much inconsistency in this system.	12.50
I found the system Unnecessarily complex.	03.12

From Table 4-9, we find that users greatly agree with first five points in the survey, I think that I would like to use this system frequently, with a mean value 86.37. Next question, I feel very confident using the system, with a mean value 83.23, after that I would imagine that most people would learn to use this system, Mean value 76.12 followed by I thought the system was easy to use, Mean value 78.12, followed by I found the various function in this system were well integrated. With mean value 77.17.

On other hand Table 4-9 shows the last 5 points have a minimum agreement from users, I found the system unnecessarily complex, I thought there was too much inconsistency in this system, I found the system very cumbersome to use, I needed to learn a lot of things before I could get going with this system, and I think that I would need the support of a technical person to be able to use this system. Although we calculated general mean for survey in Table 4-10 which shows the overall was 77.60 which mean participants accept the current system. (Sauro, 2011).

Table 04-10: Total survey mean for teachers evaluation group.

	N	Mean	StDev
Total	21	77.60	9.95

Now we will discuss mouse tracking system results, based on data captured using Hotjar service, during participant's interaction with pages system.

The mouse clicks tracked through Hotjar system shows participants were actively using pages trying to explore whole parts of pages, participants were more interested in recommended learning object and the result of his learning outcomes as shown in Figure 4-6, and Figure 4-7, in addition, to their interest into other pages components.
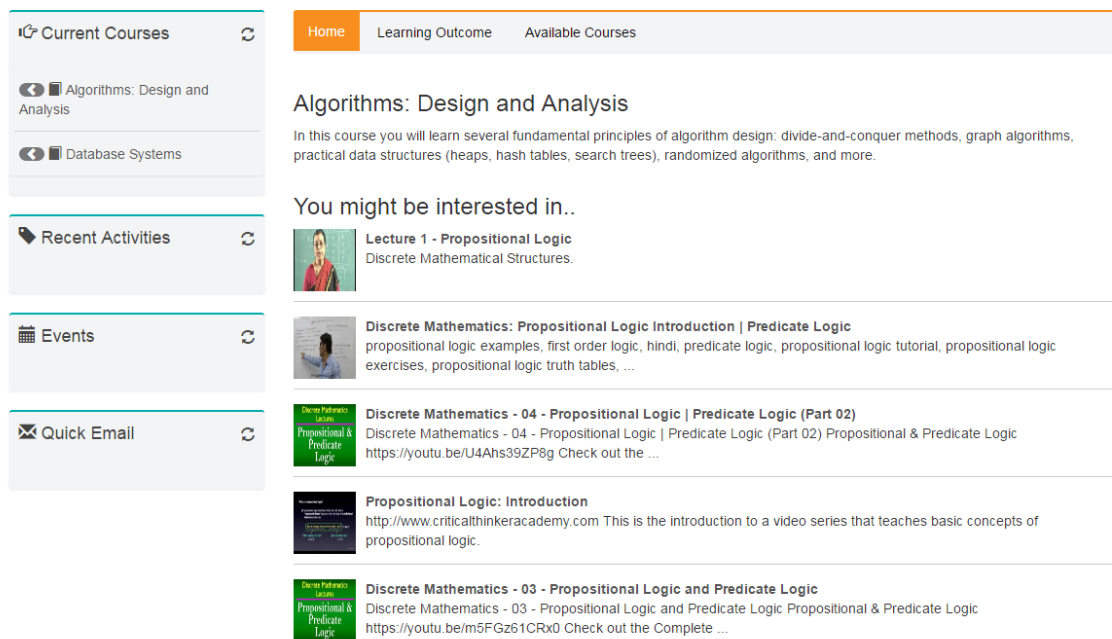

Figure 04-6: interaction on student pages.

For more clearance of user interaction with pages, this system provides a heat map where gradate from blue to read area on the user interest focusing red color where user more interning area as shown in Figure 4-9.
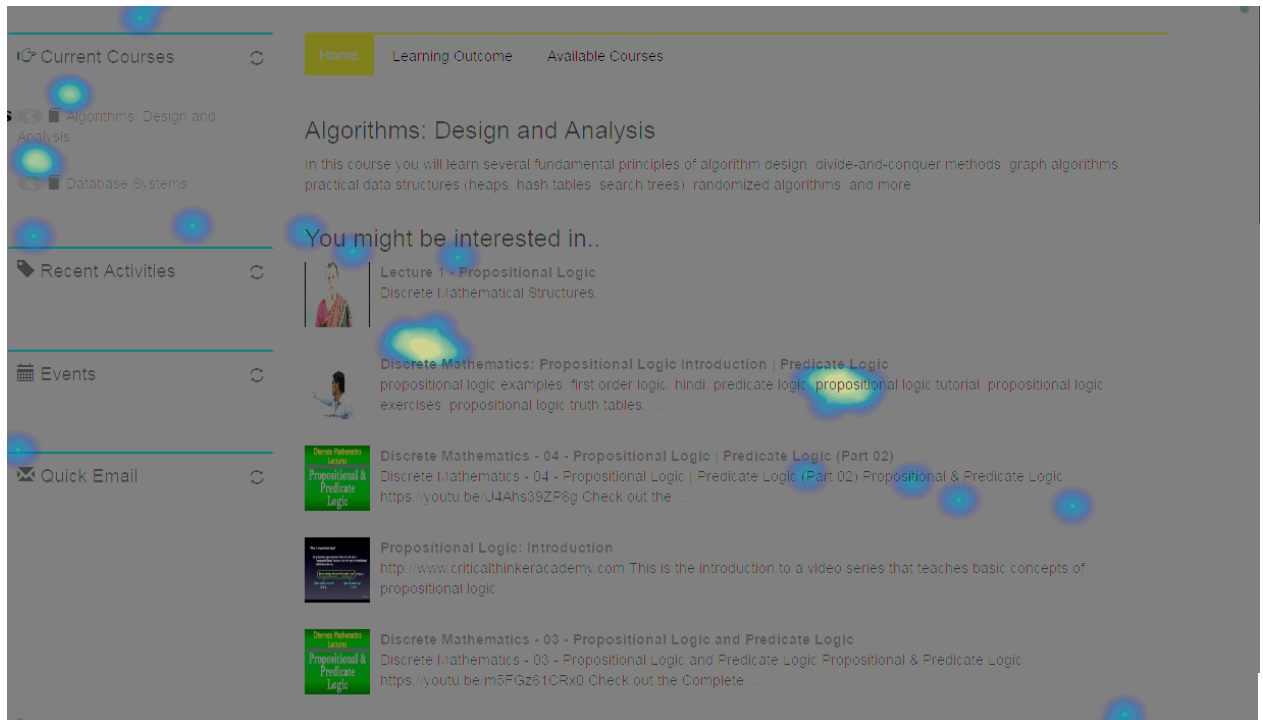
Figure 04-7: Heat map for user interaction on student pages generated by Hotjar system.

This user interactions with system captured by Hotjar system shows the point of focus in current pages system, participants were actively using this pages to reach desired information from current view, and the system was interesting for users as they actively interact with it while exploring system and performing required tasks

4.5.3 Conclustions

After reviewing results for both students and teacher groups in the both evaluation of SUS survey and usability testing tool employed in current research, we list the following findings:-

1- Participants in teacher group were satisfied with the new LMS Demo and they will suggest using current system at the university, as shown in Table 4-5: Total survey mean for teacher's evaluation group.

2- Participants in student group were also satisfied with current framework and they recommend using it at the university, as shown in Table 4-8: Total survey mean for test group of students.

Chapter five

Conclusions

In this thesis, we started from presenting the general architecture of Learning Management System framework then we presented the interface design for instructors, students and homepage. After that we listed definitions for each level, made to reach desired result based on the model and research study. Finally we presented a visualizing pages system based on the framework which provides each level components content.

This framework was implemented on top of an LMS, and academic management system. We think we can enhance the learning environment in our university using the technique which was used engage with some current LMS.

The purpose of this thesis is to practice all knowledge of professional field, learning new skills of real learning environment, so you can learn the flow of design web user interface and convert stakeholder's requirements to web designer, so we adapt the study according to needs in work. According to this we made an efficient preparation about web design tools and principle.

In this design process, all requirements were collected directly from teachers and students themselves by an efficient information search method. Selecting and analyzing the information were experienced with requirements, moreover, teachers and students were engaged in each design segment, which was beneficial for designer to adjust web user interface based on their requirements.

Suggestions for future development

Enhance interaction of learners and teachers with the full functionalities of the QLearn, so to understand learner's views and desires of this new LMS.

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Appendix 1: online SUS survey form

QLearn Usability Evaluation Servey

Your participation in this survey is very important to us. Understanding your background and professional experience will help us make this Learning Management System more useful and relevant to you and other Teachers.

The survey should only take a couple of minutes of your time.

Teacher UserName:2498 Password 123123

http://ilt.science.alquds.edu:9000/

I think that I would like to use this system frequently?*

1 2 3 4 5

○ ○ ○ ○ ○

I found the system unnecessarily complex.*

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

I thought the system was easy to use?*

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

I think that I would need the support of a technical person to be able to use this system?*

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

I found the various functions in this system were well integrated?*

1 2 3 4 5

Strongly Disagree ○ ○ ○ ○ ○ Strongly Agree

3

I thought there was too much inconsistency in this system?*

1 2 3 4 5

Strongly Disagree ⚪ ⚪ ⚪ ⚪ ⚪ Strongly Agree

I would imagine that most people would learn to use this system very quickly?*

1 2 3 4 5

Strongly Disagree ⚪ ⚪ ⚪ ⚪ ⚪ Strongly Agree

I found the system very cumbersome to use?*

1 2 3 4 5

Strongly Disagree ⚪ ⚪ ⚪ ⚪ ⚪ Strongly Agree

I felt very confident using the system?*

1 2 3 4 5

Strongly Disagree ⚪ ⚪ ⚪ ⚪ ⚪ Strongly Agree

I needed to learn a lot of things before I could get going with this system?*

1 2 3 4 5

Strongly Disagree ⚪ ⚪ ⚪ ⚪ ⚪ Strongly Agree

I found the system very cumbersome to use?*

1 2 3 4 5

Strongly Disagree ⚪ ⚪ ⚪ ⚪ ⚪ Strongly Agree

I felt very confident using the system?*

1 2 3 4 5

Strongly Disagree ⚪ ⚪ ⚪ ⚪ ⚪ Strongly Agree

I needed to learn a lot of things before I could get going with this system?*

1 2 3 4 5

Strongly Disagree ⚪ ⚪ ⚪ ⚪ ⚪ Strongly Agree

Ovaral*

[▼]

Write your review?

[   ]

Write your suggestions?

[   ]

Appendix 2: Early designs of the system

Home   **All Courses**   **Profile**

HCI Design
Chapters 5, 9-11, 13-14
Lora Aroyo   Web & Media Group

↱ ‹› ♥ ⤓   ◁ 1 of 54 ▷   ⤢

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📋 **Note**

Human–computer interaction (HCI) researches the design and use of computer technology, focusing particularly on the interfaces between people (users) and computers. Researchers in the field of HCI both observe the ways in which humans interact with computers and design technologies that lets humans interact with computers in novel ways.

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