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A FUNCTIONAL REQUIREMENT MODEL OF E-LEARNING SYSTEM IN SECONDARY SCHOOL IN DHI-QAR PROVINCE, IRAQ

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ABSTRAK

Pada hari ini, teknologi moden memudahkan program pembelajaran dan komunikasi di kalangan pelajar, guru, ibu bapa dan pihak pengurusan sekolah di institusi-institusi pendidikan. Selaras dengan perkembangan ini, keperluan pembelajaran elektronik yang sedia ada didapati tidak memenuhi keperluan semua pelajar institusi pendidikan dan ini adalah disebabkan oleh pelajar-pelajar yang mempunyai keperluan, matlamat, latar belakang, tahap pengetahuan dan keupayaan pembelajaran yang berbeza-beza antara satu sama lain. Tambahan pula, literatur sebelum ini juga mendedahkan beberapa kelemahan sistem persekitaran dalam talian semasa, termasuk kekurangan interaksi antara pengguna dan kesukaran dalam membantu kerja-kerja yang memerlukan kerjasama. Sebaliknya, persekitaran yang tidak stabil dan keadaan tidak selamat di Iraq kini menghadapi cabaran dimana ibu bapa diarahkan untuk mengelakkan menghantar anak-anak mereka ke sekolah. Selain itu, di beberapa bahagian Dhi-Qar, terdapat tiga buah sekolah yang beroperasi dalam satu bangunan pada masa yang berlainan dan terdapat menghadapi masalah kekangan bahan pembelajaran. Berhubung dengan model keperluan, terdapat kekurangan model keperluan untuk membangunkan sistem e-pembelajaran yang khusus untuk sekolah menengah. Sehubungan itu, kajian ini bertujuan untuk mencadangkan model keperluan dengan fungsi sistem e-pembelajaran untuk menghubungkan pihak berkepentingan atau pihak-pihak yang terlibat dalam proses pendidikan dalam persekitaran dalam talian. Data telah dikumpul melalui temu bual dan soal selidik. Keperluan pengguna telah diperolehi daripada kajian literatur dan temubual dengan pengguna. Kesemua maklumat kemudiannya telah diterjemahkan ke dalam prototaip, yang direka menggunakan platform sumber terbuka, Moodle. Akhir sekali, penerimaan dan penilaian kebolehgunaan telah dijalankan dengan menggunakan kaedah soal selidik. Keputusan menunjukkan bahawa para peserta berpuas hati dengan keperluan yang dicadangkan, dan keperluan ini juga didapati memenuhi semua keperluan pihak berkepentingan. Oleh itu, model yang dicadangkan dalam kajian ini boleh digunakan untuk institusi pendidikan tertentu dan kawasan yang menghadapi konflik yang sama di kawasan lain untuk membantu melengkapkan kelas tradisional sedia ada.

Kata kunci: e-pembelajaran, model keperluan, wilayah Dhi-Qar, sekolah menengah

Abstract

Recently, the modern technology simplifies the learning programs and support communication among students, teachers, parents, and the managements of schools in educational institutions. With this development, the existing electronic learning requirements do not meet all students' or the educational institution's needs, due to the varying students' needs, goals, backgrounds, knowledge levels, and learning capabilities. Furthermore, prior literature also reveals some disadvantages of current online environment systems, including lack of interaction among users and difficulty of supporting co-operative work. On the other hand, the unstable environment and the insecure situation that Iraq currently faces prompts parents to avoid sending their children to school. In addition to that, in some parts of Dhi-Qar, there are three schools running in one building, operating at different times and there is a dearth of learning materials. With regard to requirement model, there is a lack of requirement model to develop the e-learning system specifically for the secondary school. In accordance to that, this study seeks to propose a functional requirement model of e-learning system to link the stakeholders or actors of the educational process in online environment. Data were collected through interviews and questionnaires. The user requirements were obtained from literature review and interview with users. They were translated into a prototype, which was designed using an open source platform, Moodle. Finally, acceptance and usability evaluation were conducted, using questionnaires. The results reveal that the participants are satisfied with the proposed requirements, and these requirements meet all the stakeholders' needs. Therefore, the model proposed in this study can be used for particular education institutions and other conflict areas to complement the existing traditional classrooms.

Keywords: e-learning, requirement model, Dhi-Qar Province, secondary school

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In the Name of Allah, the Most Gracious and Most Merciful

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List of Abbreviations

E-learning	Electronic learning
ICT	Information and Communication Technologies
E-LS	E-Learning System
Moodle	Modular Object- Oriented Dynamic Learning Environment
SDISR	Systems Development in Information Systems Research
UML	Unified Modeling Language
RE	Requirement Engineering
SDL	Specification and Description Language
KSS	knowledge sharing system
LMS	Learning Management System
FR	Functional Requirements
NFR	Non-Functional Requirements
SRS	Software Requirements Specification

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CHAPTER ONE
INTRODUCTION

1.0 Overview

This chapter explains the background of Iraqi pre-tertiary education system and the demand for electronic technologies for better delivery of teaching and learning experience. It thus forms then study's problem statement which borders on the need for e-learning system in Iraq generally and requirement-based e-learning systems specifically for its secondary schools. This highlights the research questions to be answered by this study, and its corresponding research objectives to be accomplished. Also discussed in this chapter is the significance of this study practically and theoretically, as well as the scope that delineates the boundary that the study covers.

1.1 Background

Requirement engineering ensures that the tool or system under design is in alliance with the standard requirements, and in line with the expected functions of the system. It is opined that a sound requirement engineering process is a requisite to a functional and usable system (Shams-Ul-Arif et al., 2010). The requirement analysis of the previous studies on e-learning systems and available documentation, with users' study, will actualise an e-learning system that attends to the task needs of the users, which in this instance are Iraqi pre-tertiary students.

The requirements modeling plays a fundamental role in the Requirement Engineering (RE) process (Nuseibeh & Easterbrook, 2000) as it delivers a structured description of requirements that can be used throughout the requirements process and the rest of the software development processes. In addition, it is a main communication language

between stakeholders with different backgrounds (Cheng & Atlee, 2007). Modelling notations provide an abstract level of requirements description by providing a vocabulary and structural rules for the problem components. Modelling helps to analyze the requirements and identify detailed requirements (Nuseibeh & Easterbrook, 2000).

Information and Communication Technologies (ICTs) have hugely impacted contemporary society by fundamentally changing the process of communication, working, and education (Karagiannidis, Politis & Karasavvidis, 2014). The Internet growth has enabled online education to people in higher education institutes, corporations, government, and other sectors (Rosenberg, 2001). Moreover, one of the most growing and promising applications essential to an information society is Electronic learning (or e-learning, online learning, digital learning, and virtual learning) (Minguillón, Sicilia & Lamb, 2011).

E-learning is a modern learning method that is based on ICTs. Its main characteristic is that it overcomes time and spatial restrictions; since students can attend a course wherever they are - assuming they have adequate equipment; such as a computer connected to the Internet (Kazanidis, Valsamidis, Kontogiannis & Karakos, 2014).

In the same context, Khan (2010) defined e-learning as a modern method to deliver well-designed, learner-centred, interactive and facilitated learning environment to anyone, anyplace, anytime, by utilising the attributes and resources of various digital technologies along with other forms of learning materials suited for open and distributed learning environment. Yildirim, et al. (2014) also stated that e-learning

needs to support interactive and collaborative learning inside. It allows the school to extend the learning environment to the home and further involve parents in education process (Taylor, 2004).

The utilization of new technologies in the learning process can strengthen the parent-teacher relationship because it simplifies the transfer of information through online gradebooks and e-mails (Stephens, 2013). As a result, parents become informed about what is going on in the classroom and can support their child's academic achievement more effectively. This is also supported by Algahtani (2011), who contended that e-learning encourages parents' participation in the learning process. Therefore, e-learning can bring parents, students, and teachers together in the educational process. This will achieve engaging and fulfilling learning experience for students, and collaborative monitoring between the instructors and teachers (Garrison & Anderson, 2003). Nevertheless, design and development of any e-learning system for a particular age bracket and geographical location demands a requirements study to achieve both user-centred and task-centred e-learning system (Alexander & Golja, 2007; Valtolina et al., 2012).

In Iraq, the Iraqi pre-tertiary education system is divided into three stages, primary (ranging between ages 6 and 12), intermediate (ranging between ages 12 and 15), and Secondary (ranging between ages 15 and 18) (IOM Iraq, 2013). The Ministry of Education states that there are severe problems being faced by secondary school in the country and these range from lack of schools and educational institutions infrastructures, to deficiency in qualified teachers, curricula failure in following the global academic standards development, and unavailability of textbooks and teaching

aids (Iraqi Research Foundation for Analysis and Development, 2014). There is a poor quality of teaching and learning experience presently and this contradicts the history of educational legacy in the Arab world. The education system of Iraq was long seen as the most successful and egalitarian with illiteracy practically eradicated by the mid-1980s and high levels of enrolment at level of the university (Islamic Relief, 2014). However, because of the recent history of conflict in the country, the education quality has deteriorated significantly. During the Iraq war, over 4,700 public schools were damaged or destroyed (Islamic Relief, 2014). However, based on latest report from International Organization for Migration Iraq (2013), only 52% of Iraqi boys and 44% of Iraqi girls of secondary school age attend school, because of the overcrowded classrooms and insufficient academic materials.

In addition, in some parts of the Dhi-Qar province, there are three schools (tri-time) in the same building that operate at different times (from 8 to 11 a.m., from 11 to 2 p.m., and from 2 to 5 p.m.), and there is a dearth of learning materials (Aynaliraqnews, 2014; Alqurtasnews, 2014). Therefore, the teachers do not have enough time to have face-to-face interaction with students and parents. Additionally, the large number of the students in the high school in Dhi-Qar province create communication gap between teachers and students. This assertion was supported by Englehart, who said that "the more students who are placed in a class, the less opportunity the teacher has for contact with students on an individual basis" (p.718). The problem seems enormous, but they are not insurmountable. Adoption of Information and Communication Technologies (ICTs) provided opportunities of increasing quality of lives of people in the underserved countries and developing economies (Kramer, Jenkins, & Katz, 2007).

1.2 Problem Statement

Advent of ICTs, and especially internet, has been leveraged on in designing e-learning applications and this has helped in realising virtual classrooms where student and teachers can relate without being geographically constrained (Wheeler, 2012). Blau and Hameiri (2012) pointed out that utilizing an online environment in educational institutions, such as schools, have paved way for new possibilities of online interaction among teachers, students, and parents. This had consequently greatly aided teaching and learning.

Researchers have suggested the potential benefits of e-learning system over the traditional learning when used and applied in appropriate ways (Vonderwell, Liang and Alderman, 2007; Imadildayeva & Zhaidarbek, 2010; Ciampa, 2012). This makes quality design and development of e-learning applications to be important. It is observed, according to Beldagli and Adiguzel (2010), that most of the currently-used e-learning systems are not designed based on users-centred research and design process. Arguably, this is responsible for the design shortcomings in terms of incompatibility of the e-learning system with the students' needs, goals, backgrounds, knowledge levels and learning capabilities (Beldagli & Adiguzel, 2010). A one-design-fit-for-all approach cannot fit all students in all educational institutions (David, 2011). In addition, Neyland (2011) and Frimpon (2012) stated that, although E-Learning has been successfully implemented in many educational settings, the implementation of E-Learning projects can face slow progress and many E-Learning initiatives are not sustained.

The arguments above also supported by Taha (2014), who referred that, the implementation and development of E-Learning in the school education sector suffers from a shortage of academic and practical literature compared to the situation in higher education. Taha added that, there is also a lack of academic and practical studies that involve both stakeholders (students and teachers) for a more comprehensive overview of the obstacles to the educational process. Moreover, According to Abdullahi (2011), there is a lack of requirement model to develop the e-learning system specifically for the secondary school students. This claim also supported by Kaufman (2015) and Yu, Yuen & Park (2012), who stated that, much of the research that focused on e- learning was connected to higher-level institutions (i.e. Colleges or Universities), while research has yet to focus on e-learning within a schools setting.

Kulak and Eamonn (2004) opined that requirement model is a powerful way of capturing requirement and effective in conveying meaning. Hoffer et al. (2002) and George et al. (2004) also stated that a good requirement model helps in producing a system that truly matches the user's needs and help to produce a system that can be highly beneficial to the users. This has necessitated requirement analysis and design to ensure that e-learning applications are tailored to meet not only the basic learning and teaching deliverables but also the peculiar background knowledge levels and learning capabilities of the students.

On another hand, low adoption and usage of e-learning systems have been linked with implementation models which may not necessarily follow all stages and steps (planning, designing, integrating and improving) on a country-by-country basis

(Alkharang & Ghinea, 2013). As well as, David (2011) asserted that, the design of the e-learning and also its elements not easy can compatibly with all the student's needs. Besides that, Beetham and Sharpe (2013) referred that, there is an understanding that the evolution of technology in e-learning environments dictates the e-learning content and processes rather than incorporating pedagogic principles and determining the actual learning requirements for learners, which will vary from region to region. This further highlights the need for a requirement model for e-learning systems for secondary schools in Iraq.

The unstable environment and insecurity currently faced in Iraq is contributing to the rate of school drop-outs, and parents are demanding for alternatives which can be provided by online learning environments. With online learning environment, students, parents, and teachers can access materials and interact with one another without time and geographical constraints (Karagiannidis, Politis & Karasavvidis, 2014; De Sirisuriya, Ranathunga, Karunanayaka & Abdullah, 2014; MacNeill, Telner, Sparaggis-Agaliotis & Hanna, 2014). According to an interview conducted with Mr Jabbar Washam (Administrative Assistant at the Directorate of Education in the province of Dhi-Qar), he stated that there was lack of teachers in the Dhi-Qar province (Al-Gazi, 2014); an issue that was confirmed by the Chief of the Education Committee (Jameel Khalaf) in an official media (Al-Badri, 2014). In contrast, Olson et al., (2011) asserted that e-learning can address a shortage of teachers; especially science teachers or other disciplines. Students who could not physically attend schools frequently due to other reasons like physical challenges can equally learn remotely (Selwyn, 2012, Xanthidis, Wali, & Nikolaidis, 2013). In this light, designing and developing such e-learning system must be premised with requirement analysis and

design that will accurately capture both the task and users' preferences of the target persons.

A requirement model –targeting secondary school students of Iraq is therefore necessary. This will equally be an improved requirement model that based on the scope covered by the previous related studies conducted by Uta (2006), Buzzetto-More (2007), Al-Ajlan (2012) and Lotif et al. (2013). The review of these studies shows each one of them does not attend to all the requirements as found in others. Uta (2006) and Buzzetto-More (2007) do not have online guides, search facility, personalized learning workspace, among others. Al-Ajlan (2012) and Lotif et al. (2013) neglect provision for shared repository, grade book assignment, among others (see Table 2.4). The requirement model proposed by this study comprehensively attends to all functional requirements that results in a list that contains all missing items from previous studies. It also involves users' validation and experts' reviews to ensure that it accurately attends to the human and pedagogical needs of Iraqi secondary schools in Dhi-Qar province. According to Kulak and Eamonn (2004) designing the requirement model is considered as a powerful manner of extract and capturing requirement and effective in conveying meaning.

1.3 Research Questions

Considering the problems mentioned in Section1.2, this study attempts to answer the research questions as follows:

1- What are the functional requirements of e-learning system for secondary schools in the Dhi-Qar Province, Iraq?

2- How to construct the functional requirement model of e-learning system for secondary schools in the Dhi-Qar Province, Iraq?

3- How to evaluate the functional requirement model of e-learning system for secondary schools in the Dhi-Qar Province, Iraq?

1.4 Research Objectives

The objectives of this study are as follow:

1- To identify the functional requirements of e-learning system for secondary schools in the Dhi-Qar Province, Iraq.

2- To construct the functional requirement model of e-learning for secondary schools in the Dhi-Qar Province, Iraq.

3- To evaluate the proposed functional requirement model of e-learning for secondary schools in the Dhi-Qar Province, Iraq.

1.5 Scope of Study

First, secondary schools, teachers and students to be used in the users-centred requirement analysis of this study are from Dhi-Qar province, Iraq. The reasons for choosing Dhi-Qar province are: (1) Dhi-Qar province is the leading province in IT infrastructure in Iraq. It is the first local government that implemented e-government in Iraq (Fadhil et al., 2014; Thiqarpc, 2014), (2) the local authority in Dhi-Qar province are much more interested in adoption of ICT in the education generally (Hameed, 2012), (3) due to the insecurity in Iraq, it is one of the areas experiencing increasing drop-out rate in Iraq. The parents in collaboration with the school

administration are keenly interested in leveraging on technology to support the teaching and learning process in the province.

Second, the users' validation process in the requirement design of this study involves parents, students, teachers and management of secondary schools. These are the stakeholders involved in the study because it presents a more comprehensive perspective as earlier highlighted in the problem statement. The choice of secondary school is because it resonates with the peculiar problem of drop-out rate as it concerned the selected Iraqi province.

Third, the requirements to be analysed and developed into a requirement model in this study are the functional requirements. The functional requirements are the only part of system requirements that need users' involvement in its gathering, analysis and validation. Furthermore, this study focused on the stakeholders' perspective (parents, students and teachers) therefore the functional requirements have been highlighted. This is in line with arguments stated in the previous sections (research objectives and problem statements). The functional requirements exactly work with the system activity (Alsaleh & Haron, 2015), while Jacobson, et al. (1999) stated that, non-functional requirement as requirements that specify system properties.

1.6 Significance of Study

This study has its significances in form of contributions to both theory and practice. Theoretically, this study brings stakeholders' perspective into its requirement analysis and design approach to improve from the previous studies which are basically technical and pedagogical. In doing this, it ensures opinions and needs of educational managers, parents, teachers and students sought and used in validating the requirements analysed. The requirement model is expected to be a useful reference to

other researchers in similar domain or for developers who are interested in developing similar product. As for the educational institutions, it can be a useful guidance in developing the real online environment learning because it provides most of the requirement needed. Finding from this study would contribute and enrich the body of knowledge of this researched area by providing detail functional components of the model. The model also provides all functional requirements are clearly described in UML.

To practice, it presents an improved requirement model for developing e-learning system. Though this is specifically developed for secondary school students in Iraq, it is of benefits for all secondary school in war-torn areas and even in secured areas where option of virtual learning environment is to be explored. Teachers, parents, students and schools administrators will benefit from this by being able to closely interrelate in view of delivering better teaching experience to the students

Also, since this study presents a requirement model, it supports e-learning developers in developing users and task-centred e-learning application. Specifically, details of users' preferences can be used by e-learning systems developers to actualize usable systems.

1.7 Structure of the Thesis

This study is organized into seven major chapters:

Chapter One: Introduction. The first chapter contains the background of the study and also presents some of issues in education system in Iraq in general and Dhi-Qar specifically. It presents the need for this study as its problem statement. Furthermore,

the research objectives and research questions are covered, and also are the scope and significance.

Chapter Two: Literature Review. The second chapter comprises the literature review of this study. The studies on e-learning requirements and models are reviewed.

Chapter Three: Research Methodology. This chapter explains the methodology used in identifying, creating and verifying the functional requirements model for this research. This chapter also explained the sampling procedure and the validation of the proposed functional requirement model.

Chapter Four: Functional Requirements Identification. The fourth chapter addresses the identification of functional requirements of this study. The list of requirements and interview analysis are presented in this chapter. It results in the main features, which have been used in constructing the functional requirements model.

Chapter Five: The Functional Requirements Model. This chapter explains the construct of the functional requirements model by using Object-Oriented approach through UML diagrams.

Chapter Six: Verification and Validation. This chapter presents the verification and validation of the functional requirements model.

Chapter Seven: Conclusion. The conclusion and future work of this research are explained. In addition, the chapter includes the contribution of this research study and the limitation.

1.8 Summary of Chapter One

This chapter describes the background of this study. It gives the explanation and justification for user-centred requirement design for e-learning system for the secondary school, with Dhi-Qar province as the study group. This is further captured as the problem statement which is deconstructed into research objectives to be achieved by this study and the research questions to be answered. It discusses the scope of the study which focusses on secondary school students, functional requirements and with stakeholders' involvements in the users' validation stage. Plus structure of the thesis.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter presents a critical analysis of related previous works with critiques and summaries to serve as basis for the scholarly propositions made by this study. It presents an overview of Iraqi education sector with its historical background. Also, definitions, applications, and issues related to e-learning are discussed. More importantly, it covers literatures on the e-learning components and concepts, with respective merits and demerits. Furthermore, it examines the proposed requirements of e-learning in previous studies and e-learning models in view of establishing the necessity of conducting this research.

2.2 Requirements Modelling

Modelling raises the abstraction level to express the core essentials. This aids understanding the current reality of the existing system and domain features, and also fosters creativity in designing the new system (Unhelkar, 2005). Modelling is the most significant medium to elicit, define, analyze, validate, verify and communicate requirements. The graphical representation of modelling requirements helps to express, discuss and understand requirements among stakeholders with different backgrounds. Furthermore, it is cheaper and faster to incorporate changes in requirement models than later during implementation.

The requirements modeling plays a fundamental role in the Requirement Engineering (RE) process (Nuseibeh & Easterbrook, 2000) as it delivers a structured description of requirements that can be used throughout the requirements process and the rest of the software development processes. In addition, it is a main communication language between stakeholders with different backgrounds (Cheng & Atlee, 2007). Modelling notations provide an abstract level of requirements description by providing a vocabulary and structural rules for the problem components. Modelling helps to analyze the requirements and identify detailed requirements (Nuseibeh & Easterbrook, 2000).

The wide range of modelling techniques and notations found in the RE literature has been developed by academics and industry. They range from informal models for early requirements to more formal models for late requirements that can guide software developers (Cheng & Atlee, 2007). There are three types of modelling language: informal, semi-formal and formal (Davis, 1993). Informal language is based on natural language; it is easy to use and understand but results in ambiguity and inconsistency (Jiang, 2005). Semi-formal language has a formal syntax but informal semantics; the most widely used include the Unified Modelling Language (UML) (OMG, 2003). Formal language is typically based on a mathematical foundation such as logic or algebra; it has a well-defined formal syntax and semantics, such as Specification and Description Language (SDL) (ITU, 2002).

Hausmann (2002) used a semi-formal model to detect conflicts in functional requirements. A use-case diagram was used to analyze requirement specifications from different stakeholders. Use-cases are part of the UML. The use-case approach captures functional requirements through symbols consisting of objects and actions.

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Hausmann (2002) refers to the process of gathering and structuring information for the development of complex software system as often resulting in a set of overlapping and partly conflicting requirements models. Furthermore, Hausmann (2002) recommended that the requirements should be integrated into a consistent model.

Soares et al. (2011) suggested an approach to model and analyze a list of user requirements using the SysML Requirements diagram, the SysML Table, and the SysML Use Case diagram. The result shows using the SysML Requirements diagram is useful for developers to manage these changes of requirements. For instance, when a stakeholder asks for a change in one specific requirement, using the many relationship types that describe traceability between models helps to uncover possible impacts in other models. The relationships are also useful to aid in requirements prioritization in order to decide which requirements should be included in a certain system release. Another advantage of using the SysML Requirements diagram is to standardize the way of specifying requirements through a defined semantics. As a direct consequence, SysML allows the representation of requirements as model elements.

Saeedi (2014) suggested model called Quality Requirements Modelling Framework (QRMF) to address the shortfall of the existing Quality Requirements (QR) modelling approaches through integrating QR modelling with functional requirements (FR) modelling in a multi-perspective modelling framework. This model was developed offering a process-oriented approach to modelling QR from different views and at different phases of requirement. These models are brought together in a descriptive representation schema, which represents a logical structure to guide the construction

of requirement models comprehensively and with consistency. The aim of this study is to address the limitations of current QR modelling approaches to support the construction of comprehensive QR models based on Zachman framework; the framework is generic can be adopted in a wide range of requirement modelling techniques.

As shown, these studies employed different approaches to users' study and requirement gathering, and this suggest fairly different findings. Saeedi (2014) used a process-oriented approach to modelling QR, while Soares et al., (2011) employed the SysML Requirements diagram to represent the model. UML as system requirement and specification documentation is used by Hausmann (2002) and Afify, et al. (2011). This shows the strength of UML and also its applicability with this study. Therefore, this study uses Unified Modelling Language because it better suits the objective of this study which is functional requirement modelling. As mentioned by OMG (2003), semi-formal modelling is appropriate for constructing requirement model, as this study is focusing on.

2.3 Requirement Model for E-learning

The existing researches mostly focused on higher education institutions, and more specifically on the developed countries (Anderson, 2007; Thompson, 2007). Furthermore, the previous studies focused on requirement model in learning management system (LMS) and the documentation management rather than determined the requirement model for e-learning environment. However, Johari (2004), Harun (2010), Chumpia (2011), Alsaleh and Haron (2010) and Jalil et al. (2015) worked on requirement model for e-learning system with high education

institutions as their primary targets. Table 2.1 shows the review of previous studies regarding requirement model for e-learning.

Table 2. 1

Studies of Requirement Model for E-learning

No	Study	Characteristics
1	Johari, 2004	• This study created a requirement model for storing and retrieving IOS document: teaching and learning process at Universiti Utara Malaysia (UUM). • This study used UML diagrams to modelling the requirement. • HOORA analysis tool (HAT) was used to validate the requirement model produced in this study.
2	Harun, 2010	• This study proposed a generic requirement model for e-LMS. • This study used Story Card technique to requirements collection. • The collected requirements for this study represented though UML diagrams.
3	Chumpia, 2011	• This study focused on the development of a requirement model of social network learning site especially in e-Forum, Chat Room and Weblog for Hatyia Technical College (HTC). • This study used UML diagrams to represent the requirement model • The evaluation has been handling for the requirement model by using interview technique.

4	Alsaleh & Haron, 2015	• This study explored and described the most important functional requirements (FR) and non-functional requirements (NFR) of knowledge sharing system (KSS) used at a Malaysian public academic institution. • The strategy used is a single case study. • Data were collected through semi-structured interviews. • The study comprehensive analysis and findings would expand an area of requirement model being used for knowledge sharing in academic institutions
5	Jalil, et al., 2015	• This study presented a review on the MOBIlearn task model and its contributing factors in an attempt to capture appropriate requirements by generalizing the current state of discover common similarities from previous research publications. • This study suggested a set of pedagogical requirements identified from the literature by categorizing them based on the task model factors

As shown in Table 2.1 the study conducted by Jalil, *et al*. (2015) highlighted only the pedagogical requirements. In addition, Alsaleh and Haron (2015) concentrated on some functional requirements related to KSS such as Rich Site Summary (RSS), consultation services, expert information interconnections among disciplines, search engine and the last functional requirement was the accessibility. The first focus for non-functional requirement is the categorization system content (including easy navigate, browse, search the system content) and the second one is the interactivity, while the third NFR is the system reliability. The study conducted by Alsaleh and

Haron (2015) did not cover all the e-learning requirements, but merely concentrated on the pedagogical dimension and only highlighted the design aspect.

While, Chumpai (2011) shed light on the communication requirements for instance, chat room and forum. Unfortunately, Chumpai ignore other important requirements for the educational process such as evaluation and share repository requirements. Similarity, the study conducted by Harun (2010) focused on the communication requirements such as, announcements and forum. Harun also used some evaluation requirements (for instance assignment and quiz) rather than others requirements.

On the other hand, Johari (2004) highlighted the management requirements and ignore other essential requirements that enhance the performance of the e-learning and achieve the stakeholders' needs.

Overall, all the previous studies highlighted some of the important requirements (whether functional or non-functional). In addition, these studies did not exploit all current available requirements for open sources education platforms, such as MOODLE. Therefore, the current study strives to harness this platform to identify the suitable requirements for secondary schools in Iraq.

2.4 Functional Requirements and Unified Modeling Language (UML)

Functional requirements are essentially connected with the specific functions and tasks that the system being developed must support. Meanwhile, non-functional requirements are constraints on the system in general, such as standards, timing constraints, and quality constraints (Glinz, 2007). Functional requirements address the behaviour of the system which is purposively created for, ranging from tasks execution, interface requirements, and database requirements (Zhou, 2004). As earlier

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mentioned, there are various approaches in gathering systems' functional requirements. After due user-centred requirement analysis stage, the next stage is requirement design, and this is the essence of UML as a modelling language. The UML primarily supports the functional requirements of the system, meaning the services that the system should provide to its end users (Booch, 2005). In the requirements modelling phase, a use case model is developed in which the functional requirements of the system are defined in terms of actors and use cases (Gomaa, 2001).

UML is the standard language for specifying, visualizing, constructing, and documenting all the artifacts of a software system (Quatrani & Evangelist, 2003). Dennis, et al. (2002) defines UML as a standard set diagramming techniques that provides a graphical representation that able to model any system development project from analysis until implementation. UML is a combination of techniques from data modeling (entity relationship diagrams), business modeling (work flows), object modeling, and component modeling. In late 1980, there were many software modeling techniques used and it create many problems in the software development industry due to no standardized technique and notation. In 1995, Grady el at., (2002) had team up together and came up with an object oriented modeling technique known as Unified Modeling Language. Mark (2000) has predicted that UML will become a dominance tool in object oriented modeling. Now, UML has been recognized as a standard technique for object oriented modeling in software development industries. It communicates better to developers using object-oriented programming language, and it is therefore chosen by this study.

2.5 Learning Preferences and E- Learning Technologies

Learning is a process of knowledge acquisition which is created through experience transformation, or reading of various kinds of representations (Arthurs, 2007). The common perceptions about learning are: (1) it is an increase in quantitative knowledge or a process of acquiring information, (2) memorisation or information storage that is reproducible; (3) acquiring skills, facts and methods that are retainable and employed when necessary; (4) abstracting meaning; (5) interpreting and understanding reality in a diverse way. In this age, learning has been accelerated within the digital spaces (Pirie, 2011).

Although technology is evolving, human still maintains the ability to retain cognition, preference, and experience. Different learners have diverse cognitive processes, preferences of style of learning, and precedent experiences being applied when learning (Honey & Mumford, 1992; Kolb, 2014; Riding, 1996; Wall, Smit, Betts & Ahmed, 2005). In that regard, the learning style of a student will influence the way in which information is being processed during learning and thinking, affecting his/her learning effectiveness and efficiency accordingly (Riding, 1996). Also, the outcome of learning is affected by the learning preferences, in which Sadler-Smith (1996) classified into three dimensions:

- Dependent learners – they have preference for instructor-directed and highly structured programmes together with explicit assignments and assessment.

- Collaborative learners – they are discussion-oriented and favour group projects, collaborative assignments and social interaction;

- Autonomous learners – they prefer exercising an influence on the learning programmes content and structure within which the instructor is a resource.

The different styles of learning and learners have defied any unified type of e-learning technology. E-learning systems have become more successful due to the advancement in technology (Futurelab, et al., 2004). E-learning is a learning that is made easier using digital tools that aid students-teacher interaction with learning topics/subjects (Ouma, Awuor & Kyambo, 2013; Xanthidis, Wali, & Nikolaidis, 2013). In general, it is a web-based system that provides access to learning content (Titthasiri, 2013), and aid virtual learning environments (Behar, 2011). Figure 2.1 illustrates the concept and scope of e-learning.
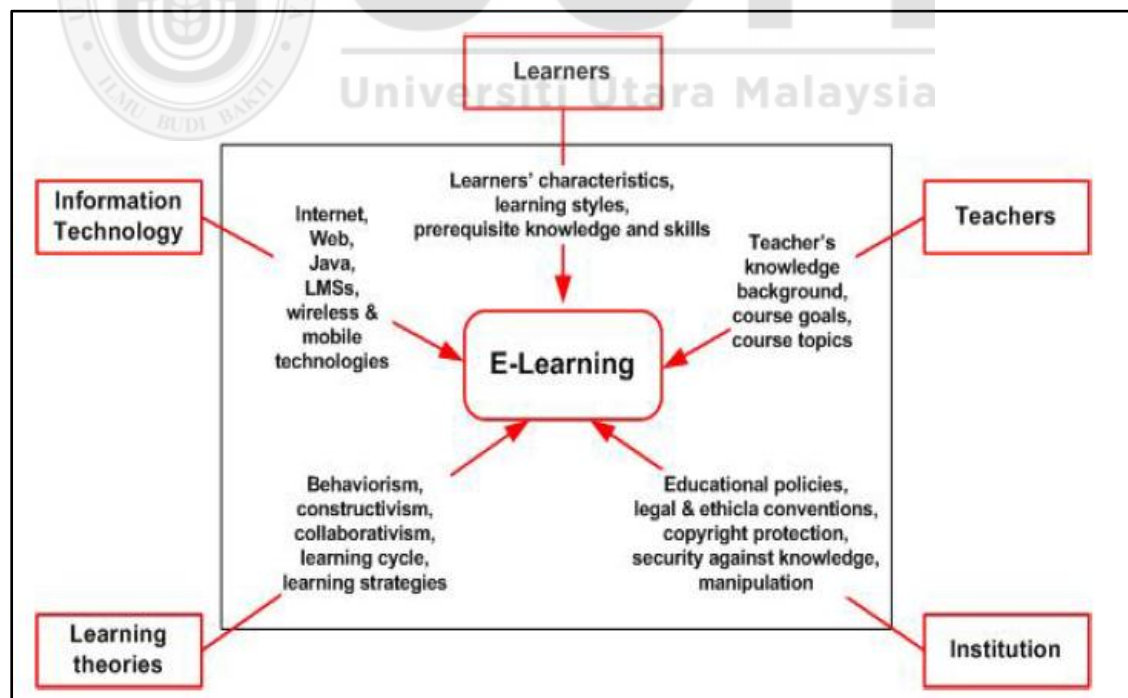
Figure 2. 1 System Components of E-learning (Hadjerrouit, 2007)

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E-learning systems have distinguishing features such as (1) they consist of programmable sites which suit different user groups; (2) each site has a complete set of customizable features and links; (3) they have editable contents and structures; (4) they have the ability to provide feedback to lecturers/students in a confidential manner; (5) they consists of online forum and discussion boards; (6) they provide notice boards, and; (7) users have to login to enter; and (8) they are gateways to important educational links (Behar, 2011, Roy, 2010, Mwasha & Pima, 2010). The tremendous evolution in technology has impacted education greatly (Ho, Hung & Chen, 2013). As a consequence, e-learning has become a promising substitute for traditional classroom learning (Goyal, 2012; Zhang, et al., 2004). However, this study believes that it is not to replace the traditional learning, but rather to complement it.

E-learning allows the education institutions to document almost all students' information electronically. Most significantly, such information can be shared with authorized users simply, records can be easily searched, and reports can be generated effortlessly (Brumbulli, Topçiu & Dalaçi, 2008). By considering such advantages, Voogt and Knezek (2008) affirmed e-learning to be of strategic importance and is a method that is effective which should be incorporated into schools' learning. Besides the e-learning flexibility, many literatures showed that e-learning improves the learning quality, prepares students for a knowledge-based society, provides lifelong learning opportunities, and supports skills of critical thinking (Appana, 2008; Cavanaugh, 2001) It also aids fast-paced communication of problem solving methods and interaction between the learner and the teacher (Johnston, Killion, & Oomen, 2005; Swan, 2001). With such advantages, this study believes that e-learning should be complementing the school system, and that the deteriorating status of Iraqi

secondary school education has a bright chance for improvement if appropriate e-learning technology is designed and adopted.

Accordingly, Dorado, Hernandez, Sani, Griffin, and Barnette (2009) recommended that educational institutions have to offer classroom instructions through an online environment. Lessen and Sorensen (2006), Coppola, Hiltz, and Roxanne (2002), and Revels and Ciampa (2012) discovered that e-learning offers advantages to both school and students, and can overcome the many constraints that can preclude students from attending traditional classes. In addition, because of e-learning or online learning flexibility, the majority of schools are able to reach out to a large population of students, thereby increasing their enrolment (Zhang, 2004). In any situation, institutions could design the online learning base on three classifications by Ally (2004):

- contact learning supported by the net
- multiform learning in the net
- self-studying in the net

Kanninen (2008) explained that part of the courses can be found in the net in the first class, such as the learning material delivery and the lectures are given as contact learning. The second class known as multiform learning refers to the use of multiple options in learning such as forum discussions, help from tutors and learning objects (e-books, videos, et cetera). Meanwhile the third class means that the learner studies alone in the net or in a virtual learning environment without external help. In recent years, the Internet and IT have been exponentially diversified (Hsieh, Lee & Su, 2013). When almost all transactions are possibly made virtual, environment of e-learning can be employed with either a content approach (providing content itself or

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access to available content) or communication approach (providing communication facilities or access thereto) (Zhang, 2004). The mind map in Figure 2.2, illustrates the approaches in electronic environments (Brown, 2003; 2005).
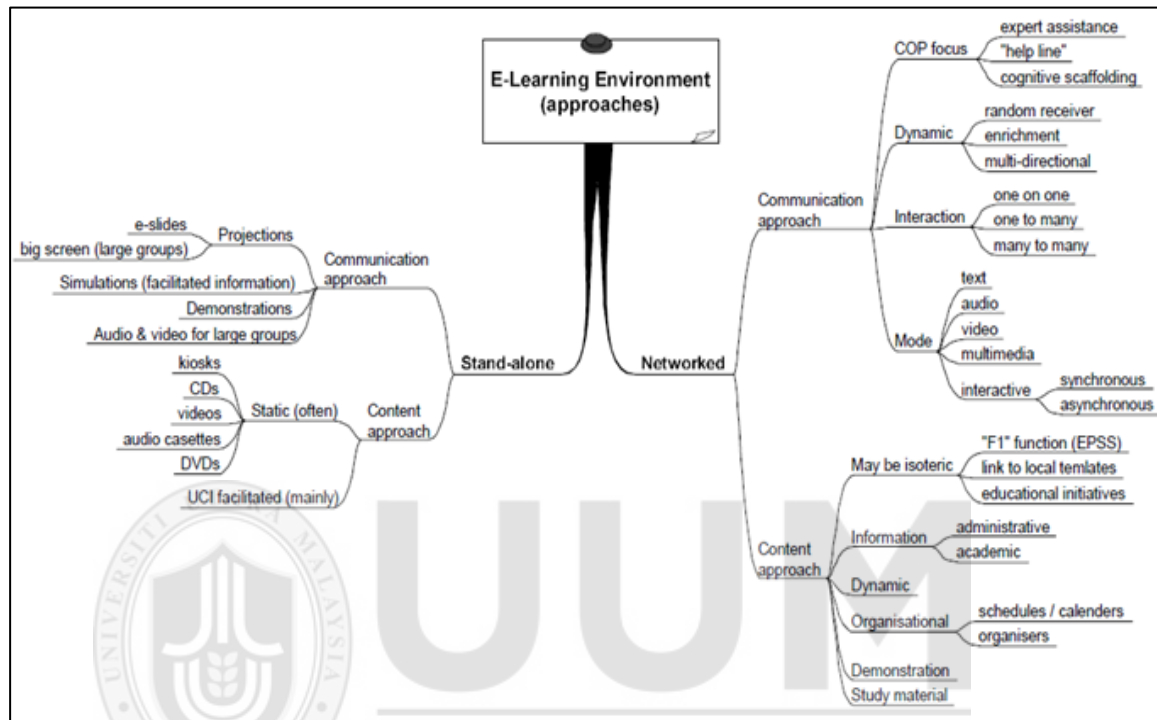
Figure 2. 2 Approaches in E-learning Environments (Brown, 2003; 2005)

Based on Brown, within any e-learning environment, technology can be used with either a content approach (providing content itself or access to available content) or communication approach (providing communication facilities or access thereto), as highlighted in Figure 2.2. It is also important to note that technologies can either be networked or stand-alone. Nevertheless, the way in which knowledge is being delivered are being moulded by Internet and multimedia technologies and that e-learning is becoming a real complementary to traditional classroom learning (Zhang et al., 2004; Beldagli & Adiguzel, 2010).

2.5.1 Strengths and Weaknesses of Online Learning System

ICT has been touted as potentially powerful enabling tools for educational change and reform. In fact, over the past decades, a lot of the productivity gains in the developed world economies to a great extent can be related with the impact of ICT (UNESCO, 2010). ICT plays a part in addressing access and issues of equity. It is a powerful tool, with the potentials of transforming the educational opportunities and many students' life chances, as well as those excluded by their special circumstances and needs for special education. Discriminatory communication patterns are also reduced founded on physical and social cues including gender, race, socioeconomic status, and physical features (Elizabeth, 2012).

In e-learning, space commitment is irrelevant and students can study freely when they have time (Kanninen, 2008). This enables students to make use of their time on class projects on their own terms, without having to be physically present. Student can communicate among themselves and with their instructors through bulletin boards, chat rooms, electronic mail, and white boards, at any time (Koh & Hill, 2009). It also helps students to connect with group members anywhere and anytime (Alsaadat, 2009). This really saves cost on both student's and the educational providers' sides (Mackintosh, 2005; Beldagli & Adiguzel, 2010; Elizabeth, 2012; Kushnir, Manzhula & Valko, 2013).

In terms of pedagogical ability, students can develop critical thinking skills and reflection in an online learning environment. In this regard, Conrad and Donaldson (2011) argued that in an online environment, collaborative activities involve sharing of student idea and other forms of interaction which trigger deeper content processing. In fact, group learning works in online learning environments and it promotes

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transformative learning. In it, students develop their critical thinking skills and reflect on their learning (Palloff & Pratt, 2010). The asynchronous environment also permits students to read messages, reflect, and carefully post their ideas (Petrides, 2002; Vonderwell, 2003). Consequentially, students may receive more thoughtful and in-depth comments from their mates for complementing those occurring in the synchronous context.

Besides the benefits of online classes, Song, Singleton, Hill and Koh (2004) and Vonderwell (2003) stated its few weaknesses. One of which is lack of community sense. Participants of online learning shows lack of connection with school and other learners, and this can have a negative impact on the overall class experience and group works. It is however said that this can also be experienced in traditional classroom setting if it is not properly managed (Koh & Hill, 2009). However, it is obvious that the advantages of e-learning environment trump the disadvantages, and it remains the best alternative in the face of the problem of increasing drop-out students. Table 2.2 shows the summary of the strengths and weaknesses of online learning

Table 2. 2

Strengths and Weaknesses of Online Learning based on the Previous Studies

Studies	Strengths	Weaknesses	Description
Murphy and Collins (1997)	Convenience-Participants indicated they can read and respond to comments in online education at times convenient to them.		This study determined that the students recognized a need to use their communication conventions and protocols to communicate clearly and minimize misunderstandings in their online transactions with others.

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Chizmar and Walbert (1999)	Thoughtful and responsible comments. Flexibility		This study described the preparation and execution of a statistics course using Web technologies. Offered two viable models—a classroom / lab approach and an economic model manipulating approach using Excel—for classroom delivery of instruction uses the Internet.
Poole (2000).	Convenience- students participated in online discussions at times most convenient to them.		This study examined the nature of student participation in one such course. Access to course materials varied widely from student to student but reflected an overall commitment to learning.
Hara and Kling (2001)		Delay in responses – Students felt lack of immediacy in getting responses back from the instructor	This study presented a qualitative case study of a Web-based distance education course at a major U.S. university. The case data reveal a taboo topic: students' persistent frustrations in Web-based distance education. First, this study analyzed why these negative phenomena are not found in the literature. Second, discussed whether students' frustrations inhibit their educational opportunities.
Petrides (2002)	Flexibility Thoughtful and responsible comments	Delay in responses Skeptic with level of Expertise	This study examined the ways in which a higher education class-room that used Web-based technology as a supplement to a regularly scheduled class-room based course, addressed issues of learning and learning- centered education.
Schrum (2002)	Flexibility		This study reviewed issues regarding distance education, including the value, success, and challenges; discusses current projects that focus on curriculum and use distance learning technologies, including

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			videoconferencing and Web-based learning; and considers how to start using distance education.
Song, Singleton, Hill and Koh (2004)	Convenience Design of the course Comfort with technologies Time management	Delay in responses Technical problems Lack of community Difficulties in understanding the goals of the course	The purpose of this study was to gain insights into learners' perceptions of online learning. Seventy-six (76) graduate students were surveyed to identify helpful components and perceived challenges based on their online learning experiences. Results of the study indicated that most learners agreed that course design, learner motivation, time management, and comfortableness with online technologies impact the success of an online learning experience
Brown and Voltz (2005)	Design of the course		This study highlighted the elements of effective design that consider assist in the development of high quality materials in a cost efficient way. It introduced six elements of design (Activity, Scenario, Feedback, Delivery, Context and Influence) and discussed each in some detail.
Serce and Yildirim (2006)		Lack of diversity of Tools.	This study deals with the issue of semantic interoperability of educational contents on the Web by considering the integration of learning standards, Semantic Web, and adaptive technologies to meet the requirements of learners. Additionally, a way how to integrate several original approaches was proposed
Gilbert, Morton and		The usability and robustness	The study draws on in-depth qualitative. Comments from student evaluation of an

Rowley (2007).		of the delivery platform is not adequate and can be very slow	e-learning module on an MSc in Information Technologies and Management, to develop a picture of their perspective on the experience.
Vonderwell, Liang and Alderman (2007)	Thoughtful and responsible comments.	Delay in responses Lack of community or feelings of isolation	This study explored asynchronous online discussions, assessment processes, and the meaning students derived from their experiences in five online graduate courses at the Colleges of Education of two Midwestern higher education institutions. The findings suggest that asynchronous online discussions facilitate a multidimensional process of assessment demonstrated in the aspects of structure, self-regulatory activities, learner autonomy, learning community and student writing skills.

2.5.2 E-learning at School and E-learning at University

With the advancement of technology and the changes in technological resources, there is a need to integrate new resources into these models for improvements and better fitting into the needs of the high-school students, and also as encouragement to using online courses offered to them (Badri, et al., 2014). Moreover, according to Taha (2014) e-learning has increasingly been integrated into educational institutions. It has transformed the learning and teaching processes, created new opportunities for secondary school students and has had an impact on the development of a student's personality. In addition, students are equipped with the basic skills to deal with ICT during their basic education and because they are exposed to different forms of ICT in their everyday life interactions, the "Net Generation" or "Digital Natives" are highly

motivated to learn more about ICT and improve their skills and competencies to deal with technology and its various forms.

However, there are few models that highlighted intention to use e-learning among high-school students. Taha (2014) asserted that, much of the research on the implementation of E-learning has largely focused on higher education rather than the school sector, even though E-learning implementation in the school sector faces many challenges and obstacles such as ICT infrastructure, school support human capacity teachers attitudes and learners readiness (Redempta and Elizabeth, 2012; Mulwa and Kyalo, 2013). In generally, modern technologies play a very important role in secondary school students' lives through the transition from studying information and communications technology as a separate subject to the introduction and integration of E-learning within all secondary schools and all subjects.

Higher education has numerous ways of benefitting from e-learning. Students and staff can use e-learning systems for their everyday activities like information search, retrieval, through search engines and transaction services. It can deliver support the learning experience with high quality infrastructure, and content development. Furthermore, e-learning in higher education opens up learning opportunities and the opportunity to use learning tools. Laurillard (2004) argued "it is important because e-learning can make a significant difference to how learners learn, how quickly they master a skill, how easy it is to study and, equally important, how much they enjoy learning". The characteristics of students have changed in the last few years; as they have gained more experience, a majority of them have enough skills to use the new technology and are more effective with it. University students now have web access to

lecture notes, assignments, audio lectures and selected digital resources in order to develop and support their study (Ojukwu, 2006). There are personalised web environments, such as web portals, in which discussion forums with class or group mates are fostered. This new kind of access gives students better flexibility in studying and enhances learning experiences.

Furthermore, the literature referred that, use of the Internet is less popular among younger children. Older students, such as college students tend to spend more time on the Internet, and to engage in more types of online activities such as, watching video clips, chatting on Instant Message, or browsing news items than their younger counterparts in developed countries (Lenhart, et al. 2007; Rideout et al., 2010). Moreover, Livingstone, et al. (2010) pointed out that, online communication activities (for instance, visiting social network sites and chatting on Instant Message) have also become more obviously popular among the adolescents. Based on this discussion, the students in secondary school do not have more IT skill and previous experience with new technologies. In the same time, the institutions face several ICT infrastructures, school support human capacity teachers' attitudes and learners' readiness. In turn, the college students have good experience with using ICT, because they working with online education (such as online portal) constantly.

2.5.3   The Previews Studies of E-learning Requirements

There are many studies focusing on the requirements or tools for online learning system, in which these requirements or tools can help this study to create a requirement model. In the first study, Uţă (2006) listed the following requirements for an electronic learning.

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1. **Learning Community Participation:**

   - Each course and class has real time chat room and structured offline forums, giving interactive learning via ideas shearing and discussions.

   - Public and learning community-related discussion forums can also be created by the administrator.

2. **Record Tracking**

   - Learners' course learning time is very vital and has to be documented. It includes total time of learning, learning time of single course, learning time of single course chapter, and time of testing.

   - Learners' learning progress has to be recorded, which includes summary of learning, learning for all courses and progress of learning for a single course.

   - Learner able to carry out inspection on their own learning record and results of test while managers and teachers as well can query learning results and records of learners.

3. **Creation of Course**

   - Process of Intuitive creation permits the designers' content to easily build course materials via a web interface by following the system instructions.

   - Provision the contents import and export that adhere to such standards of e-Learning.

   - Contents of course can be available anytime for the learners' view, or hidden for future usage which may also be shared with other instructional designers.

   - Provision many file formats similar MS Office, Images, HTML, Adobe PDF, Video and Audio, and Macromedia Flash.

4. Management of Course

- The teacher able to set class time, lists of eligible learner, and max number to enrolment for a course.

- Online courses can be created or manage by the instructor, or providing support in the classroom management.

- The system of smart approval that will automatically check learner id's and complete enrolments when learners enrol in a course must be available. Relevant directors will be automatically notified in case require manager approval

- Learners' management of different classes and creation of multiple classes are allowed in class management procedure.

- The function of the pre-requisite courses is requiring learners to complete courses certain course firstly. Must implying courses before being allowed to enrol in the respective courses, when courses were set as pre-requisites of other courses.

- Provide a waiting list function when reach the max number to enrolment of a course, the system placed interested students on a waiting list. If anyone withdraws, the system substitutes him or her with the next available person on the waiting list.

- Online testing mechanisms can be integrated with the classroom courses, in view of creating blended learning structure.

- The functions of classroom course management are attendance management, leave application, external training management, and results management in assisting enterprises in classroom and online training systems' integration.

5. **Curriculum Management**

- The instructor creates online curriculum online with possible inclusion of the number of courses, and also sets the eligible learner list with the maximum number to be enrolled according to the curriculum.

- Intelligent approval system is applied. It checks learner ids automatically. It also completes the learners' enrolment of a course. Therefore, relevant managers will be informed through an automation means provided the approval of manager is required for the curriculum enrolment in such curriculum.

- Support a waiting list function.

- A pre-requisite curriculum function.

6. **Results Evaluation**

- The instructor designs tests or surveys based on the available requirements.

- There must be a question bank function. This can be created by the instructors, and can often contain questions of dissimilar difficulty levels. Based on settings, tests can be created with due consideration of questions of different difficulty level. In this case, fixed or random question selections are permitted, with question types include: Yes/No; written answer questions and multiple choices. Pictures and multimedia files can also be inserted into the question to enrich the question contents.

- Different courses can use the question bank repeatedly, shared between the instructors.

- The teacher may add many tests to a course. The test contents may be automatically adjusted according to different difficulty levels. The testing time

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and maximum re-test attempts can also be set and multiple choice questions can be automatically graded by the system while written answer questions can be graded online by the instructors who are notified by email.

7. Reports

- Reports are generated according to learning record or evaluation results.

- Unique training analysis reports can be customised by the users through the extraction of data from the database.

- Reports can be designed by the users according to unique requirements. This will provide improved visual analysis of learning results

- System can automatically send notification email to users when course publication, course expiration, course approval, test results and other events occur.

Those features are factors enabling e-learning to be more effective than the traditional learning. This study agrees that they should be incorporated in e-learning systems to support all e-learning necessities. Buzzetto-More (2007) further elaborated those features, which are summarized in Table 2.3.

Table 2. 3

Tools in Online Learning System (Buzzetto-More, 2007)

Category	Sub-category	Special tools	Functions
		Activity tracking	Monitor how often students access the course, areas they are accessing, and how they are progressing through the course material

Instructor Tools		Assessment/ Assignment manager	Create, distribute, and evaluate quizzes, surveys e-portfolios, exams, assignments. and rubrics
		Grade book	Manage (view, enter or override) student grades that may share with students
		Group manager	Create and manage class groups for discussion boards, and chats
		Interactive student view	Check students' work—review content, submit assignments, and lake quizzes
		My files	Store and access students' private files
		Quick start set-up page	Set up courses and quickly add other tools
Student Tools		Assessments and Assignments	Submission of and evaluation received from quizzes, self-tests, exams, assignments, and portfolios.
		My files	Store and access students' private files
		My grades	View students' grades
		My progress	View parts of course students have accessed

		Notes	Students create their own annotations of documents and image posted within the course
		Personalized content	Content and activities selected and released to students (individuals or groups) to suit their individual learning needs
		Sign-up sheet	Students join their own class groups
Interaction tools	Presentation	Syllabus	Convey information about the organization of the course, expectations, and other course related material
		Content page	Digital course material provided by the instructor for students to view
		Content folder	Collection of course-related documents including lecture notes, multimedia presentations, assignments, quizzes
		Learning module	Organized the content of a course into contents table that students use to navigate via the course
		Media library	Multimedia collection of terms, definitions, or images related to specific course.

		Web link	Links to online resources and made available to students by the instructor
	Communication	Announcements	Create and send announcements to everyone in the course
		Calendar	Share Important Dates For Events, Deadlines, Assignments, Etc.
		Chat and white-board	Real-time conversation; allows class discussions, tutorials, etc.
		Discussions	Organize public and private whole- or small-group discussions around specific topics.
		Mail	Send and receive private e-mail in the course
		Who's online	Link to online resources selected and made available to students by the instructor
	Assessment Portfolio	Individual assignment	Create and distribute course assignments, download, evaluate, and grade completed work
		Group assignment	Make and allocate course assignment to groups of students; download, evaluate, and grade completed work.
		Self-test	Students can test their knowledge by create multiple-choices tests

		Survey	Collected ungraded, anonymous information from students that provide instructors with feedback and statistics about data
		Quiz	Offers a variety of testing option

More recently, there are two other studies which classified the requirements and the tools for e-learning, these are Al-Ajlan (2012) and Lotfi, *et al.* (2013). Where, Lotfi *et al.* (2013) classified the tools into four categories include: communication tools, shared repository tools, group learning tools, and assessment tools. Figure 2.3 depicts the simplified illustration of e-learning's requirements or tools based on Lotfi *et al.*
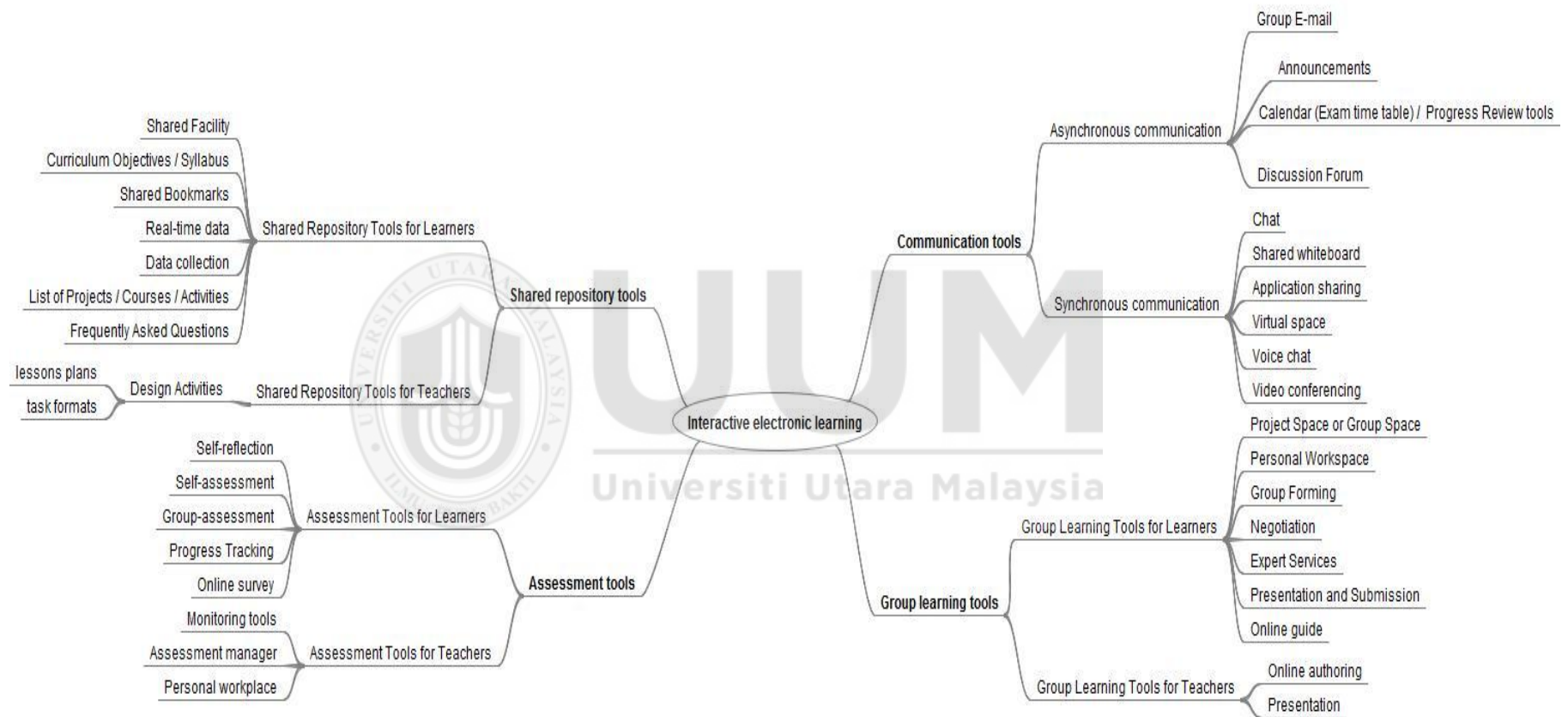
Figure 2.3 Requirements or Tools based on the Lotif et al (2013)

Al-Ajlan (2012) conducted a study on e-learning tools and highlighted the different of the requirements or tools for online learning. This is presented below:

Table 2. 4

E-learning Tools based on the Al-Ajlan (2012)

LEARNER TOOLS	SUPPORT TOOLS	TECHNICAL SPECIFICATION
1. Communication Tools • Discussion forums • File exchange/ Internal email • Online journal/notes • Real time chat • Video services/ white board	**1. Administration Tools** • Authentication • Course authorization • Registration integration • Hosted services	**1. Hardware/ Software** • Client browser request • Database request • Server software • Unix server • Windows server
2. Productivity Tools • Book marks • Orientation/ help • Searching within course • Calendar/ progress review • Work offline synchronize	**2. Course Delivery Tools** • Course management • Instructor helpdesk • Online grading tools • Student tracking • Automated testing and scoring	**2. Pricing/ Licensing** • Company profile • Costs • Open source • Optional extras • Software version
3. Student involvement • Group work • Self-assessment • Student community building • Student portfolios	**3. Curriculum Design** • Accessibility compliance • Course templates • Curriculum management • Customized look and feel • Instructional standards compliance • Instructional design tools • Content sharing/ reuse	

This provides the need for functional requirement model which will attend to the observed limitations of previous studies and as well be validated by the stakeholders in the target community in Iraq. Table 2.5 summarizes the limitations for each studies.

Table 2. 5

Limitations of the previous studies

Module	Components	Uţă (2006)	Buzzetto-More (2007)	Al-Ajlan (2012)	Lotif et al (2013)
				Studies	
Communication & Community participation	Real time chat room	√	√	√	√
	Course community discussion forum	√	√	√	√
	Video conferencing			√	√
	Calendar (share Important Dates For Events)		√	√	√
	Sending and receiving e-mail in the course	√	√	√	√
	Announcements		√		√
	Share white board		√	√	√
	Who's online		√		
	Application sharing				√
Manage Course	Create course	√	√	√	
	Update course	√		√	
Manage Curriculum	Create curriculum	√		√	
	Upload and download material	√	√	√	√
	Set list of eligible learners	√		√	
	Set maximum participant of a class	√			
Evaluate Learners	Activity tracking	√	√	√	√
	Self-reflection		√	√	√
	Project progress				√
	Online survey	√	√	√	√
	Grade book	√	√		
	Assignment and assessment		√	√	
	Quiz	√	√	√	
Support Learning	Project space			√	√
	Personal work space		√	√	√
	Expert services				√

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	Online guides/ help			√	√
Shared Repository	Search facility			√	√
	Shared bookmarks			√	√
	Content folder /Data collection	√	√	√	
	Syllabus /Lessons plans		√		√
	Media library	√	√		
	Web link		√		
	Frequently Asked Questions				√
Total	34	15	21	22	21

In conclude, this study seeks to synthesize the previous requirements, to become more suitable for the secondary school in Iraq by presenting a broad array of functional requirements that are exempted for the individual studies. Therefore, the study strives to include all the important requirements in proposed system to meet the stakeholders' needs and enhance interaction among them. These stakeholders are the parents, teachers, school managers and the students.

2.6 E-learning Conceptual Models

E-learning conceptual models provide general guide and theoretical basis for e-learning system development. Studies have been contextualizing these conceptual models to suit their specifics and peculiarities in designing e-learning systems (Imadildayeva & Zhaidarbek, 2010). Therefore, an understanding of an e-learning conceptual model is required (Herrington & Oliver, 2000). An e-learning model provides overall guidance and support to any learning type and teaching style in any classroom or e-learning environment (Kuchi et al., 2003). According to Khan (1997) and Oliver (2005), the e-learning models and components exist with the focus on describing essential elements to

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influence e-learning outcomes with other factors in order to create a meaningful learning environment. Moreover, this study analyses the following extant models, i.e. Khan Model, Salmon model, ADDIE model, and DIY E-learning model, to identify contributing pedagogic principles, communication and technology dimensions.

2.6.1 Khan's Model

Khan (2005) states that several factors help to create a meaningful environment and that different dimension of the environment must be explored to accommodate diverse learning styles and various learning needs. The independence of open learning in terms of device (or hardware or platform), distance (anyplace), and time (anytime) is achieved through the web (Khan, 1997). With this, e-learning could enable everyone to venture into learning. Figure 2.4 illustrates the concept developed by Khan (1997).
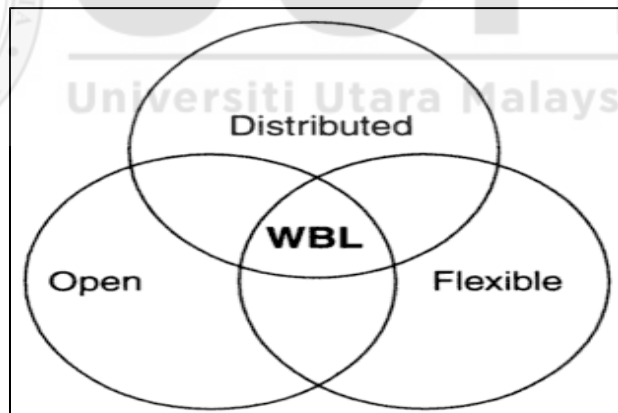
Figure 2. 4. Open, Flexible, and Distributed Web-based Learning (Khan, 2010)

The design and format of web-based flexible, open, and distributed learning on the Web can be fundamentally different from traditional classroom instruction. Traditional classrooms have space boundary and addresses learning like a closed system within the confines of a given classroom, school, textbook and field trip.

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Khan (2010) developed an e-learning framework. Its eight dimensions are: interface design, evaluation, management, institutional, pedagogical, and technological, resource support, and ethical as illustratively conceptualized in Figure 2.5. Each dimension possesses sub-dimensions with focus on particular e-learning environment. List of factors that can be considered for the creation of successful experience for diverse learners are presented in the Khan's framework (Khan, 2010). This is presented in Figure 2.5 and Table 2.6.
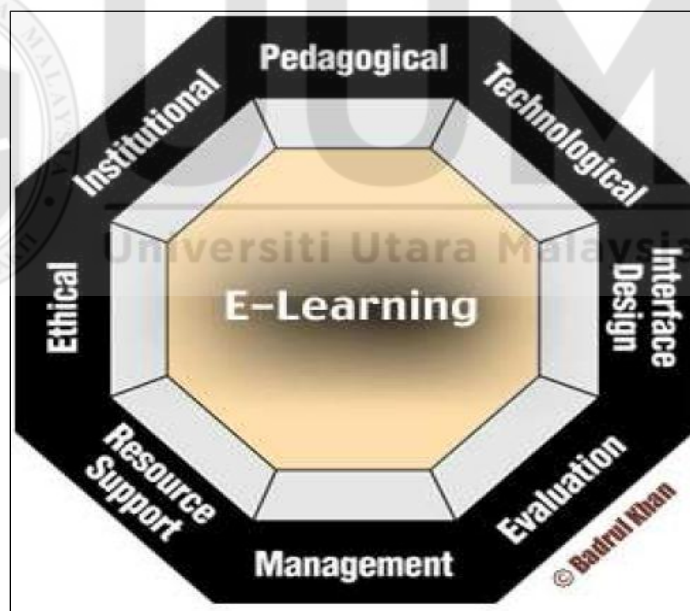
Figure 2. 5. Khan's Model (Khan, 2010)

Table 2. 6

Dimensions and Sub-dimensions of the Web-based Learning Model (Khan, 2010)

```
1. Pedagogical                          5. Management
   1.1 Goals/Objectives                    5.1 Maintenance of learning environment
   1.2 Design approach                     5.2 Distribution of information
   1.3 Organization
   1.4 Methods and strategies           6. Resource Support
   1.5 Medium                              6.1 Online support
                                           6.2 Resources
2. Technological
   2.1 Infrastructure planning          7. Ethical
   2.2 Hardware                            7.1 Social and cultural diversity
   2.3 Software                            7.2 Geographical diversity
                                           7.3 Learner diversity
3. Interface Design                        7.4 Information accessibility
   3.1 Page and site design               7.5 Etiquette
   3.2 Content design                      7.6 Legal issues
   3.3 Navigation
   3.4 Usability testing                8. Institutional
                                           8.1 Academic affairs
4. Evaluation                              8.2 Student services
   4.1 Assessment of learners
   4.2 Evaluation of instruction and learning
       environment
```

1. Teaching and learning are the pedagogical dimensions of e-learning model. They address the goals/objectives, organisation, methods and strategies, design approach, and instructional media of Web-based learning environments.

2. Issues of technological infrastructure in e-learning environments are examined by the technological dimension of the e-learning model. Infrastructure planning, hardware, and software are addressed in the said dimension.

3. The e-learning program interface design is the overall look and feel of the programs. It encompasses page and site design, content design, navigation, and usability testing.

4. Evaluating e-learning includes assessing both learners and evaluation of the instruction, and also learning environment.

5. Maintenance of learning environment and distribution of information are e-learning management approaches.

6. The resource support, as a dimension of the e-learning model is for the examination of the required online support and resources for meaningful learning environments.

7. The ethical considerations of e-learning relate to social and political influence, cultural diversity, bias, geographical diversity, learner diversity, information accessibility, etiquette, and the legal issues.

8. The institutional dimension is concerned with issues of administrative affairs, academic affairs and student services related to e-learning.

Khan's model focuses on analysis and investigation using components of the eight dimensional model, resources and technology in conjunction with instructional design principles. In addition, the flexibility of Khan's model allows for its application to any scope of learning environment as long as proper planning is carried out and adequate instruction methodologies are selected (Khan, 2005). As well as, Khan (2010) believes that this e-learning model is effective as it focuses on learner support and adheres to a structured design process where emphasis is on analysis, design, evaluation, and implementation. In the same context, Khan's e-learning model makes provision for learning irrespective of the scope of the learning requirements. Actually, Khan's (2010) e-learning model is more user-friendly were responses, feedbacks and enhanced requirements are essential to improve learning, design and the effectiveness of e-learning systems. In addition Khan's model provides a competent guiding mechanism for the development of the e-learning system. Moreover, it provides a useful approach to clarifying the complexities of web-based learning environment, appropriate to apply to

web-based instruction and training of any scope. This study believes that Khan's model can be used to ensure that no important factor is omitted from the design of e-learning system.

2.6.2 Salmon's Model

This model believes that learning is when the energy and impetus are transformed, mostly in leaps and bounds, not necessarily a smooth path, as learners change from the unknown to known (Dirckinck-Holmfeld, 2002). In fact, the 'interactivity bar' running along the right of the flight of steps suggests the intensity of interactivity that you can expect between the participants at each stage. Where, at stage one, they interact only with one or two others. After stage two, the numbers of others with whom they interact, and the frequency, gradually increase, although stage five often results in a return to more individual pursuits. Therefore, the nature of the interaction and the kind of information and messages that participants exchange also change through the steps and stages of the model. Actually, the chief benefit of using the model to design a course with online networking and group work is that you know how participants are likely to exploit the system at each stage, and you can avoid common pitfalls. As well as, the results should be higher participation rates and increased student satisfaction. The model is illustrated in Figure 2.6.
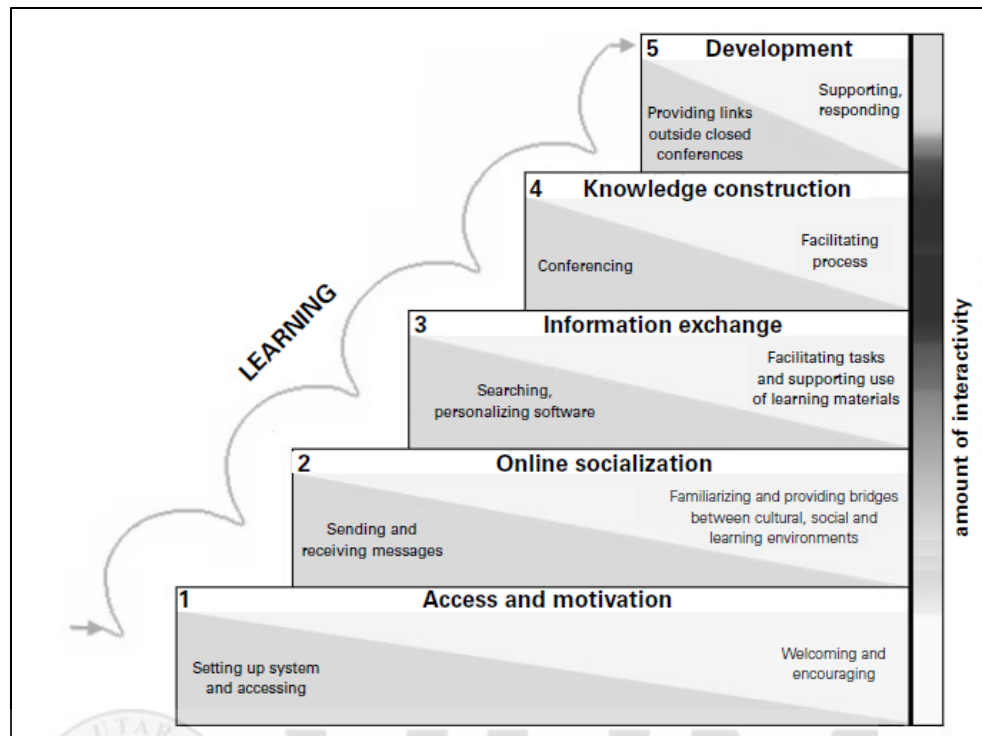
Figure 2. 6. Salmon's Model for Teaching and Learning Online (Salmon, 2000)

According to Salmon (2000; 2003) this model encompass from the five stages:

1. **Stage 1 - access and motivation:** This stage addresses the essential prerequisite individual access and the online learning induction process of the participants. Participants' attitudes towards computers and their ability to get effective help are the two main variables at this stage. Another key issue is being motivated to spend time and effort. In short, participants need to know what they will get out of the system when they are involved in logging on. The purpose at this stage is to expose participants to the platform (not train them), and to enable them to become successful in using technology and see the benefits.

2. **Stage 2 - online socialization:** It involves individuals establishing their online identities, and locating others with whom to interact. In stage two, participants get

used to being in the new online environment. Many of the benefits of online networking in education and training flow from building an online community of people who feel they are working together at common tasks. However, such power is not inevitable but depends on the participants' early experiences with access to the system and integration into the virtual community. Online, people have the ability to convey feelings and build relationships.

3. **Stage 3 - information exchange:** At this stage, participants exchange information and start to support other participants' goals. Critically, by this stage, ensure that every participant has a role to play and is actively participating. In this stage, they start to appreciate the broad range of information available online. Therefore, information exchanges flow very freely in messages since the 'cost' of responding to a request for information is quite low. In my experience, participants become excited, even joyful, about the immediate access and fast information exchange. They also show consternation at the volume of information suddenly becoming available.

4. **Stage 4 - knowledge construction:** Course-related discussions develop at this stage, and the interactions become more collaborative. Indeed, at this stage, participants begin to interact with each other in more exposed and participative ways. Therefore, they formulate and write down their ideas or understanding of a topic. Participants' grasp of concepts and theories is enhanced through the debate and by examples advanced by other participants. Once this process begins, it has its own momentum and power. As well as, participants are liable to learn as much from one another as from course material or from the interjections of a tutor. What they learn, of course, is not so much product (e.g., information) as process –

in particular the creative cognitive process of offering up ideas, having them criticised or expanded on, and getting the chance to reshape them in the light of peer discussion.

5. **Stage 5 - development:** Real reflection and personal development will occur in the achievement of goals at the final stage. In this stage, participants become responsible for their own learning through computer-mediated opportunities and need little support beyond that already available. Rather different skills come into play at this stage. These are those of critical thinking and the ability to challenge the 'givens'. At this stage, participants start to challenge the basis of the system. In addition, they demand better access, faster responses or more software and they become extremely resistant to changes to or downtime on the system. It is also at this stage, however, that participants find ways of producing and dealing with humour and the more emotional aspects of writing and interacting.

In a nutshell, there are five levels or stages guiding the instructor's activity in order to promote the building of virtual learning communities and aiming at the independence of student, working with the other group. Therefore, the success of e-learning is subjected to the support of participants organized through a structured process of development that is based on five steps. In fact, this study finds that this model is simple, however it is less informative. The idea is not clear enough to guide the development of e-learning system. Therefore, this model focuses on interactive between participants during the five stages of model rather than technology and pedagogical dimensions.

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2.6.3 ADDIE Model

The term ADDIE is derived from the initials of five traditional phases: Analysis, Design, Development, Implementation, and Evaluation (Dick, Carey & Carey, 2001; Selimi & Veliu, 2011). ADDIE model describes a step-by-step process for the implementation of a formal instructional design process. This model is applicable to nearly any training form which includes instructor-led, e-learning, blended training programs and more (Google, 2015). Therefore, ADDIE provides suggestions, feedback, and design guidelines for the development of e-learning module (Imadildayeva & Zhaidarbek, 2010). This base of this instructional model is on the instruction systematic development and learning and is made up of seven phases (Figure 2.7): analysis, design, development, implementation, execution, evaluation, and feedback.
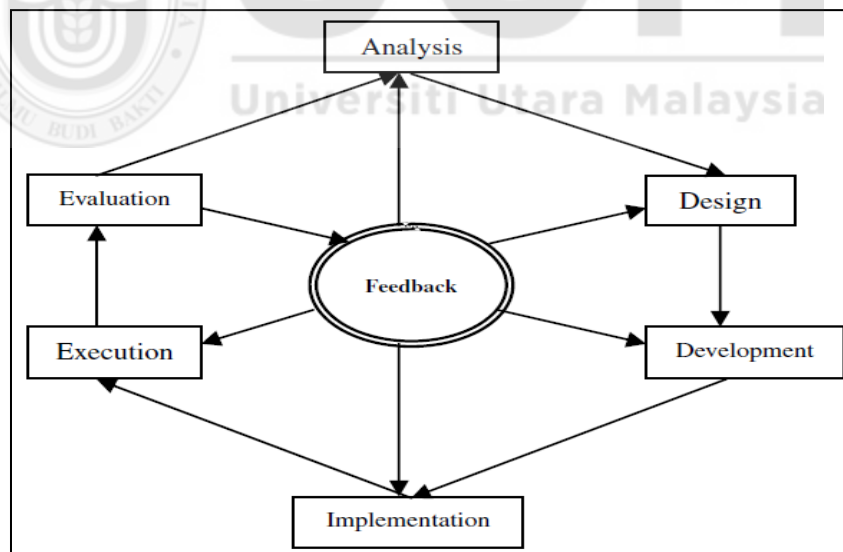
Figure 2. 7. ADDIE Model (Dick, Carey & Carey, 2001)

1. **Analysis:** this phase defines 'what' to teach. This first phase purpose is to sense the characteristics of learning and the learners need, determine the environment in which the learning will be carried out and the resources available. Characteristics of the learners were determined by collecting demographical information and administering a pre-requisite test in computer skills. This phase outputted: learning objectives and educational content (knowledge, skills to be learned and activities to be developed to acquire content of the science teaching methods course).

2. **Design:** this phase defines 'how' to teach. The analysis outcome is employed in creating an instructional blue print, where the learner's process of learning, defining the learning approach, the information structure to be delivered (facts, concepts, processes, procedures, and principles), standards to be employed, execution criteria, and the learners expected achievements are specified.

3. **Development:** this phase describes the teaching tools employed, the materials, strategies, sequences of events, and necessary resources listed in the prior step. These are all implemented.

4. **Implementation:** this phase is to build the system of e-learning. Several software programmes were used such as 'FrontPage' that can take on-board text, images and video clips. Links were added between content of the course, as hypertext and hypermedia are useful tools for the constructivist designer as a branched design of instruction is constructed rather than a linear format.

5. **Execution:** this phase involves the use of the learning process by the learners. The course in its electronic form was loaded on students' computers in a lab set up on-campus. The orientation meeting clarified plan of work, time available for finalising each module, deadlines for submitting assignments and requirements to passing the course.

6. **Evaluation:** during execution, the information output is gathered. This is the results from post-tests as well as determining problems or difficulties during execution.

7. **Feedback**: preliminary testing result of the course on a small number of students together with the comments and suggestions from peers and specialists were put into consideration. Suggestions in relation to all stages of the e-instructional model, clarity of photos, videos and presentation of text were all taken into account to modify accordingly before the final version of the course was executed to the experimental group. Therefore, results from the experimental overall post-test and students' opinions of the course were analyzed in light of course objectives to make further modifications where necessary. Feedback in this sense acts as a formative assessment for all stages of the model.

The ADDIE model has faced criticism for being slow for the development of e-learning and producing unsuccessful solutions. Some researchers perceive it as a traditional waterfall model of software development where each phase follows a sequential order of execution. In fact, this model has many disadvantages, such as, the analysing phase might be lengthy and time-consuming because there are so many things to be crystalized. Also, the designing phase takes much time, especially if it is evaluated and revised. Meanwhile,

the developing stage is subjected to the materials and cost that affect production. Furthermore, this study believes that teachers with less technical, low financial, and have less time should not choose ADDIE model.

2.6.4 DIY E-learning Model

Currently, teachers learn about e-learning mainly from peers and mentors instead of through formal professional development. The materials and the communication among teachers and students in the DIY model are more significant, and it gives the teachers all the control (Thompson &Lamshed, 2006). "Do it yourself (DIY)" e-learning model bases is on the positive experiences of interviewed trade teachers currently using e-learning in their teaching practice. According to Thompson and Lamshed (2006), the DIY model means that the fast adoption of new e-learning tools as they become available is likely to happen, as well as a more open attitude to adoption and experimentation. The model consists of eight steps as seen in Figure 2.8 and described below:

1. **Find Out:** Identify new e-learning tools. Participants cannot enter the e-learning field without knowing what the field offers. Although the internet is a huge repository for new and innovative technologies, there is reluctance by some trade teachers to use it as a valid source of information. It often seems too complex to fathom, and the range of choices too limitless. Therefore teachers need other ways of sharing this information about what is there, and what works.

2. **Choose:** Select the tools to suit programme's purpose and student needs. There is now a plethora of e-learning tools available, some free of charge and most at significantly reduced cost. The range of e-learning tools available is seemingly limitless, and nearly covers every aspect of communication.

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3. **Learn:** appointing a person that can mentor and work with teachers, who can actually sit down and talk, and show sympathy to their needs and improves the e-learning implementation significantly.

4. **Experiment**: Experiment with the tools and test them. This step is to adapt the e-learning tool to the teaching requirements. Tools may be used in a way they were not initially designed for. We found many examples of this, where the technology is used differently in different situations. There needs to be time and space made for experimentation.

5. **Convert:** employing the pre-existing resource materials and converting them into a form that fits the tool of e-learning. Some teachers are using e-learning as an opportunity to revise and revitalise their older materials. In one case, some of the materials had been developed 25 years ago. Times have moved on, both for the teacher and student, and the new technology opens up new ways of re-purposing the material into new and more interesting forms.

6. **Share:** Share resources and knowledge with other teachers who are discovering the pathway of e-learning. The efficiencies in e-learning are gained by sharing resources, across departments, across institutes and even across state/territory borders. However, when sharing materials, it is important that copyright and ownership is cleared before use, particularly across institutes or state/territory borders.

7. **Reuse**: Find resource that's suitable, store and archive it, so that it can be reused at any stage in the future if relevant. The great potential of digital resource material is that it is not only easy to store and retrieve if properly managed, but more

importantly (as compared to print resource material) it is easy to modify or edit and distribute. Print materials are wasteful in that there is a lot of duplication, and they go out of date quickly.

8. **Review**: It is part of quality management, but it is also a vital learning part, modifying, and perfecting what is done. An important part of the DIY model of e-learning is experimentation, and therefore there needs to be an inbuilt review process. Evaluation and refinement processes should be built in to any development project, just as it is now a matter of course to evaluate teaching and learning programs.

Figure 2. 8. DIY E-learning Model (Thompson & Lamshed, 2006)

This model focuses on the teachers more than students. It concentrates on appropriate tools for the teachers. In the developing process, when exploring or testing new ideas, students can provide feedback at the commencement of the process. Teachers will learn about e-learning primarily from peers and mentors rather than through formal professional development. Therefore, the skills will be passed from one teacher to another, mostly informally and in the context of their teaching. Although this means teachers will need to initially spend more time learning how to use e-learning tools, once mastered, there may be a longer term impact and more rapid spread across a trade department because the skills will reside in the department, not externally.

Based on the review of e-learning conceptual models presented, it is observed that only Khan model incorporated pedagogical perspective into the whole framework which also contains design, evaluate, and use components which are common to all. Ramanand (2013) also stated that Khan model is one of the most comprehensive theoretical models that fulfil related system specification perspective by its user interface and evaluation dimensions. Khan model offers comprehensive view on the relevant factors in the e-learning systems that can be used as measuring variables for e-learning effects and implementation (Imadildayeva & Zhaidarbek, 2010). Khan model (2010), through its classification into main parts, educational has pedagogical, ethical and evaluation, and technological domain which include interface design, as well as organizational domain with institutional, resource support and management.

In the same vein, a typical e-learning should provide all the communication tool features to ensure easy communication and feedback between instructors and learners and also

learners and peers (Cavus & Zabadi, 2014). This can be through synchronous communication; participants need to join the communication at the same time from different places, and asynchronous communication, such as electronic mail (email) where, available flexibility and speed (Anderson, 2007). This, as included in the requirement modelling is to be supported by Salmon model's "Information Exchange".

2.7 E-learning Platforms

The main purpose of this section is to study, analyze, and explore the right decision when choosing a suitable e-learning platform to meet the requirements of secondary schools. This section specifically, focused on a comparison between various e-learning platforms. 12 e-learning platforms involved in this comparison to determine the best platform can this study to adopt it. Where, Al-Ajlan (2012) referred to the most 12 platforms used in e-learning, such as Desire2Learn 8.1, ANGEL learning management Suite (7.1), TeleTop Virtual Learning Environment, The Blackboard Learning System (V7), Scholar269, Edmodo, actually all the previous platforms are commercial. While, LON-CAPA,Saki 2.3, dotLRN/OpenACS. ATutor 1.54, Weebly and Moodle 2.9.1 are considering as open sources systems. Table 2.7 displays information about the 12 e-learning platforms which mentioned earlier.

Table 2. 7

Electronic Learning Platforms

No	Product	Developer name	URL
1	LON-CAPA	Gerd Kortemeyer	LON-CAPA Project
2	Desire2Learn 8.1	Desire2Learn Inc.	Desire2Learn Inc.
3	ANGEL Learning 7.1	ANGEL Learning Inc	Angel Learning
4	TeleTOP VLE	TeleTop B.V.	TeleTop
5	Blackboard (V6.2)	BlackBoard	Blackboard LSE
6	Sakai 2.3	Sakai 2.3	Sakai
7	dotLRN/OpenACS	dotLRN	dotlrn.org
8	scholar360	scholar360	www.scholar360.com
9	ATutor 1.5.4	University of Toronto	atutor.ca/atutor/index.php
10	Moodle 2.9.1	Moodlerooms	www.Moodle.org
11	Edmodo	Jeff O'Hara and Nick Borg	www.edmodo.com
12	Weebly	San Francisco company	www.weebly.com

Indeed, these platforms have many features and capabilities. Therefore, in this section the researcher depends on the requirements and the tools mentioned before, to simplify of the compare between these platforms. In fact, most of these comparing are from Al-Ajlan (2012), Kumar, Thongmak (2013) and Callister et al (2015) as well as observation for platforms. The table illustrates this comparison:

Table 2. 8

Comparison between 12 Platforms based on Learner Tools (Al-Ajlan ,2012)

No	1	2	3	4	5	6	7	8	9	10	11	12
Product / Tools	LON-CAPA	Desire2Learn 8.1	ANGEL Learning 7.1	TeleTOP VLE	Blackboard (V6.2)	Sakai 2.3	dotLRN/OpenACS	scholar360	ATutor 1.5.4	Moodle 2.9.1	Edmodo	weebly
1. Learner Tools												
1.1. Communication Tools												
Discussion Forums	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Discussion Management	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
File Exchange	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Internal Email	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Online Journal/Notes	N	Y	Y	N	Y	Y	N	Y	N	Y	Y	Y
Real-time Chat	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Video Services	N	N	N	N	N	N	N	N	N	Y	Y	Y
Whiteboard	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y
1.2. Productivity Tools												
Bookmarks	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	N
Calendar / Progress review	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
Orientation/Help	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Searching Within Course	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y

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Work Offline/Synchronize	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
1.3. Student Involvement Tools												
Group work	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Student Community Building	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Student Portfolios	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
Total Features	16	16	16	16	16	16	16	16	16	16	16	16
Total Available Features	11	15	15	14	14	15	11	12	12	16	16	14
Total Missing Features	5	1	1	2	2	1	5	4	4	0	0	2

Table above includes three types of tools: Communication Tools, Productivity Tools and Student Involvement Tools under Learner Tools, where each tool has some features and capabilities. From 12 platforms, Moodle 2.9.1 and Edmodo have all the 16 features, while, three platforms have 15 features out of 16 features of this part. These platforms are ANGEL Learning Management Suite, Desire2Learn and Sakai.

Table 2. 9

The Comparison between 12 Platforms based on Support Tools (Al-Ajlan ,2012)

No	1	2	3	4	5	6	7	8	9	10	11	12
Product / **Tools**	LON-CAPA	Desire2Learn 8.1	ANGEL Learning 7.1	TeleTOP VLE	Blackboard (V6.2)	Sakai 2.3	dotLRN/OpenACS	scholar360	ATutor 1.5.4	Moodle 2.9.1	Edmodo	weebly
2. Support Tools												

2.1. Administration Tools												
Authentication	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Course Authorization	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hosted Services	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Registration Integration	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2.2. Course Delivery Tools												
Test Types	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Automated Testing Management	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Automated Testing Support	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Course Management	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Online Grading Tools	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
Student Tracking	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N
2.3. Content Development Tools												
Accessibility Compliance	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Content Sharing/Reuse	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
Course Templates	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Customized Look and Feel	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Instructional Design	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Instructional Standards Compliance	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Total Features	16	16	16	16	16	16	16	16	16	16	16	16
Total Available Features	16	16	16	15	15	16	16	15	16	16	15	14
Total Missing Features	0	0	0	1	1	0	0	1	0	0	1	2

Table 2.9 focused on the Support Tools, these tools contain three kinds of tools: Administration Tools, Course Delivery Tools, and Content Development Tools, and all of these tools have features and capabilities except Scholar360, TeleTOP Virtual Learning Environment, Edmodo, Weebly and The Blackboard Learning System (V.7). This means that Moodle 2.9.1 and the other remaining products are strong on Support Tools. While, Technical specifications tools contain two kinds of tools: Hardware/Software Tools and Pricing/Licensing; all kinds of Technical Specifications Tools have some features and capabilities, as in Table 2.10:

Table 2. 10

The Comparison between 12 Platforms based on Technical Tools (Al-Ajlan ,2012)

No	1	2	3	4	5	6	7	8	9	10	11	12
Product / **Tools**	LON-CAPA	Desire2Learn 8.1	ANGEL Learning 7.1	TeleTOP VLE	Blackboard (V6.2)	Sakai 2.3	dotLRN/OpenACS	scholar360	ATutor 1.5.4	Moodle 2.9.1	Edmodo	weebly
3. Technical Specifications												
3.1. Hardware/Software Tools												
Client Browser Required	N	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y
Database Requirements	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Unix Server	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Windows Server	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3.2. Pricing/Licensing Tools												

Company Profile	N	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y
Costs	N	Y	Y	Y	Y	N	N	Y	N	Y	Y	N
Open Source	Y	N	N	N	N	Y	Y	N	Y	Y	N	Y
Optional Extras	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y
Total Features	8	8	8	8	8	8	8	8	8	8	8	8
Total Available Features	3	6	6	4	7	6	4	7	7	8	7	7
Total Missing Features	5	2	2	4	1	2	4	1	1	0	1	1

As shown in Table 2.10, the comparison between 12 platforms is based on Technical Specifications Tools. The results show, the best product is Moodle 2.9.1 and the second products are Edmodo, ATutor 1.5.4, Scholar360, Weebly and Blackboard Learning System, which missed only 1 out of the 8 Technical Specifications Tools. Whilst, the weakest product is LON-CAPA, which missed 5 out of the 8.

As a conclusion, the final results from these 12 platforms based on the features on the e-learning shown the Moodle 2.9.1 is the best platform, which have all the forty features and capabilities, and the second products is Edmodo, which have missed 2 out of the 4o features. Furthermore, Moodle is the best of the Open Source System platforms. Table 2.11 illustrates the final results.

Table 2. 11

Summary of the Comparison between 12 Platforms (Al-Ajlan ,2012)

No	1	2	3	4	5	6	7	8	9	10	11	12
Product / **Tools**	LON-CAPA	Desire2Learn 8.1	ANGEL Learning 7.1	TeleTOP VLE	Blackboard (V6.2)	Sakai 2.3	dotLRN/OpenACS	scholar360	ATutor 1.5.4	Moodle 2.9.1	Edmodo	weebly
Total Features	40	40	40	40	40	40	40	40	40	40	40	40
Total Available Features	30	37	37	33	36	37	31	34	35	40	38	35
Total Missing Features	10	3	3	7	4	3	9	6	5	0	2	5

Therefore, these results encouraged the researcher to adopt Moodle as the platform to design the e-learning system for secondary school in Dhi-Qar. Furthermore, Moodle is a free, secure, social learning platform for teachers, students, management of school and parents. In addition Moodle is open source and can customize all the content and roles of users.

2.8 Overview of the Education System in Iraq

World Bank (2015) emphasizes that one of the most powerful instruments to reduce poverty and inequality and laying foundation for economic growth sustenance is education. Various developments experienced by many countries show that economic development achievement is no longer a dependant on the natural resources and production elements only. It also largely depends on knowledge and skills at practical

levels that are available in the labour force. This enables technological absorption and follows the successive and rapid modern production techniques development (Mahmud, 2013).

Iraq established its education system in 1921 with this goal and vision at sight. The country offers public and private paths to the citizen. In the early part of 1970s, the education turned to public and was made free at all levels, with the primary level made compulsory. As an evidence of the government serious care for education, Iraq education system was assigned to be managed by two ministries. These are the Ministry of Education (MOE) and the Ministry of Higher Education and Scientific Research (MOHSR). Specifically, the MOE is in charge of the pre-school, primary, secondary, and vocational education. Meanwhile the MOHSR is in charge of the tertiary education and research centres.

In the early 1980s, the system of a six-year primary (or elementary) level grouped as the first level was introduced and implemented. In that new system, the second level which also spans for six years makes up an intermediate-secondary and an intermediate-preparatory, whereby individual has three years span. These schools graduates could enrol in vocational schools, teacher training schools or institutes, or colleges, universities, or technical institutes.

The Iraqi education system, prior to 1990, was proven as one of the most developed in the region, with record of many boys and girls had access to basic literacy training, as

well as advanced education (Enloe, 2010). As evidences, by the year 1984, Iraq has achieved: (1) Gross Enrolment Rates which rise over 100%, (2) enrolment has almost complete parity of gender, (3) the level of illiteracy among populace aged between 15 and 45 declined to less than 10% (Yaumena, 2014). Unfortunately, Iraq involved in the Gulf War in 1991.

With the Gulf War and subsequent economic sanctions, public resources are mostly diverted to military spending, as decided by the government. This naturally caused a steep decline in total social spending. The education budget suffered because of this, with deficit that has continued growing as years pass. At the present time, no strategic plan was also in place to address these issues. Consequently, this led to (1) the drop in the Gross enrolment in primary schooling to 90%, (2) The dropout rate increases to 20% (31% Female, 18% Male), (3) increase in the gender gap (95% Male, 80% Female), and (4) The rate of dropout reached 34% for secondary schools (Lehr, 2012).

As a country with 8,000 years leading position among Arab countries in social programmes, Iraq has been faced with sequence of conflicts which led to rapid infrastructure deterioration and basic social services (Mahmud, 2013). However, now that system ranks close to the bottom (UNESCO, 2011). The lack of security and political instability have taken a considerable toll, particularly in the form of a 'brain drain' as trained and educated Iraqis continue to leave the country.

Now, the country is faced with deteriorating education quality as children are not interested in schooling due to the fear of conflict, and parents are also indisposed (IMO,

2013). The Education ministry in the country has decided to also respond to this declining education rate and increasing drop-out rate, especially among the secondary school students (Iraqi Research Foundation for Analysis and Development, 2014). In doing this, design, development and adoption of ICT technologies have been suggested in the education sector, and e-learning technologies that can bridge geographical and physical constraints is highly recommended (Wheeler, 2012).

2.9   Summary of Chapter Two

This chapter discusses the overview of education sector in Iraq. This emphasises the historical background of its development and highlights its present deteriorated state. This explains why ICT adoption and user and task-centred e-learning system are needed for the secondary school students of the country. E-learning technologies and concepts are also elaborately discussed, and the need for functional requirement modelling is also emphasised. This is supported by review of past related studies requirement modelling for e-learning systems. Then, various methods of requirement modelling are discussed which is used to explain the rationale behind the choice of UML as the modelling language and system specification medium used by this study. This chapter also listed the verification dimensions of requirement model and appropriate questions to be asked while evaluating requirement model using the dimensions. Finally, the e-learning conceptual models are discussed and critiqued to explain the choice of this study and the implication in the requirement analysis and design process.

CHAPTER THREE
METHODOLOGY

3.1 Introduction

This chapter elaborates the research methodology which is adapted to this study. They have been set as the foundation for this study. Furthermore, this chapter outlines and elaborates the research methodology to be followed through in ensuring that the objectives stated in Chapter One are achieved.

3.2 Research Method

This study adapts the Systems Development in Information Systems Research (SDISR) outlined by Nunamaker and Chen (1990). The use of system development as a research methodology has been argued and defended by many researchers in the IS field (Nunamaker & Chen, 1990; Nunamaker et. al., 1991; Gregg, Kulkarni &Vinzé, 2001; Burstein & Gregor, 1999).   Nunamaker and Chen (1990) expressed that system development as a research methodology can be used not only as a means of clear understanding of a research domain, but also sometimes changes the processes and products in a research domain. Besides, Damkhi (2012) suggests that SDISR is suitable for small to medium sized development projects or applications. That is the reason for many studies to use SDISR to design system or application for educational purposes (such as, Salim, Zulkifli, Mohamed, Razak and Saad (2009) and Alzaza and Zulkifli (2007)).   It is a multi-dimensional and multi-methodological approaches. It allows different approaches to be carried out for each research process. Moreover, it promotes

iteration between the five phases, as depicted in Figure 3.1 (Nunamaker & Chen, 1990).

With this method, research contributions can be obtained through system development,

experimentation, observation, and performance testing of the developed system.

Phases	Processes	Techniques	Outputs
Identify the functional requirements	• Identify the components to construct the functional requirements	• Using documents study • Interview • Expert review	• List of requirements of e-learning system
Create a functional requirement model	• Create a functional requirements model of e-learning system	• Use UML to model the functional requirement	• Use case Diagram, activity diagrams, sequence diagrams and class diagram
Verify the proposed functional requirement model	• Verify the functional requirements model of e-learning system	• Verification by expert reviewer.	• Verified functional requirements model of e-learning system
Build the System	• Customize the e-learning system for secondary school	• Using open source Moodle	• Prototype system of e-learning
Observe and Evaluate the System	• evaluation of e-learning system	• Using Acceptance and usability evaluation for e-learning prototype	• Validated model for e-learning system

Figure 3. 1. A Research Process of Systems Development in Information Systems
Research (Nunamaker and Chen, 1990; Nunamaker, Chen and Purdin, 1991)

3.3 Functional Requirements Identification

Requirement identification is arguably the most important part of the whole RE process. There are many elicitation techniques and also methodologies that propose complete roadmaps using a combination of different techniques and tools. Some of these techniques are interviews, workshops, observational and documentation studies etc. Each technique has its particular effectiveness in particular situations. Again, comparing interviews to observation, interviews are better at the beginning of elicitation where verbal communication produces a big amount of initial data. In this study, the requirement gathering techniques being used are multi fact finding through interview and documents review as well as expert review.

3.3.1 Documentation Review

Documentation studies provide ways to explore the existing documentation or knowledge and acquire requirements from a series of deductions (Zhang, 2007). As well as try reuse requirements from another similar project; analyzing its requirements specification and extracting what might be relevant to the project at hand as well. In this stage, elicited the most important requirements that be suitable of the stakeholders (students, teachers, parents and managers of schools) who have relation with educational process in secondary school be carried out.

At this stage, this study thoroughly searched the web repositories with key words (phrase) of "requirement for e-learning systems". Suggested articles are vetted and duly sorted. Finally, Uţă (2006), Buzzetto-More (2007), Lotfi, et al. (2013), and Al-Ajlan (2012) are

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the documents selected through the documentation process. The content of each of the previous related studies on e-learning functional requirements are analysed to elicit the functional requirements for e-learning systems as proposed by the individual studies. Also, each of all the requirements gathered are checked to ensure they are valid, consistent, complete, real and verifiable. The duplicated functional requirements are removed to actualise a list of functional requirements under specified classified headings. The details of the findings are presented in Chapter 4.

3.3.2 Interview

Interview the most widely used technique in requirement gathering to get deeper information from the participants (Mohd, 2002). This study used semi-structured interview which is more flexible (Firesmith, 2003) to identify the functional requirement for the e-learning system. Moreover, the interviews were conducted in this stage using online video call applications (Viber, Skype and Messenger) and Camtasia Studio 6 to capture the interviews and save them. Meanwhile, the researcher conducted interviews with 24 participants (12 students, 6 parents, 4 teachers and 2 managers) from two secondary schools representing two regions (urban and rural). In addition, the interview questions divided in two sections; the first section involved the open ended questions to give the participants more freedom to expression. These questions were adapted from Kurti (2008) because it tailored to understand users' need which is important in users' requirement gathering.

The second section of questions are close ended, it was adapted from Lotfi, et al. (2013) as well as based on the list of elicited functional requirements from the analysed content of the documents (i.e. past previous related studies on e-learning functional requirements). These questions were used to determine the importance of each requirement though five Likert scales ranging from 1 (not important) to 5 (very important) (see Appendix B). The questions of the interview are translated from English language to Arabic language by the Language Center in Universiti Utara Malaysia (UUM). At this stage, objective one is achieved which is identifying a functional requirement model.

3.3.3 Experts' Reviews

In the last stage from identify the requirement, the list of requirements that elicited from previous studies and the users (student, parents and managers) will checking through three experts who work in different secondary schools. The experts were selected based on their strong background in IT and learning, where each of them has more than 10 years of experience. The details of the experts' profile are presented in Appendix G. In general, in this stage the experts will check the selected requirements from the literatures and users (teachers, students, parents and managers) to ensure all the important requirements are covered.

3.4 Create the Functional Requirements Model

This phase related to the creation of the requirement model after the completion of requirement gathering. UML diagrams are used to represent the requirements model.

Accordingly, this study came out with use case diagrams, activity diagrams, sequence diagrams and class diagram in this stage. The main use cases of the proposed functional requirements are manage curriculum, manage course, share repository, manage communication, evaluate student, support learning and manage user.

3.5 Verification of the Functional Requirements Model

This activity examines the quality of the constructed SRS and ensures satisfying stakeholders' requirements. Pfleeger and Atlee (2006) defined the verification to ensure whether the system is built in a right way. General speaking, there are several techniques to validate and verify the requirement model, namely: (1) Tracing approaches, (2) Prototyping, (3) Testing, (4) User manual writing, and finally (5) Reviews and Inspections (Benadikar, 2011).

This study uses prototyping and review techniques. These two techniques used by previous studies to validate the model such as (Siti Mahfuzah, 2011). Through the prototyping technique, the researcher used acceptance and usability evaluation with the end users (students, teachers, parents and managers). Prototyping is the process of translating system's specification into a tangible outcome in order to gain users' feedback (Dix et al., 2004; Preece et al., 2007). In the second technique, three experts participated to verify the final requirement model. Sekaran and Bougie, (2010) stated that, use expert review ensures that the measure includes a sufficient and representative set of items of intended concept.

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The proposed functional requirement model was verified by three experts; are the senior lecturers from School of Computing, UUM. Lili and Jing, (2012) and Shih and Chen (2013) highlighted the same number of experts (three experts) to validate the final model. They were selected based on their strong background in software engineering; moreover, each of them has more than 10 years of experience in their respected fields. The details of the experts' profile are presented in Appendix G.

Prior to the verification process, the experts were contacted to get their consent to be a reviewer in this study. The model, questionnaires and instructions were given to the respective reviewers to get the feedback regarding the proposed model. The verification process involved a double-check verification from the reviewers. First, the reviewers were given the proposed functional model, and the researcher was given the comments for some improvements. The improvements were done accordingly, and given back to the reviewer.

The reviewer checked the improvement done, and confirmed the proposed functional model. The questionnaire was adapted from Bahadon (2014) and Firesmith (2003), as reviewed in section 2.6, chapter 2, of this study, and presented in Appendix F. The review focused on Completeness, Consistency and Unambiguous of the proposed model. The experts were given an ample time to complete their reviews. After the requirement model has been verified by the reviewers, the model was refined (see Appendix F). The refinement process takes into account all the comments and suggestions provided by the reviewers.

With regard to the requirement model verification, Finkelstein, Huang, Finkelstein and Nuseibeh (1992) a number of authors have set down software specification evaluation criteria. Although there is a variation in emphasis, these criteria equally apply to the requirements specification of instrument systems. Finkelstein, Huang, Finkelstein and Nuseibeh (1992) included consistency, completeness and unambiguous of the specifications. In more recent, Bahadon (2014) use this technique in his study to validate the requirement model for Labour Case Management System. Thus, this study exploits the present technique to verify the proposed requirement model. The following sections discuss about the components of this technique in detail.

Completeness

This instructs that the entire requirements specification should be complete and contain all relevant requirements with ancillary material (e.g., as specified in its template or content and format standard), individual requirements should also be complete (Firesmith, 2003). As having all the necessary information and being detailed enough; according to the goals of modelling.

Completeness is a semantic quality. Questions to be asked in evaluating the systems' specification completeness are (Firesmith, 2003): (1) Is each requirement self-contained with no missing information?, (2) Does each requirement contain all relevant information? For example, does the requirement include all relevant preconditions such as the relevant state of the application or component?, (3) Does each requirement need no further amplification or clarification?, (4) Does each requirement provide sufficient

information?, and (5) Is each identified "requirement" actually a single requirement and not actually multiple requirements?

Consistency

Consistency instructs that there must be no contradictions in the models, as related to semantic quality. According to Firesmith (2003), consistency also addresses the views between the same level of abstraction or development phase (horizontal consistency), and between views that model the same aspect, but at different levels of abstraction or in different development phases (vertical consistency). Collections of inconsistent requirements are impossible to implement, therefore individual requirements should be consistent. Questions to be asked in evaluating the systems' specification correctness are (Firesmith, 2003): (1) Is each requirement externally consistent with its documented sources such as higher-level goals and requirements?, (2) Is each requirement externally consistent with all other related requirements of the same type or at the same requirements specification? For example, two requirements should neither be contradictory nor describe the same concepts using different words, and (3) Are the constituent parts of each requirement internally consistent? For example, are all parts of a compound pre-condition or post-condition consistent?

Unambiguity

Unambiguity expresses the need for model not to allow multiple interpretations (Firesmith, 2003). The requirement must be stated in such way that avoids misinterpretation. It should equally be simple and easy to understand (IEEE, 2011). Furthermore, every requirement stated should only have one interpretation (Software

Engineering Standards Committee, 1998). According to Raja (2009), most of software bugs are due to the ambiguous, incomplete and omitted requirement. Every software requirements should never be ambiguous to avoid unnecessary problem during development phase.

In sum up, these four quality characteristics will ensure there no missing requirements and the requirement model is sufficient to represent the system with provide sufficient information for each requirement to avoid ambiguity.

3.6 Build the System

A system is implemented to see the design feasibility and the usability of the functionalities, as developed in the system (Nunamaker, Chen & Purdin, 1991). With the system, an insight on the advantages and disadvantages of the design alternatives could be obtained (Sjödahl, 2014). This information is very helpful since the system may need to be redesigned because the acceptance and the usability studies are to be done after the system development. In this stage, customize the system by using Moodle platform. Hence, established two secondary schools in this system (Al- Jomhoriyah and Tall Al-Zaater) from two regions (urban and rural) and each school have three grades. Furthermore, the system was published online (www.ie-ls.com) and allowed all the users to access and test the system. The system was developed based on the requirement gathered from the participants through the interview. It was pre-tested by selected users several times (two months) before the system evaluation.

3.7 Evaluate the System

After the system was developed, the stakeholders (students, teachers, parents and managers of schools) were given two months to use the system prototype. The users were given some instructions regarding how to use the system prototype and all the required activities that have to be performed. Moreover, they were given some checklist of the important system requirements to give them clear figure on the system (see Appendix B).

After two months, an evaluation of the prototype system was conducted through a set of questionnaire, as had been conducted by the previous studies, whereas the prototype or the system is used to evaluate the initial requirements (Sommerville, 2004; Saqi & Ahmed, 2008). Therefore, this study customizes the system based on the requirements of the previous studies; afterward evaluation of the system was conducted through the questionnaire with users related to this phenomenon (Educational process). The proposed system was tested and evaluated by the users (teachers, students, school management and parents). The questionnaire for prototype evaluation was available online, so that the users (teachers, students, school management and parents) will have easy access to the system. In general, the evaluation in this study includes:

A- Evaluating the acceptance: The questionnaire (detailed in Appendix C) consists of two sections. The first section is about personal information including region, role and grade for student. Meanwhile, the second section consist of (17) questions adapted from Sim (2012); Davis (1989); Su, et al., (2010) to gather participant's perception on the communication, usefulness, ease-of-use and satisfied of the E-LS. Where, the communication and satisfaction factors adapted from Sim (2012)

and the questions related to ease of use factor from Davis (1989), while, the questions of usefulness from Su, et al., (2010).

B- Evaluating the usability: There are (19) questions which are adapted to the questionnaire from Lewis 1995 to test the usability of the E-LS (refer to Appendix D).

The questionnaires were distributed to 122 participants from two secondary schools represent of two areas (urban and rural). The latest conference conducted in Dhi-Qar on 16 November 2014 on e-government revealed that there are 40 schools equipped with a good IT infrastructure (Shaykhli, 2014). As the procedures are similar in all schools in Iraq (the instructions, materials and teaching ways), selecting two schools is appropriate because they are all homogeneous (General Directorate of Curricula, 2013).

Likert scale is used to measure the stakeholder's' acceptance and usability in this research. Many previous studies also adopted Likert scale as the method to measure the learners' acceptance and usability in electronic learning such as Lam et al. (2009) and Lim, Hong and Tan (2008). Therefore, Likert scale is appropriate to be used in this research to measure the learners' level of acceptance towards the system. During the questionnaire development, questions were focused on the main issues with emphasis on using short, simple unbiased language. The questionnaire took on average 10 minutes to complete.

Furthermore, the questionnaire was designed using Google Form. Google Form is a free web-based word processor, spreadsheet, presentation, form, data storage service provided by Google. It allows users to create and edit documents online and an URL link will be

given to each document created. The participants were given an URL link that linked to the questionnaire to participate it online. Google Form also provides spreadsheet as a backend database for storing the collected data. The questionnaire invitations were posted on the E-LS to be available for all participants. After distributing the questionnaires to the stakeholders (students, teachers, parents, managements of schools), the data are gathered, and analyzed using IBM SPSS 21.

3.8   Data Analysis

The IBM SPSS 21 (Statistical Package for Social Science) software was used to analyze the data collected. This study used three types of statistics for data analysis, descriptive statistics, reliability analysis, and analysis for multiple responses. Descriptive statistics was used to summarize the data that includes number of participants, minimum and maximum scale, mean and standard deviation. Mean is arithmetical average of a frequency, standard deviation is used to measure dispersion of data from mean (Sim & Yin 2012). In addition, analysis for multiple responses was presented to analyze data on multiple-choice questions. A frequency table is used to display the percentage of responses. Reliability analysis was used to estimate the internal consistency of responses on a measure. It was used to analysis the data that are Likert scale based.

 In term of analysis of experts' feedback, Microsoft Excel was used to analyze the feedback from the experts based on Completeness, Consistency and Unambiguous aspects of the proposed model. Descriptive statistics also was used to summarize the data that includes mean and standard deviation for the expert's finding. The details of the analysis processes are presented in Section 6.4.1.

3.9   Population and Sample Size

Population is the entire group of people that this research wishes to investigate. The target population of this research includes students, teachers, parents, management of school in secondary schools which selected from two different areas in Province of Dhi-Qar. There are approximately of 997 students, 56 teachers, 997 parents and 2 managers who are currently in those selected programs (see Appendix A). A sample is basically a subset of the population (Wong, 2008). According to Kent (1999), a minimum sample size of 100 participants is needed for any kind of quantitative research to get a significant result. Therefore, the most effective sample size is more than 30 and less than 500 (Roscoe, 1975). Thus, this study involves a sample of 122 persons. It is sufficient for this study, because the characteristics of E-LS users are homogenous. Table 3.1 highlighted the population based on the schools area:

Table 3. 1

Population (Appendix A)

School's Name	Number of Teachers	Number of Students	Number of Managers	Number of Parents
Al-Jomhoriyah	31	637	1	637
Tall Al-Zaater	25	360	1	360
Total	56	997	2	997

In addition, this study applied stratified random sampling to determine the sample size. Meanwhile, stratified random sampling as its name implies, involves a process of

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stratification or segregation, followed by random selection of subjects from each stratum. The population is first divided into mutually exclusive groups that are relevant, appropriate, and meaningful in the context of the study (Sekaran & Bougie, 2013). The determination of the probability sampling of users for each school is needed. The probability sampling was calculated using the following formula (Kothari, 2004):

Probability sampling of user = **NP * NS / T**

(NP= Number of users in each school, NS= Number of sample to be distributed, T= the total of the users at all schools). Hence, according to above equation the probability sampling calculated as shown in Table 3.2:

Table 3. 2

Sample

School's Name	Number of Teachers	Number of Students	Number of Managers	Number of Parents	Total
Al-Jomhoriyah	2	37	1	37	**77**
Tall Al-Zaater	2	21	1	21	45
Total	4	58	2	58	122

3.10 Validity and Reliability

The validity of the instrument was within the concern of this study. Since the instruments involved in this study were adapted from those established instruments, however, the instruments were distributed to four experts. The responses from the experts were

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recorded. The experts only suggested a few minor modifications, which are on terminologies and editorial works. Hence, all recommendations from the experts were followed (Appendix E).

Beside validity, reliability is another concern in this study. It was ensured through the Cronbach Alpha value. For that purpose, having gathered the data, the reliability was tested. Based on the gathered data, the acceptance and usability instruments are able to gather intended data because the Cronbach Alpha was from 0.714 to 0.910. With reference to Hair, et al. (2006) and Coakes and Steed (2009), it is highly reliable (Alpha is greater than 0.7).

3.11 Summary of Chapter Three

This chapter describes the process to accomplish the key objectives for this study, as stated in Chapter One. While SDISR by Nunamaker and Chen (1990) is adapted for this study, while every stage; the conceptual framework construction, system architecture development, the system analysis and design, system building, and experiment; is described in this chapter.

CHAPTER FOUR
FUNCTIONAL REQUIREMENTS IDENTIFICATION

4.1 Introduction

This chapter describes the functional requirements of e-learning system in secondary school that are used for interaction among teachers, students, parents, and the management of schools.

4.2 Requirements for the System

Understanding right requirements is essential in developing software. Without right requirements that address what a system's needs, developing a system will be difficult. Hence, this chapter describes the requirements for the system build-up for this study. Besides addressing what the system needs, the requirements for this study addresses also its interoperability issues. Basically, the proposed requirements model is based on critical review of four studies which are earlier described in Chapter 2.

Table 2.4 in Section 2.3.3 shows that, all the e-learning system functional modules proposed in the works of Uţă (2006), Buzzetto-More (2007), Al-Ajlan (2012) and Lotif et al. (2013). It presents 34 e-learning system functional modules in entirety, and this shows that the reviewed studies lack at least 12 functional modules each. The highest scarcity study is Uţă (2006), with 19, and the lowest is Al-Ajlan (2012) with 12. This study proposes an improved functional requirement model that encompasses the missing functional modules of the studies, for instance Uta (2006) and Buzzetto-More (2007) lack

online guides, search facility, personalized learning workspace, among others. Al-Ajlan (2012) and Lotif et al. (2013) lack provision for shared repository, grade book assignment. Table 4.1 presents the functional requirements that elicited from these studies.

Table 4. 1

Functional Requirements Elicitation

Module	Functional Requirement	Source(s)	Applicable Use Cases
Communication & Community participation	Real time chat room	Uţă (2006); Buzzetto-More (2007); Al-Ajlan (2012); Lotif et al (2013)	Send and receive message to members of the same course or different course
	Course community discussion forum	Uţă (2006); Buzzetto-More (2007); Al-Ajlan (2012); Lotif et al (2013)	Post comment on topics discussed under course headings
	Video conferencing	Al-Ajlan (2012); Lotif et al (2013)	Make video conferencing between teacher and students in the course
	Calendar (share important dates for events)	Buzzetto-More (2007); Al-Ajlan (2012); Lotif et al (2013)	Share important dates for events
	Sending and receiving e-mail in the course	Buzzetto-More (2007); Al-Ajlan (2012); Lotif et al (2013)	Sending and receiving e-mail in the course
	Announcements	Buzzetto-More (2007); Lotif et al (2013)	Make announcement as it regards the learning programmes and events
	Share white board	Buzzetto-More (2007); Al-Ajlan (2012); Lotif et al (2013)	Write texts or draw pictures and give explanation at the same time
	Who's online	Buzzetto-More (2007)	See who's active at a moment.
	Application sharing	Lotif et al (2013)	Share application
Manage Course	Create course	Uţă (2006); Buzzetto-More (2007); Al-Ajlan (2012)	Create course to be available
	Update course	Uţă (2006); Buzzetto-More (2007); Al-Ajlan	Edit the course

		(2012)	
Manage Curriculum	Create curriculum	Uţă (2006); Al-Ajlan (2012)	Create class to be available
	Upload material	Uţă (2006); Buzzetto-More (2007); Al-Ajlan (2012); Lotif et al (2013)	Upload class material
	Download material	Uţă (2006); Buzzetto-More (2007); Al-Ajlan (2012); Lotif et al (2013)	Download class material
	Set list of eligible learners	Uţă (2006); Al-Ajlan (2012)	Access classes based on authentication
	Set maximum participant of a class	Uţă (2006)	Set the maximum students that can enrol per course
Evaluate Learners	Activity tracking	Uţă (2006); Buzzetto-More (2007); Al-Ajlan (2012); Lotif et al (2013)	Record total, single course time and learner's progress
	Self-reflection	Buzzetto-More (2007); Al-Ajlan (2012); Lotif et al (2013)	Students evaluate their own performance
	Project progress	Lotif et al (2013)	Show project progress
	Online survey	Buzzetto-More (2007); Al-Ajlan (2012); Lotif et al (2013)	Ability to make survey of evaluation for specific subject
	Grade book	Uţă (2006); Buzzetto-More (2007)	Share information about grades
	Assignment and assessment	Buzzetto-More (2007); Al-Ajlan (2012)	Make assignment and receive the answer
	Quiz	Uţă (2006); Buzzetto-More (2007); Al-Ajlan (2012)	Mark multiple choices and structured questions
Support Learning	Project space	Lotif et al (2013); Al-Ajlan (2012)	It is a place for a group of collaborators to focus on a certain project and work on the project
	Personal work space	Buzzetto-More (2007); Al-Ajlan (2012); Lotif et al (2013)	It is a space for every user
	Expert services	Lotif et al (2013)	For giving knowledge and source to learner
	Online guides/ help	Al-Ajlan (2012); Lotif et al (2013)	To support or advice the learner

Share Repository	Search facility	Al-Ajlan (2012); Lotif et al (2013)	Search in the course
	Shared bookmarks	Al-Ajlan (2012); Lotif et al (2013)	Share bookmarks between student and teacher
	Content folder/Data collection	Uţă (2006); Al-Ajlan (2012); Buzzetto-More (2007)	Share folder
	Syllabus /Lessons plans	Buzzetto-More (2007); Lotif et al (2013)	Upload syllabus or curriculum objectives by teacher
	Media library	Uţă (2006); Buzzetto-More (2007)	Share media files
	Web link	Buzzetto-More (2007)	The teacher share web link with student
	Frequently Asked Questions	Lotif et al (2013)	View FAQ section

Based on the requirements from the previous studies (Uţă, 2006; Buzzetto-More, 2007; Al-Ajlan, 2012; Lotif et al, 2013) the researcher proposed selected requirements to the users for choosing the most important functions and compatible with their work.

4.3 Interview Analysis

The requirement determination captures requirements and defines them in natural language (Maciaszek, 2001). The requirement elicitation process involves communication with stakeholders. Therefore, requirement elicitation requires knowledge about application domain and organizational as well as specific problem knowledge. Thus, the researcher in this study utilized the experience possessed in education institutions for eliciting the requirement. Besides, various techniques could be used for gathering information, such as structured and unstructured interviews, questionnaires, and documents study. They could be geared based on their convenience. Accordingly, this study gathered data through interviews. The interviews were conducted with the main

actors in the educational process in Dhi-Qar. The data were collected from two secondary schools in the province, which have been selected based on the various arguments as mentioned in Chapter 3 (see Section 3.5). Altogether, 24 participants (12 students, 6 parents, 4 teachers and 2 managers of schools) involved in the interview sessions, in which a detailed breakdown is illustrated in Figure 4.2. The number of people who participated in the interview can be two or more as suggested by Hussain and Ismail (2011). To distinguish between the participants of the study, the interviewees are addressed as the following: T1 - Teacher1, S1 – Student, P1 – Parent1, and M1 – Manager 1.
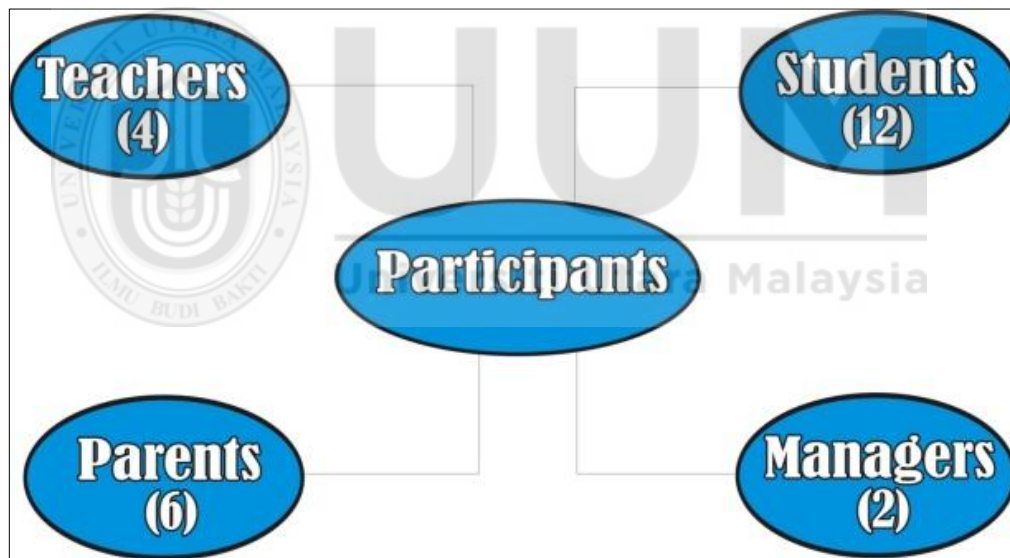
Figure 4. 1. Number of Participants Included in Interview

The interview questions were encompassed into two parts: the first part includes the questions where the researcher asked the participants open-ended questions to extract rich information on their experience and opinion. Meanwhile, the second part involves questions on the functions that are deemed required for the E-LS that highly support the

educational process (Appendix B). All interviews were carried out with the participants in Arabic because it is the most preferred language since all interviewees are Arab native. However, the answers are translated into English when necessary for further discussion in this thesis.

4.3.1 Open-Ended Questions

Most interviewees asserted the importance of using modern technologies in sharing the knowledge among the partners, especial in the unsafe circumstance. In fact, a student from a rural area, S1 expressed:

"It is very wonderful to use the Internet to share and disseminate opinions among students. Also, we can discuss about different subjects in our course in a special educational environment and under teacher's supervision. In fact, the discussions have always been useful and positive, besides they give very good outcomes".

Participants from schools in urban areas also agree about the benefits of the use of the Internet for communicating with their peers in the same class and with other students who take the same subject. Regarding that, S2 expressed:

"We always use social media tools for messaging and discussing with friends and family. Therefore, if the school harness such technologies and make them available for us in the official context, it will become very useful and make the teaching and learning activities more interesting".

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Besides making teaching and learning more interesting, participants also express that the utilization of the Internet could encourage them to be more competitive. This is because they could have their eyes on what others have been doing. This could be seen in an expression by S3:

> *"It is highly necessary if we can see what other colleagues say. It could encourage us to compete in making achievement. In fact, in the first place, it could accelerate healthy discussion and communication among us. This will eventually lead to the achievement of the school".*

Not only participants in rural area believe that it could highly benefit them, but also participants in urban area. This is seen in the expression by S4:

> *"The use of technology is highly potential, so it should be available for use any time. It could improve our ability in communication and discussing with our learning community, which further improves our prospects in digesting new things around us. Since technology advances very drastically, we highly believe that the utilization in schools could enhances our learning experience".*

Nevertheless, both students in rural and urban areas also believe that such technologies could support their morale development and maturity. This is elicited from the expression by S5:

> *"We as students need guidance and follow-up from the management of the school, especially on the best way to use those technologies in our course.*

As it is a new environment for us, we might face some difficulties in the

beginning".

Based on the interviews with key participants in the educational process, the students in both areas (rural and urban) asserted the importance of harnessing modern technologies for teaching and learning purposes that includes communication among themselves and their teachers. Additionally, according to the interviews, the students involved in the session also indicate that, using online system and Internet technology in teaching and learning could potentially overcome many dilemmas such as limited class times and difficulties in understanding certain contents. Besides putting a special consideration on that, E-LS is also specially designed to bridge the communication between teachers and students in the unstable circumstances.

In regards to teachers' perspectives, the teachers who were involved in the interviews emphasize that there are some pedagogical challenges in e-learning system. As an instance, T1 in rural area expressed:

"Not all students and teachers could understand the whole content using

e-learning system in secondary schools because it is a new technology.

Most of them have not experienced such technology before".

While the teachers in rural area doubt about the pedagogical aspect, teachers in urban areas do not really have problem with that. In contrast, they express the benefits their learning community would gain through the implementation of a virtual system. This could be deduced from the expression by T2:

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"...some of e-learning systems faced isolation challenge because it is used alone (without traditional learning) but when we use e-learning to support traditional learning, it will be very useful for us to manage our course and gives us more chance to interact with students".

On the other hand, regarding the requirements for the E-LS, which is compulsory for offering courses online, teachers in rural area are confident that they could communicate with their students more actively. This leads to deep engagement among themselves and the students. It could be understood from the expression by T3:

"We as teachers, need this system in the digital environment to be more active with our students. With the system, we can communicate with our students at any time anywhere. Not only that, we can also communicate with students' parents and school management directly".

The expression by the teachers in rural area is agreed by the teachers in urban area. This is deduced based on the expression by T4:

"We expect that this system is equipped with the ability to add links and online lessons to share with our students. Also, we need to make online quizzes and deliver assignments to students because we do not have enough time if relying merely on in-school time to cover all material and make all quizzes during the course".

Having asked the students and teachers, their feedbacks upon the E-LS are in a strong agreement. Besides them, this study also interviewed the management of schools.

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Basically, they urge on the importance of such e-learning system in schools. In rural area, M1 expressed:

> *"It will simplify the managerial works and organize the documents and can follow the students and teachers easier than that with the conventional system. This also reflects the educational process, in which it follows the current advancement".*

Similarly, managers of schools in urban area also realize the important E-LS in their environment. As an example, M2 expressed:

> *"The use of new technology in education will help in developing the teaching and learning process. In fact, it could enhance the ability among academic staff in developing the managerial works, as well as it provides more interactivity among the main actors in teaching and learning process".*

Further, managers of both schools in rural and urban areas appreciate such system in terms of its ability to provide a mean for wide-scale and real-time communication. Particularly, they could use the system to communicate with their students and their parents, publish announcement, and publish examination results. Additionally, they also addressed some important challenges that such system can overcome. Regarding this, M1 expressed:

> *"There is a lack of communication and interaction among us and the parents of our students. Most of them are not able come to school to track their children's achievement because they are busy with their work. On*

top of that, the second reason is that the daily operation school time is too

short time".

This opinion was also emphasized by the managers of schools in urban area, with another emphasis. This is elicited from the expression by M2:

> *"Another important challenge that most schools face, especially those*
>
> *with a large number of students is data loss. In some situations, student*
>
> *information such as results and year of study missed from our record".*

Similar with the students, teachers, and managers, parents of our students also emphasize that the use of computers and the Internet in teaching and learning practices in schools is necessary. Since the computers have been very common in daily life, incorporating them in teaching and learning activities could potentially increase the students' desire in teaching and learning. Further, when asked about what they need, P1 expressed:

> *"We as parents, need to communicate with the management of school*
>
> *whenever necessary. With such system, the communication is ready any*
>
> *time anywhere. When there is any difficulties in attending school, all*
>
> *announcements and teaching and learning activities could still be*
>
> *followed and participated using such system".*

In addition, regarding the possibility of viewing their children's activities in school and the possibility of discussing with teachers through E-LS, P2 from urban area expressed:

> *"This is a highly necessary teaching and learning approach. We need to*
>
> *view the children's activities during the course and we need their marks,*

as well as we need to discuss with their teachers about the level of our

children's progress and achievement. Further, we would want to suggest

to the teachers on how we can improve our children's level and solve the

problems that they face in their study".

The literatures stress on the importance of parents to motivate and encourage their children to actively involved in teaching and learning, and also to enhance their performance. Almost all of the parents who participated in the interview session stated that the E-LS will become more significant for them, especially, for most of them who work in different and far places from the schools. Also, it would be very beneficial for parents who are very busy and tend to forget the time of the school meetings. All these barriers make the communication among the parents and the management of schools as well as teachers more difficult. Consequently, this may effect on the students' performance. Based on the interviews, the parents indicate their willingness to embrace the E-LS, partly because they are aware of the importance of such system.

Overall, the participants (students, teachers, parents and managers) confirmed that there is needing to apply e-learning in secondary school with suitable requirements that addressed the main problems in education process such as lack of teachers and materials as well as the limited time in schools. Therefore, the point of view of the key participants highlighted the requirements of the system that considered a very crucial in supporting the problem statement and designing the system to be powerful enough for achieving user tasks.

4.3.2 Closed-Ended Questions

On top of open-ended questions, in which the responses are outlined in the previous section, this study also asked some closed-ended questions (see more details in Section 3.3.2). They were addressed to the same group of participants, posted through Google Form. The questions were designed accordingly, to enriching the functions to be incorporated in the E-LS. Later, data were analyzed using Microsoft Excel, and the results are outlined in the following subsections. The selected features based on the feedback from the participants, where, the feature considers desirable when most of participants selects 4 (important) and 5 (very important). With regard to communication features, most of participants prefer the asynchronous features such as (Forum Discuss, Mail, Announcements, Content Folder, etc.) rather than synchronous communication features.

4.3.2.1 Feedback by the Students

One of the main actors in E-Learning System (E-LS) is student. Hence, their opinion regarding the functions of the E-LS were discovered. There are 23 features of common e-learning system, which this study deduces from literature. However, this study believes that not all features are compulsory for the proposed E-LS. Hence, determining them based on the main actors' feedbacks is the most appropriate way, because eventually they are the people who are going to use the system in their teaching and learning activities. Based on their feedback, the importance of features in E-LS are outlined in Table 4.2.

Table 4. 2

Features Related to Students for E-LS

No.	Features	Not Important	Slightly Important	Not Sure	Important	Very Important
1	Email	0%	0%	0%	42%	58%
2	Announcement, News & Event	0%	0%	0%	25%	75%
3	Calendar	0%	0%	0%	25%	75%
4	Discussion forum	0%	0%	0%	17%	83%
5	Shared Whiteboard	75%	0%	25%	0%	0%
6	Application sharing	75%	0%	25%	0%	0%
7	Video Conferencing	92%	8%	0%	0%	0%
8	Shared bookmarks	0%	0%	0%	67%	33%
9	Syllabus , Curriculum objectives	0%	0%	0%	75%	25%
10	Project Space	83%	17%	0%	0%	0%
11	Online guides and support	0%	0%	0%	75%	25%
12	Self–reflection	83%	17%	0%	0%	0%
13	Online survey or Evaluation	0%	0%	0%	42%	58%
14	Real time chat	0%	0%	0%	33%	67%
15	Content folder	0%	0%	0%	33%	67%

		0%	0%	0%		
16	My progress	0%	0%	0%	83%	17%
17	Assessment and assignment	0%	0%	0%	83%	17%
18	Search Facility	0%	0%	0%	50%	50%
19	Quiz	0%	0%	0%	25%	75%
20	My Grades	0%	0%	0%	42%	58%
21	Personal Workspace	0%	0%	0%	83%	17%
22	Web link	0%	0%	0%	83%	17%
23	Media library	0%	0%	0%	67%	33%

Table 4.2 exhibits that Email, Online survey or Evaluation, and My Grades are preferred to be incorporated into the system, where 42% of the participants said they are important and the other say they are very important. Besides, 75% of the participants said that Announcement, News and Event, Calendar, and Quiz are very important features and 25% believed that they are important. Regarding the Syllabus, Curriculum objectives, Online guides and support, 25% of the participants find them very important and the other 75% find them as important. The trend is similar with My progress, Assessment and assignment, Web link, Personal Workspace and Discussion Forum, in which all participants find them significant to be incorporated in the system. Particularly, 17% of them find them very important while the rest say they are important.

Nevertheless, Shared bookmarks, Media library, Real time chat, and Content folder also significant to be incorporated. Particularly, 63% of the participants believe that Shared bookmarks and Media library are very important and the rest believed they are important, while 33% believe Real time chat and Content folder are very important and 67% say they are important. All the participant believed that search facility is important (50% important and 50% very important.

In contrast to those features, the students believed that Project Space and Self-reflection could be reserved for later inclusion. Particularly, 83% of the participants believe they are not important, while 17% consider it as slightly important. Besides that, 75% of the participants believed that Application sharing and Shared Whiteboard are not important, while the rest are not sure. It is similar with Video Conferencing, with 92% believe it is not important while the rest believed it is slightly important.

4.3.2.2 Feedback by Teachers

While 23 features were addressed to students, teachers were asked a little more, because there are some features only allowed for teachers to do but not allowed for students. This makes the total features asked for their feedbacks are 28. Based on their responses, the results as outlined in Table 4.3 were gathered.

Table 4. 3

Features Related to Teachers for E-LS

No.	Features	Not Important	Slightly Important	Not Sure	Important	Very Important
1	Email	0%	0%	0%	75%	25%
2	Announcement, News & Event	0%	0%	0%	50%	50%
3	Calendar	0%	0%	0%	75%	25%
4	Discussion forum	0%	0%	0%	0%	100%
5	Shared Whiteboard	100%	0%	25%	75%	0%
6	Application sharing	100%	0%	0%	0%	0%
7	Video Conferencing	100%	0%	0%	75%	25%
8	Shared bookmarks	0%	0%	0%	50%	50%
9	Syllabus , Curriculum objectives	0%	0%	0%	100%	0%
10	Frequently Asked Questions (FAQ)	0%	0%	0%	75%	25%
11	Project Space	75%	25%	0%	0%	0%
12	Online guides and support	0%	0%	0%	75%	25%
13	Online survey or Evaluation	0%	0%	0%	75%	25%
14	Curriculum management	0%	0%	0%	100%	0%

15	Real time chat	0%	0%	0%	75%	25%
16	Content folder	0%	0%	0%	100%	0%
17	Assessment and assignment	0%	0%	0%	0%	100%
18	Search Facility	0%	0%	0%	75%	25%
19	Quiz	0%	0%	0%	0%	100%
20	Project tracking	75%	25%	0%	0%	0%
21	Grades book	0%	0%	0%	50%	50%
22	Personal Workspace	0%	0%	0%	50%	50%
23	Web link	0%	0%	0%	100%	0%
24	Media library	0%	0%	0%	100%	0%
25	Expert Services	0%	0%	25%	75%	0%
26	Activity tracking	0%	0%	25%	75%	0%
27	Who's online	0%	0%	0%	100%	0%
28	Self–reflection	83%	17%	0%	0%	0%

Referring to the results in Table 4.3, all participants believe that Syllabus, Curriculum objectives, Curriculum management, Content folder, Web link, Media library, and Who's online are important to include in E-LS. Meanwhile, all participants believe that Quiz, Assessment and assignment, and Discussion forum are very important features. On top of those important features, 75% of the participants also believe that Email, Calendar, Frequently Asked Questions (FAQ), Online guides and support, Online survey or Evaluation, Search Facility and Real time chat are important, and the rest believe that they are very important to be incorporated. Besides that, half of participants believe that Grades book, Personal Workspace, Shared bookmarks, and Announcement, News & Event are important and the other half believe that they are very important. However, 25% of the participants are not sure whether Expert Services and Activity tracking are important while 75% of the participants believe they are important.

Surprisingly, teachers believe that Application sharing, Shared Whiteboard, and Video Conferencing are not important to be incorporated in E-LS. Similarly, only 25% of the participants slightly believe that Project Space and Project tracking are important while 75% of participants believe they are not important.

4.3.2.3 Feedback by the Management of Schools

The management of schools do less in teaching and learning activities. Basically, they do some administrative tasks. Hence, based on the practice in the existing situation, 9 features have been addressed to the participating managers for them to feedback to this study. Having gathered their feedback, the results are detailed in Table 4.4.

Table 4. 4

Features Related to the Management of School for E-LS

No.	Features	Not Important	Slightly Important	Not Sure	Important	Very Important
1	Email	0%	0%	0%	100%	0%
2	Announcement, News & Event	0%	0%	0%	0%	100%
3	Calendar	0%	0%	0%	0%	100%
4	Grade book	0%	0%	0%	100%	0%
5	Orientation/ help	0%	0%	0%	100%	0%
6	Syllabus, Curriculum objectives	100%	0%	0%	0%	0%
7	Creation of course	0%	0%	0%	0%	100%
8	Management of course	0%	0%	0%	0%	100%
9	Real time chat	0%	0%	0%	100%	0%

It is seen in Table 4.4 that the managers agree on all features. They are important to be incorporated in the E-LS except for Syllabus and Curriculum objective (all participants

believe that it not important). In detail, the managers believe that Email, Grade book, Orientation/help, and Real time chat are important features, and that Management of course, Creation of course, Calendar, and Announcement, News & Event are very important features.

4.3.2.4 Feedback by Parents

While the management of schools have less roles in teaching and learning activities, parents have lesser than that. Hence, this study proposed eight features to them, based on their roles in the existing practice. Having their feedbacks collected, the results are detailed in Table 4.5.

Table 4. 5

Features Related to Parents for E-LS

No.	Features	Not Important	Slightly Important	Not Sure	Important	Very Important
1	Email	0%	0%	17%	50%	33%
2	Announcement, News & Event	0%	0%	0%	0%	100%
3	Grade book	0%	0%	0%	33%	67%
4	Online survey or Evaluation	0%	0%	0%	67%	33%
5	Real time chat	0%	0%	0%	33%	67%
6	Orientation/ help	0%	0%	33%	50%	17%
7	Calendar	0%	0%	0%	0%	100%

Table 4.5 showcases that all parents involved in this study agree that it is necessary to incorporate all features in E-LS. Particularly, all participants believe that Announcement, News & Event and Calendar features are very important. Meanwhile, 67% of the participants believe that Grade book, and Real time chat are very important while 33% believe that they are important. Online survey or Evaluation is believed very important

by 33% of the participants while 67% believe that they are important. Interestingly, Email is believed by 33% of the respondents as very important, while 50% of the respondents believe that it is important. The remaining 17% are not sure whether it is important. Meanwhile, for Orientation/help, 17% of the participants believe that it is very important, 50% of the participants believe that it is important, and 33% are not sure.

Based on the discussion aforementioned in the previous section, enriched with the feedbacks for the closed-ended questions, this study deduces that the participants of this study asserted on the various benefits from the use E-LS. Particularly, the feedbacks upon the closed-ended question that details the importance of the features, this study believes that the interviewees have honestly expressed their opinion for the benefits of the teaching and learning activities using the E-LS. This could make the learning process and the communication among the stakeholders possible and easier. Therefore, based on the results, the functional requirements are illustrated in Table 4.6.

Table 4. 6

List of Functional Requirements According to Users' Feedback

Functional Requirement	Applicable Use Cases
Real time chat room	Send and receive message to members of the same course or different course
Discussion forum	Post comment on topics discussed under course headings
Calendar (share important dates for events)	Share important dates for events
Sending and receiving e-mail in the course	Sending and receiving e-mail in the course
Announcements	Make announcement as it regards the learning programmes and events
Who's online	See who's active at a moment
Activity tracking	View total, single course time and learner's progress
Create course	Create course to be available

Edit course	Edit the course
Manage Curriculum	Create and edit class
Online survey	Ability to make survey of evaluation for specific subject
Grade book	Share information about grades
Assignment and assessment	Make assignment and receive the answer
Quiz	Mark multiple choices and structured questions
Personal work space	It is a space for every user
Online guides/ help	To support or advice the learner
Expert services	For giving knowledge and source to learner
Search facility	Search in the course
Shared bookmarks	Share bookmarks between student and teacher
Content folder /Data collection	Share folder
Syllabus /Lessons plans	Upload syllabus or curriculum objectives by teacher
Media library	Share media files
Web link	The teacher share web link with student
Frequently Asked Questions	View FAQ section

In general, as discussed in the Section 4.3.2, the selected features were chosen based on the feedbacks from the participants, where, the features are considered desirable when most of participants selects "4" (important) and "5" (very important).

4.4 The Expert Review

In this section the requirements were selected by the users (teachers, students, parents and managers) checked by three experts from secondary school to ensure all the important requirements are covered (see appendix H). The experts were selected based on their strong background in IT and learning, where each of them has more than 10 years of experience. The details of the experts' profile are presented in Appendix G. Table 2.7 shows the selection of requirements by 3 experts which are represented as Expert A, Expert B and Expert C.

Table 4. 7

The Experts' Feedback

Module	Functional Requirement	Expert A			Expert B			Expert C			Total		
		Yes	No	I don't know	Yes	No	I don't know	Yes	No	I don't know	No. Yes	No. No	No Don't Know
Communication & Community participation	Real time chat room	√				√		√			2	1	0
	Course community discussion forum	√			√			√			3	0	0
	Video conferencing		√		√				√		1	2	0
	Calendar (share Important Dates For Events)	√			√			√			3	0	0
	Sending and receiving e-mail in the course	√			√			√			3	0	0
	Announcements	√			√			√			3	0	0
	Share white board	√			√			√			3	0	0
	Who's online	√				√			√		1	2	0
	Application sharing		√		√				√		1	2	0
Manage Course	Create course	√			√			√			3	0	0
	Update course	√			√			√			3	0	0
Manage Curriculum	Create curriculum	√			√			√			3	0	0

	Upload material	√			√			√			3	0	0
	Download material	√			√			√			3	0	0
	Set list of eligible learners	√				√		√			2	1	0
	Set maximum participant of a class		√			√			√		0	3	0
Evaluate Learners	View activity tracking	√			√			√			3	0	0
	Self-reflection		√		√				√		1	2	0
	Project progress		√		√				√		1	2	0
	Online survey	√			√			√			3	0	0
	Grade book	√			√			√			3	0	0
	Assignment and assessment	√			√			√			3	0	0
	Quiz	√			√			√			3	0	0
Learning Tools	Project space		√		√				√		1	2	0
	Personal work space	√			√			√			3	0	0
	Expert services		√			√			√		0	3	0
	Online guides/ help	√			√			√			3	0	0
Share Repository	Search facility	√			√			√			3	0	0
	Shared bookmarks		√			√		√			1	2	0
	Content folder /Data collection	√			√			√			3	0	0
	Syllabus /Lessons plans	√			√			√			3	0	0
	Media library	√			√			√			3	0	0
	Web link	√			√			√			3	0	0
	Frequently Asked Questions	√			√			√			3	0	0

The selected requirements based on the feedback from the experts, where, the requirement considers desirable when two experts select (yes). The result from the experts' review shows some requirements need to be included such as share white board as well as manage user (create, edit and delete user). While, some of the requirements are not necessary or duplicate, for instance who's online (with real time

chat) and shared bookmarks (with upload and download materials). Table 2.8

presented the final list of requirements after the experts' feedback.

Table 4. 8

The Final List of Requirements

Module	Functional Requirement	Applicable Use Cases
Communication & Community participation	Real time chat room	Send and receive message to members of the same course or different course
	Course community discussion forum	Post comment on topics discussed under course headings
	Calendar (share Important Dates For Events)	Share important dates for events
	Sending and receiving e-mail in the course	Sending and receiving e-mail in the course
	Announcements	Make announcement as it regards the learning programmes and events
	Share white board	Write texts or draw pictures and give explanation at the same time
Manage Course	Create course	Create course to be available
	Update course	Edit the course
Manage Curriculum	Create curriculum	Create class to be available
	Upload material	Upload class material
	download material	Download class material
	Set list of eligible users	Access courses based on authentication
Evaluate Learners	Activity tracking	View total, single course time and learner's progress
	Online survey	Ability to make survey of evaluation for specific subject
	Grade book	Share information about grades
	Assignment and assessment	Make assignment and receive the answer
	quiz	Mark multiple choices and structured questions
Support learning	Personal work space	It is a space for every user
	Online guides/ help	To support or advice the learner
Share Repository	Search facility	Search in the course
	Content folder/Data collection	Share folder
	Syllabus /Lessons plans	Upload syllabus or curriculum objectives by teacher
	Media library	Share media files

	Web link	The teacher share web link with student
	Frequently Asked Questions	View FAQ section
Manage user	Add new user	The manager add new user in the course
	Update user information	The manager update user information
	Delete user	The manager delete user from the course

These final requirements it is considered comprehensive requirements can help the educational institutions such as schools and ministry of education for designing suitable e-learning systems cover all the user's needs. On the top of that, these requirements will aid the developers of the online learning to develop e-learning system that will be fit with stakeholders needs.

4.5 Summary for Chapter Four

This chapter discusses the requirements of E-LS. Functional requirements are explained. The elementary requirements are suggested from various literatures. Followed by, the analysis of the interviews with the users and experts to conclude the final requirements. More precisely, Chapter 4 consist three levels to identify the functional requirements for e-learning system in secondary schools in Iraq. First, based on the four studies of the requirements (Uţă (2006), Buzzetto-More (2007), Al-Ajlan (2012), Lotfi, et al. (2013)) the researcher elicited all the requirements mentioned in these studies. Thereafter, the present requirements were posted to the users (students, teachers, parents and managers of schools) to highlight the important requirements need in the education process. Finally, the outcome from the users was given to the expert to result the final requirements for e-learning system of the secondary schools.

CHAPTER FIVE
THE FUNCTIONAL REQUIREMENTS MODEL

5.1 Introduction

This chapter looks into the design of the functional requirements model for e-learning system in secondary school that which are used for interaction among teachers, students, parents and management of schools. The use case diagrams, use case specification, activity diagrams, sequence diagrams and class diagram are all some of the areas that will be looked into during the write up of this chapter. The following diagrams are drawn so that the user understanding of the system can be implemented and used into developing an actual working system.

5.2 The Proposed Functional Requirements Model

This section describes the design and modelling of the proposed functional requirements model using Uniform Modelling Language (UML) tools. Barclay and Savage (2004) stated that the UML diagrams provide developers of software systems to look at the systems developed from different perspectives and varying degrees of abstraction use case diagrams, sequence diagrams and class diagrams are the commonly created diagrams when modelling systems. In this section, building on the previous outcome in the Table 4.9, the final functional requirements which has been identified, as shown in Table 5.1.

Table 5. 1

Functional requirements

Requirement ID	Use Case Name	Requirement Description
FR_01	Login	
FR_01_01		Authenticate user
FR_01_02		validate username/password
FR_02	Manage Curriculum	
FR_02_01		Create Curriculum
FR_02_02		Upload Materials
FR_02_03		Download Materials
FR_02_04		Set list of eligible users
FR_03	Manage Course	
FR_03_01		Create Course
FR_03_02		Edit Course
FR_04	Share Repository	
FR_04_01		Share Content Folder
FR_04_02		Share Web Link
FR_04_03		Share Media Library
FR_04_04		Share Syllabus
FR_04_05		Search Facility
FR_04_06		View FAQ
FR_05	Support Learning	
FR_05_01		View Personal work space
FR_05_02		View Online Guides/ Help
FR_06	Manage Communication	

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FR_06_01		Use Real Time Chat
FR_06_02		Publish Announcements
FR_06_03		Manage Calendar
FR_06_04		Send Mail
FR_06_05		Use Forum
FR_06_06		Share White board
FR_07	Evaluate Students	
FR_07_01		Post Assignment
FR_07_02		Submit Assignment
FR_07_03		Post Quiz
FR_07_04		Submit Quiz
FR_07_05		Post Online Survey
FR_07_06		Submit Online Survey
FR_07_07		Update Grades Book
FR_07_08		View Grades Book
FR_07_09		View Activity Tracking
FR_08	Manage User	
FR_08_01		Add User
FR_08_02		Update User Information
FR_08_03		Delete User

5.2.1 Use Case Diagrams:

The use case diagram is considered as a modelling method in UML that formalizes the functional requirements incorporated in the E-LS. Moreover, the use case diagram describes what the system does from an external side. It describes a series of steps which include actions and interactions between the system and the actors; use cases address the question of how to interact with the actor of the system and describe the actions that the system works (Alhir, 2003). Use cases use scenario as an example for what happens when someone interacts with the system (Ambler, 2009). Each use case diagram includes:

1- Use Case: this describes a sequence of actions that provide something of measurable value to an actor in this research the actors are parents, teachers, students and school management and is drawn as a horizontal eclipse.

2- Actor: an actor is a person, organization or external system that plays a role in one or more interactions with online communication system (Ambler, 2009). Actors are drawn as stick figures.

3- Association: associations between actors and use cases are indicated in use case diagrams by solid lines (Ambler, 2009). An association exists whenever an actor is involved with an interaction described by a use cases.

4- System Boundary: a rectangle around the use cases is called the system boundary box to indicate the scope of the system and anything within the box represents functionality that is in scope and anything outside the box is not. System boundary boxes are rarely used (Alhir, 2003).

The use case diagram that is shown in Figure 5.1 shows the overall operations that will be taking place in the system to model the system functions at a high level which will be broken down to more detailed diagrams.
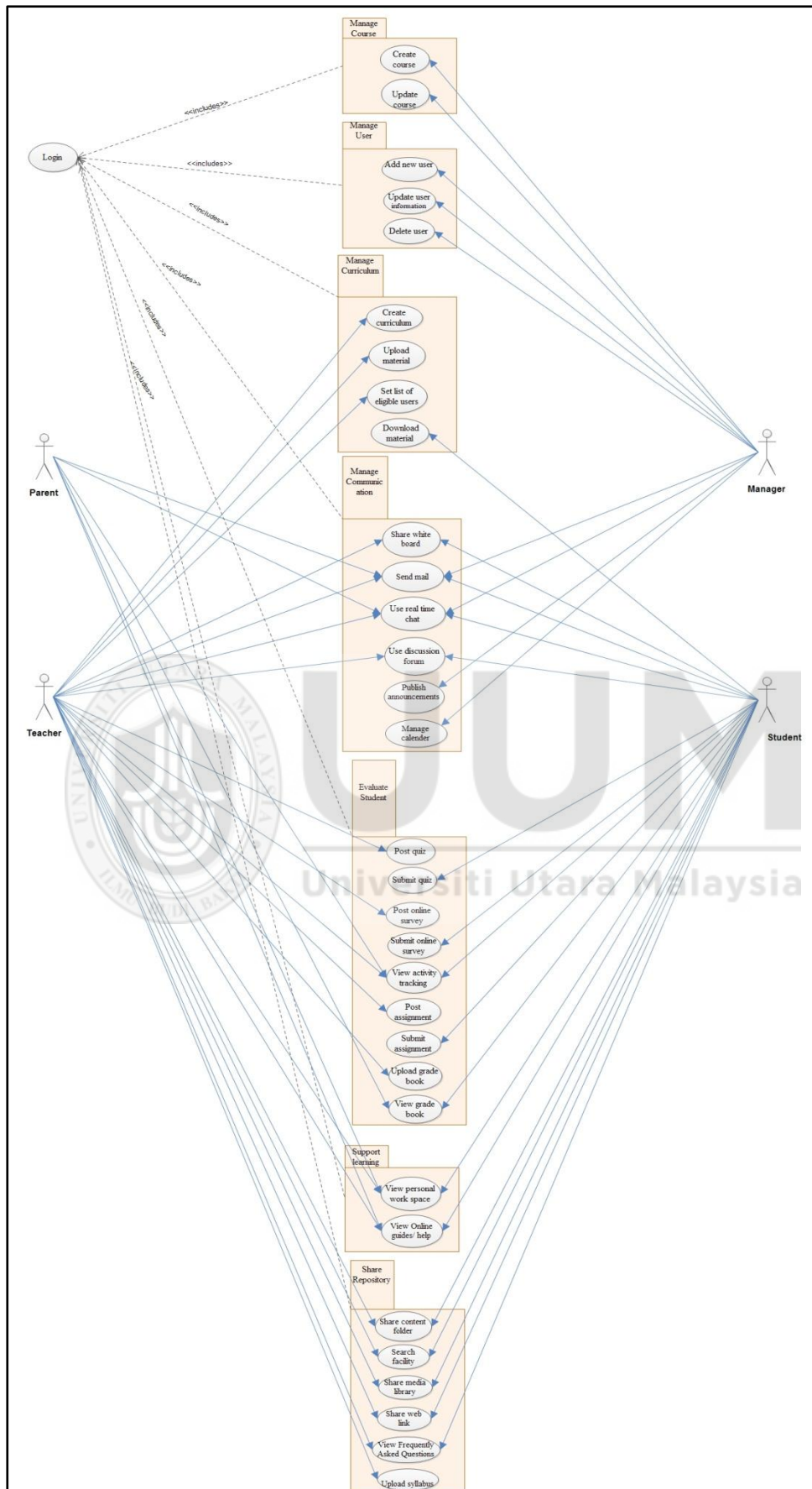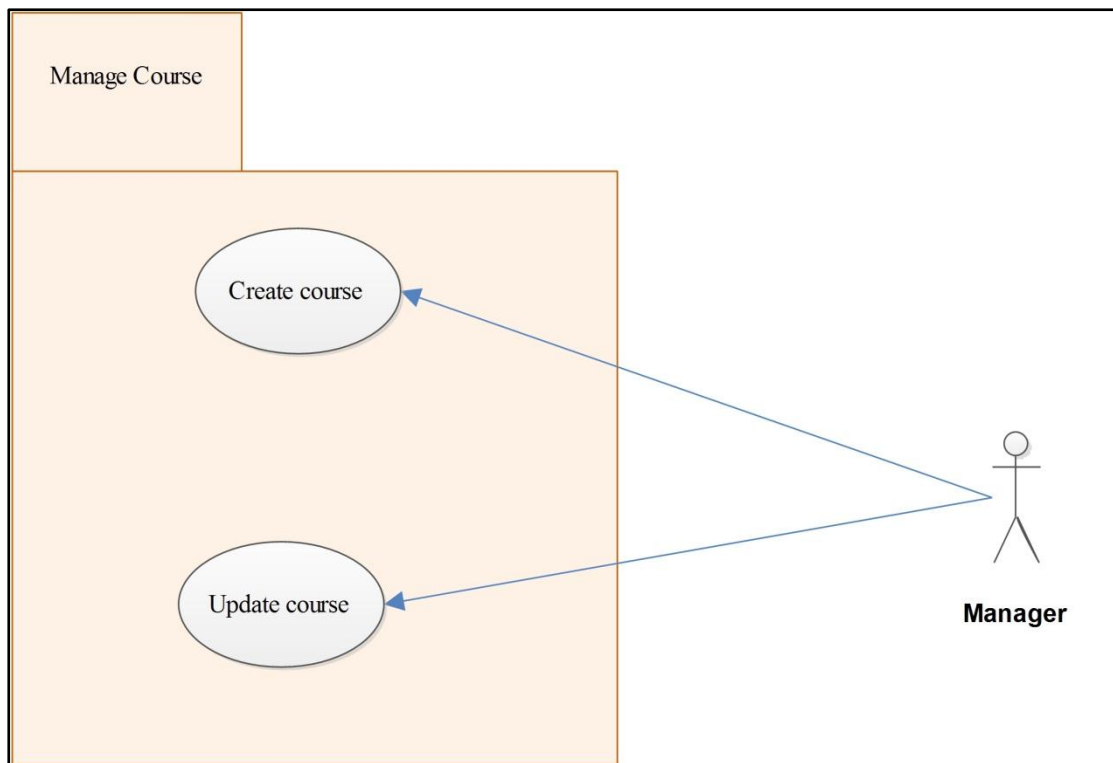
119

Figure 5. 1. Use case Diagram
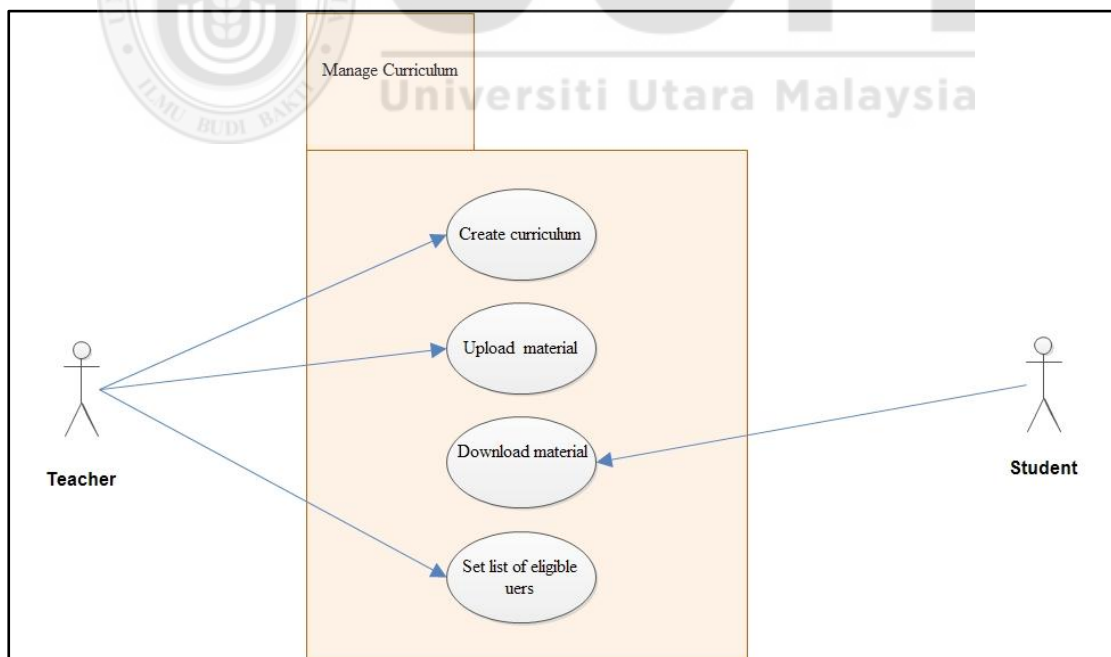
120

Figure 5. 2. Manage Course Use case

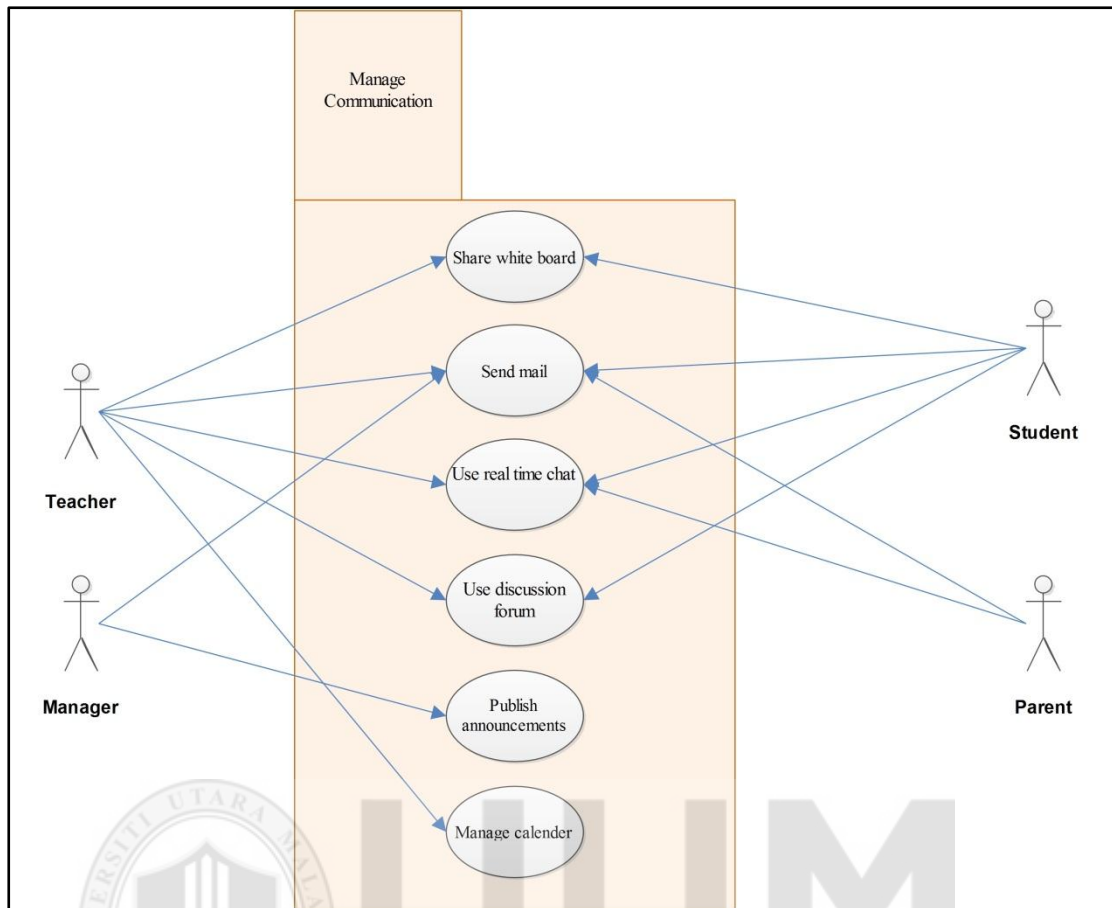*Figure 5. 3. Manage Curriculum Use case*

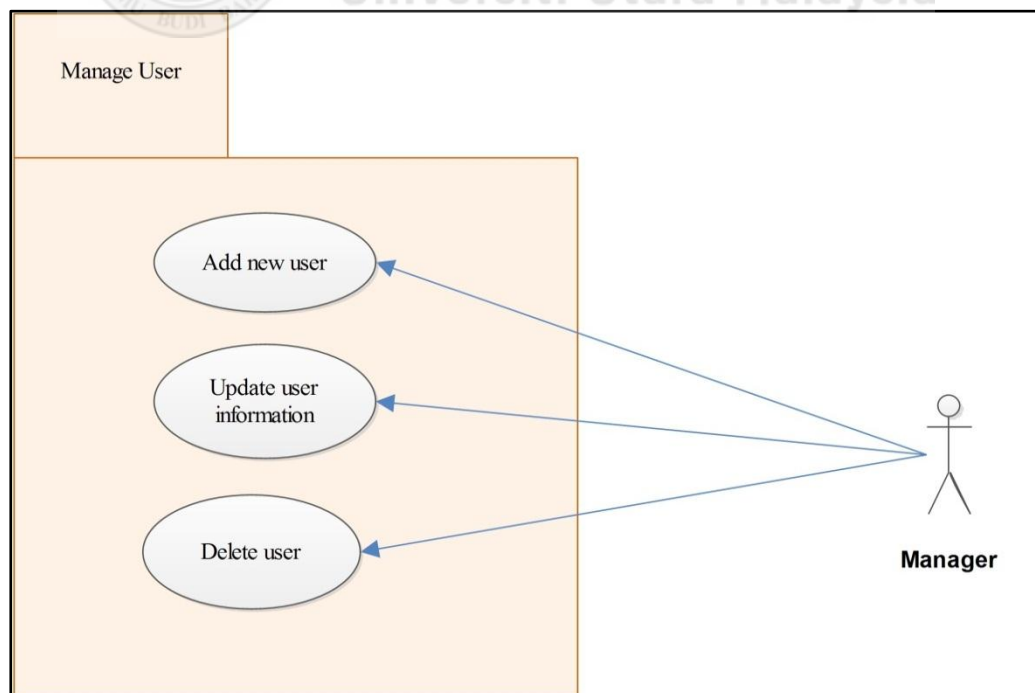121

Figure 5. 4. Manage Communication Use case

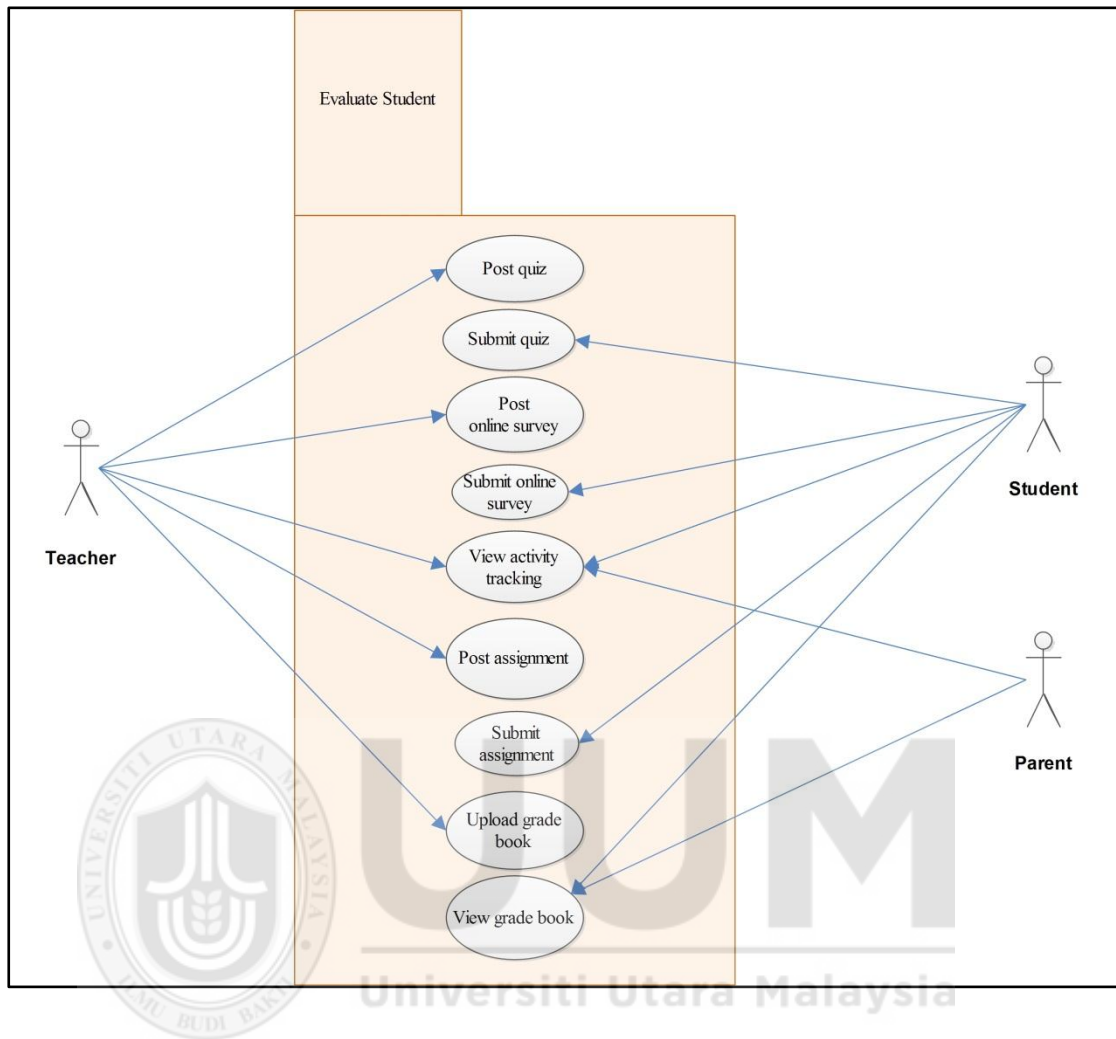*Figure 5. 5.* Manage User Use case

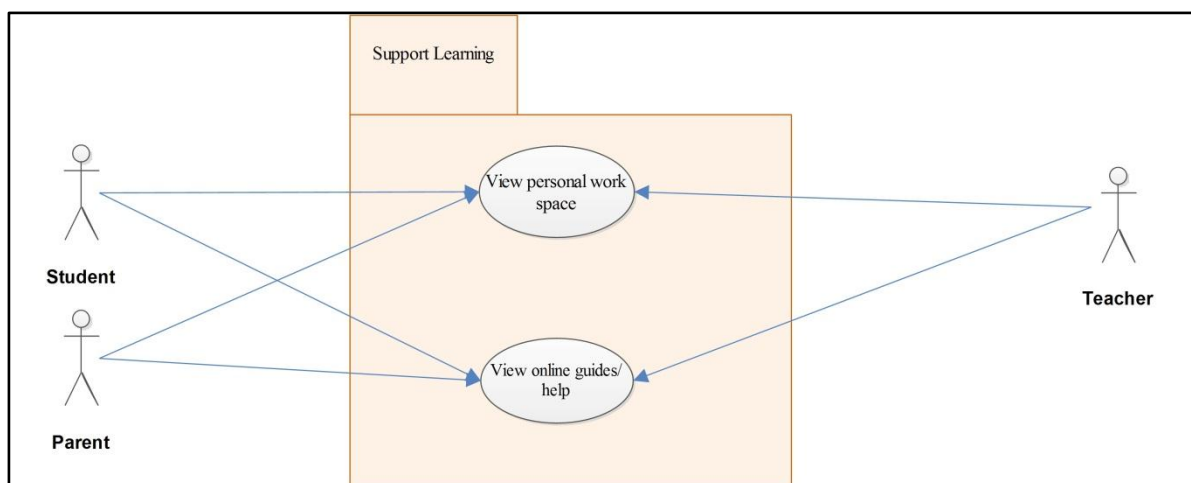122

Figure 5. 6. Evaluate Student Use case
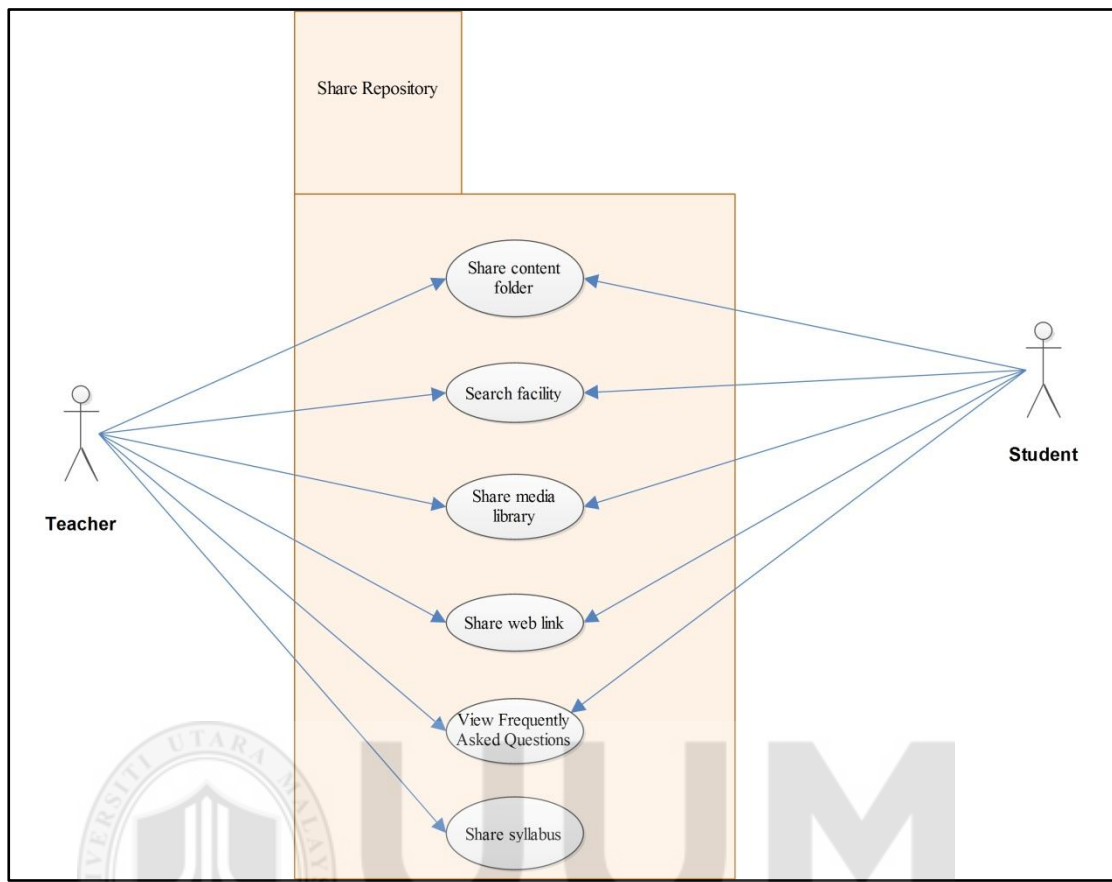

Figure 5. 7. Support Learning Use case

Figure 5. 8. Share Repository Use case

5.2.2 Use Case Specification

The use case specification provides the functionality that the system will support and describes how the actor will use the system in order to obtain specific results of value when using the online communication system (Modern analyst, 2010). The use case specification is described as follows:

Table 5. 2

Use Case Specification for Login System

Use Case Name: Login System	ID: FR_01	Importance Level: High
Primary Actor: 1. Manager 2. Teacher 3. Student 4. Parent	Use case Type: Detail, essential	
Pre-condition: The user must have already enrolled and have user name and password to log in.		
Stakeholder and interest: 1. Manager - wants to manage the system. 2. Teacher - wants to manage his class such as add notes, quiz, assignment, etc. 3. Student - wants to view the system. 4. Parent- wants to view his student progress.		
Brief description: The use case 1 displays the login process. Only enrolled users will have access into the system. Hence, authenticity filter is necessary.		

Normal flow of events: [FR_01_01]
    1. This use case starts when the user clicks on the "login" hyperlink.
    2. The user key-in user name and password to login.
    3. The system verify the user account and password in database.
    4. The system successfully authenticates user account and password and display main menu or [E-1: FR_01_02].		

Sub flows: Not applicable		
Exceptional flows: E-1: Invalid password/username ID [FR_01_02] 1. The system fails to authenticate user account and password entered by user. 2. The system display error login message (to inform invalid password and user ID). 3. The user can choose to either return to the beginning of the normal flow or cancel the login which ends the use case.		

Table 5. 3

Use Case Specification for Manage Curriculum

Use Case Name: Manage Curriculum	ID: FR_02	Importance Level: High

Primary Actor:
  1. Teacher
  2. Student
	Use case Type:
	Detail, essential	

Pre-condition: The user must login into the system.		

Stakeholder and interest:
  1. Teacher - wants to manage his class such as add notes and materials.
  2. Student - wants to download the class materials.		

Brief description: The use case 2 describes how the teacher manages the class.		

Normal flow of events:
Create Curriculum [FR_02_01]
  1. This use case starts when the teacher clicks on "administration" hyperlink.
  2. The system displays the menu of administration section.
  3. The teacher clicks on the "create class" button
  4. The system responds to the instruction and opens the new class page.
  5. The teacher fills the desired information such as name, short name and summary.
  6. The teacher clicks the "create" button.
  7. The system saves the information and add new class.
  8. If the teacher selects upload materials go to [S1: FR_02_02].
  9. If the student selects download materials go to [S2: FR_02_03].
  10. If the teacher selects set list of eligible users go to [S3: FR_02_04].		

Sub flows:
S1: Upload Materials [FR_02_02]
  1. The teacher selects the class that need to be updated.
  2. The teacher clicks on "Edit" hyperlink for specific class.
  3. The teacher updates the class by uploading new materials.
  4. The teacher adds the details of new materials such as name, description, appearance details, availability details and so on.
  5. The teacher clicks on "Save" button to save the changes.
  6. The system informs that the class has been updated.
 	
S2: Download Materials [FR_02_03]
  1. The student selects the specific class.
  2. The student clicks on material that need to download it.
  3. The system downloads the material.
 	
S3: Set list of eligible users [FR_02_04]
  1. The teacher clicks on "Administration" hyperlink.
  2. The system displays the menu of administration section.
  3. The teacher selects "users" menu from list.
  4. The teacher selects enrol user button.
  5. The system display list of user who register in course.		

| 6. The teacher choice the user from the list. |
| 7. The teacher determines the role for each user such as teacher, student and parent. |
| 8. The teacher click "enroll" button and "finish" button. |
| 9. The system adds the selected user in the class with determined role. |

Alternate/exceptional flows:
Not applicable

Table 5. 4

Use Case Specification for Manage Course

Use Case Name: Manage Course	**ID:** FR_03	**Importance Level:** High
Primary Actor: 1. Manager	**Use case Type:** Detail, essential	
Pre-condition: The Manager must login into the system.		
Stakeholder and interest: 1. Manager - wants to create or edit the course.		
Brief description: The use case 3 describes how the manager creates and manages the course.		
Normal flow of events: **Create Course [FR_03_01]** 1. This use case starts when the manager clicks on the "create course" button. 2. The system responds to the instruction and opens the new course page. 3. The manager click on "Manage Courses and Categories" hyperlink. 4. The system displays the new page with create course and category options. 5. The manager click on "Create Course" hyperlink. 6. The system displays the form for course information. 7. The manager of school fills the desired information such as name, course number, description, ID, format, course layout and choose students/teachers to assign to the course. 8. The manager of school clicks the "Save and Return" button. 9. The system save the information and add new course. 10. If the manager select edit course go to [S-1: FR_03_02].		
Sub flows: **S-1: Edit Course [FR_03_02]** 1. The manager selects the course that need to be updated. 2. The manager clicks on "Edit Setting" hyperlink. 3. The system displays the information of selected course. 4. The manager changes and edits the information of selected course. 5. The manager click on "Save and Display" button to save the new changes of course. 6. The system informs that the course has been updated.		

Table 5. 5

Use Case Specification for Share Repository

Use Case Name: Share Repository	ID: FR_04	Importance Level: High

Primary Actor:
  1. Teacher
  2. Student
	Use case Type:
	Detail, essential	

Pre-condition: The user must login into the system.		

Stakeholder and interest:
  1. Teacher - wants to share information.
  2. Student - wants to view the shared information.		

Brief description: The use case 4 describes how the teacher share the information with students.		

Normal flow of events:
Share Content Folder [FR_04_01]
    1. This use case starts when the teacher clicks on the "add activity and source" button.
    2. The system responds to the instruction and opens the list of activities.
    3. The teacher selects add folder from the list.
    4. The system displays the form for folder information.
    5. The teacher fills the desired information such as subject, summary and uploads the files.
    6. The teacher clicks the "save" button.
    7. The system save the information and add the folder.
    8. The student click on the folder link.
    9. The system displays the detail of the folder.
    10. If the teacher selects share web link go to [S-1: FR_04_02].
    11. If the teacher selects share media library go to [S-2: FR_04_03].
    12. If the teacher selects share syllabus go to [S-3: FR_04_04].
    13. If the teacher selects search facility go to [S-4: FR_04_05].
    14. If the teacher selects view FAQ go to [S-5: FR_04_06].		

Sub flows:
S-1: Share Web Link [FR_04_02]
    1. This use case starts when the teacher clicks on the "add activity and source" button.
    2. The system responds to the instruction and opens the list of activities.
    3. The teacher selects add URL from the activities list.
    4. The system displays the form for adding URL information.
    5. The teacher fills the desired information such as name, description, location, determines who student can see it and adds the link.
    6. The teacher clicks the "Save and Display" button.
    7. The system saves the new URL and its details and displays it.
    8. The student views the web link after added by clicks the hyperlink of activity.
    9. The system displays the detail of the activity.		

S-2: Share Media Library [FR_04_03]
1. This use case starts when the teacher clicks on the "add activity and source" button.
2. The system responds to the instruction and opens the list of activities.
3. The teacher selects add media library from the activities list.
4. The system displays the form for media library information.
5. The teacher fills the desired information of this activity such as name, description, location and can select who student can see it.
6. The teacher clicks the "Save and Display" button.
7. The system saves the information and add media library.
8. The student views the web media library after added by clicks the hyperlink of the activity.
9. The system displays the detail of the media library activity.

S-3: Share Syllabus [FR_04_04]
1. This use case starts when the manager clicks on the "add activity and source" button.
2. The system responds to the instruction and opens the list of activities.
3. The teacher selects add file from the activity list.
4. The system displays the form of file information such as name, description, and so on.
5. The teacher fills the desired information and uploads the syllabus file.
6. The teacher clicks the "Save and Display" button.
7. The system saves the information and add the syllabus file.
8. The student can view the file by click on it.
9. The system displays the syllabus file.

S-4: Search Facility [FR_04_05]
1. This use case starts when the user presses on the "search" box.
2. The teacher/student enters the word that want search about it.
3. The teacher/student clicks on "search" button.
4. The system responds to the instruction and lists the matched words.

S-5: View FAQ [FR_04_06]
1. This use case starts when the student press on the "FAQ" hyperlink.
2. The system responds to the instruction and display the FAQ page.
3. The student views the information of FAQ page.

Alternate/exceptional flows:
Not applicable

Table 5. 6

Use Case Specification for Support Learning

Use Case Name: Support Learning	ID: FR_05	Importance Level: High

Primary Actor:
   1. Student
   2. Teacher
   3. Parent
	Use case Type:
	Detail, essential	

Pre-condition: The user must login into the system.		

Stakeholder and interest:
   1. Student - wants to view the information.
   2. Teacher - wants to view the information.
   3. Parent - wants to view the information.		

Brief description: The use case 5 describes how the student views the information of support learning.		

Normal flow of events:
View Personal work space [FR_05_01]
   1. This use case starts when the user click on "Home" hyperlink.
   2. The system responds to the instruction and opens the personal work space page.
   3. The user views the personal work space.
   4. If the user selects view online guide go to [S-1: FR_05_02].		

Sub flows:
S-1: View Online Guides/ Help [FR_05_02]
   1. This use case starts when the user click on the "online guide" hyperlink.
   2. The system responds to the instruction and display the online guide page.
   3. The user views the information of online guide page.		

Alternate/exceptional flows: Not applicable		

Table 5. 7

Use Case Specification for Manage Communication

Use Case Name: Manage Communication	ID: FR_06	Importance Level: High

Primary Actor:
   1.Manager
   2.Teacher
   3.Student
   4. Parent
	Use case Type:
	Detail, essential	

Pre-condition: The user must login into the system.		

Stakeholder and interest:
    1. Manager – wants to add announcements, calendar and communicate with parents.
    2. Teacher - wants to communicate with students and parents.
    3. Student - wants to communicate with teachers.
    4. Parent - wants to communicate with teachers and manager.

Brief description:
The use case 6 describes how the users communicate with each other.

Normal flow of events:
Use Real Time Chat [FR_06_01]
    1. This use case starts when the user clicks on the "add activity and source" button.
    2. The system responds to the instruction and opens the list of activities.
    3. The user selects add chat from the activity list.
    4. The system displays the form of chat information such as room name, description, date, Room ID, and mode.
    5. The user fills the desired information of chat activity.
    6. The user clicks the "Save and Display" button.
    7. The system save the information and add new chat link.
    8. The user can use chat and communicate with each other by click the chat icon.
    9. The system displays the chat room.
    10. The user can update the chat by click on "chat setting" button.
    11. The system displays the setting page.
    12. The user changes the setting and click on save changes.
    13. The user can delete the chat by click on delete button.
    14. If the teacher select publish announcements go to [S-1: FR_06_02].
    15. If the teacher select manage calendar go to [S-2: FR_06_03].
    16. If the teacher select display mail go to [S-3: FR_06_04].
    17. If the teacher select display forum go to [S-4: FR_06_05].
    18. If the teacher select share white board go to [S-5: FR_06_06].

Sub flows:
S-1: Publish Announcements [FR_06_02]
1. This use case starts when the manager clicks on the "announcements" button.
2. The system responds to the instruction and opens the announcements page.
3. The teacher fills the desired information such as name and upload file.
4. The teacher clicks the "save changes" button.
5. The system saves the changes and add the announcement.
6. The user views the announcements after added by click the announcements button.
7. The system displays the detail of announcement.
8. The teacher can edit the announcements by click on announcements setting.
9. The system displays the setting page.
10. The teacher changes the setting and click on save changes.
11. The teacher can delete the announcement by click on delete button.

S-2: Manage Calendar [FR_06_03]
1. This use case starts when the manager clicks on the "calendar" block.
2. The system responds to the instruction and opens the calendar page.
3. The teacher fills the desired information such as determine date and add event.
4. The teacher clicks the "save changes" button.

5. The system saves the changes and add the event.
6. The user views the calendar after updated by click the calendar block.
7. The system displays the determined events.
8. The teacher can edit the calendar by click on calendar setting.
9. The system displays the setting page.
10. The teacher changes the setting and click on save changes.
11. The teacher can delete calendar by click on delete button.

S-3: Send Mail [FR_06_04]
1. This use case starts when the user clicks on the "mail" button.
2. The system responds to the instruction and opens the mail page.
3. The user fills the desired information such as the receiver and the subject.
4. The user clicks the "send" button.
5. The user receives the mail.
6. The user can delete the mail by choose it and click delete

S-4: Use Forum [FR_06_05]
1. This use case starts when the teacher clicks on the "add activity and source" button.
2. The system responds to the instruction and opens the list of activities.
3. The teacher selects add forum discuss from the list.
4. The system displays the form for forum information
5. The teacher fills the desired information such as subject, description.
6. The teacher clicks the "save changes" button.
7. The system saves the information and create new forum.
8. The student can discuss and communicate with each others by click the forum.
9. The system displays the forum discussion page.
10. The teacher can edit the forum by click on forum setting.
11. The system displays the setting page.
12. The teacher changes the setting and click on save changes.
13. The teacher can delete forum by click on delete button.

S-5: Share White board [FR_06_06]
1. This use case starts when the teacher clicks on the "add activity and source" button.
2. The system responds to the instruction and opens the list of activities.
3. The teacher selects add white board from the list.
4. The system displays the page for white board.
5. The teacher put the desired information such as draw figures and uploads pictures.
6. The teacher clicks the "save" button.
7. The system saves the information.
8. The student views the white board after uploaded by click the white board.
9. The system displays the white board.
10. The teacher can edit the white board by click on white board setting.
11. The system displays the setting page.
12. The teacher changes the setting and click on save changes.
13. The teacher can delete white board by click on delete button.

Alternate/exceptional flows:
Not applicable

Table 5. 8

Use Case Specification for Evaluate Student

Use Case Name: Evaluate Student	ID: FR_07	Importance Level: High
Primary Actor: 1.Teacher 2.Student 3. Parent	Use case Type: Detail, essential	

Pre-condition:
The user must login into the system.

Stakeholder and interest:
1. Teacher - wants to evaluate his students.
2. Student - wants to view the evaluation.
3. Parent - wants to view the evaluation.

Brief description:
The use case 7 describes how the teacher evaluates his students.

Normal flow of events:
Post Assignment [FR_07_01]
1. This use case starts when the teacher clicks on the "add activity and source" button.
2. The system responds to the instruction and opens the list of activities.
3. The teacher selects add assignment from the list.
4. The system displays the form for assignment information
5. The teacher fills the desired information such as name, description, submission date, submission type, maximum number of uploaded times, maximum attempt and grade method.
6. The teacher clicks the "save changes" button.
7. The system saves the information and display assignment link.
8. If the student selects submit assignment go to [S-1: FR_07_02].
9. If the teacher selects post quiz go to [S-2: FR_07_03].
10. If the student selects submit quiz go to [S-3: FR_07_04].
11. If the teacher selects post online survey go to [S-4: FR_07_05].
12. If the teacher selects submit online survey go to [S-5: FR_07_06].
13. If the teacher selects upload grades book go to [S-6: FR_07_07].
14. If the student/parent selects view grades book go to [S-7: FR_07_08].
15. If the user selects view activity tracking go to [S-8: FR_07_09].
16. The teacher can edit the assignment by click on assignment setting.
17. The system displays the setting page.
18. The teacher changes the setting and click on save changes.
19. The teacher can delete assignment by click on delete button.

Sub flows:
S-1: Submit Assignment [FR_07_02]
1. The student click on the assignment link.
2. The system displays the assignment page.
3. The student answer the assignment.
4. The student clicks "submit" button.
5. The system informs teacher that the assignment has been submitted.

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S-2: Post Quiz [FR_07_03]
1. This use case starts when the teacher clicks on the "add activity and source" button.
2. The system responds to the instruction and opens the list of activities.
3. The teacher selects add quiz from the list.
4. The system displays the form for quiz information.
5. The teacher fills the desired information such as name, description, timing, maximum attempts, grade method, questions order and question behaviour.
6. The teacher clicks the "save changes" button.
7. The system saves the changes and display the quiz link.
8. The teacher clicks edit quiz to add the questions inside it.
9. The system displays the quiz page.
10. The teacher clicks "create a new question" button.
11. The system responds to the instruction and opens the list of question types.
12 The teacher selects the question type and click "Next" button.
13. The system displays the question page.
14. The teacher fills the desired information such as the question content, grade, the correct answer.
15. The teacher clicks the "save changes" button.
16. The system saves the changes.

S-3: Submit Quiz [FR_07_04]
1. The student clicks on the quiz link.
2. The system displays the quiz page.
3. The student answers the questions of quiz.
4. The student clicks "submit" button.
5. The system informs teacher that the assignment has been submitted.
6. The system displays the mark.

S-4: Post Online Survey [FR_07_05]
1. This use case starts when the teacher clicks on the "add activity and source" button.
2. The system responds to the instruction and opens the list of activities.
3. The teacher selects add online survey & evaluation from the list.
4. The system displays the form for survey information
5. The teacher fills the desired information such as name, description and attachment file or picture and determines who can see it.
6. The teacher clicks the "save changes" button.
7. The system saves the changes and add the survey link.
8. The teacher can edit the survey by click on survey setting.
9. The system displays the setting page.
10. The teacher changes the setting and click on save changes.
11. The teacher can delete survey by click on delete button.

S-5: Submit Online Survey [FR_07_06]
1. The student clicks on the survey link.
2. The system displays the survey page.
3. The student answers the survey questions.
4. The student clicks "submit" button.

S-6: Update Grades Book [FR_07_07]
1. The teacher selects the specific class.
2. The teacher selects the grade administration.
3. The teacher selects the grades book that need to be updated.
4. The teacher clicks on "import" hyperlink to add the students' grade.
5. The teacher updates the grades book by importing the grade from external files.
6. The teacher clicks on the "upload Grade" button to save the grade.
7. The system informs that the grades book has been updated.

S-7: View Grades Book [FR_07_08]
1. The student/parent selects the Administration section in main page.
2. The student/parent presses the "Grade Administration" hyperlink from administration section.
3. The student/parent clicks on the "Overview Report" hyperlink to view the overall details.
4. The student/parent clicks on the "Grade" hyperlink from class section to view the grades.
5. The system displays the grades for student.

S-8: View Activity Tracking [FR_07_09]
1. The user selects the "Administration" section in main page.
2. The user clicks on the "activity tracking" button inside the specific class.
3. The system responds to the instruction and opens activity tracking page that include total time spent on learning, time spent on a single course, time spent on test and assessment and learners' progress report.
4. The user views the activity tracking.

Alternate/exceptional flows:
Not applicable

Table 5. 9

Use Case Specification for Manage User

Use Case Name: Manage User	ID: FR_08	Importance Level: High
Primary Actor: 1. Manager	Use case Type: Detail, essential	
Pre-condition: The Manager must login into the system.		
Stakeholder and interest: 1. Manager - wants to add, update and delete user.		
Brief description: The use case 8 describes how the manager manages the user.		
Normal flow of events: **Add User [FR_08_01]** 1. The manager clicks on "Administration" hyperlink. 2. The system displays the menu of administration section. 3. The manager selects "users" menu from list.		

4. The system displays the menu of user choice.
5. The manager selects "Add New User" hyperlink.
6. The system displays the form of information for new user
7. The manager fills the details of new user.
8. The manager clicks "Create" button.
9. System creates user and save it information.
10. If the manager selects update user information go to [S-1: FR_08_02].
11. If the manager selects delete user go to [S-2: FR_08_03].

Sub flows:

S-1: Update User Information [FR_08_02]

1. The manager clicks on "Administration" hyperlink.
2. The system displays the menu of administration section.
3. The manager selects "users" menu from list.
4. The system displays the list of users.
5. The manager selects the user who want edit it.
6. The system displays the information for the user.
7. The manager updates the information of the user.
8. The manager clicks "save changes" button.
9. The system informs that the user has been updated.

S-2: Delete User [FR_08_03]

1. The manager presses on "Administration" hyperlink.
2. The system displays the menu of administration section.
3. The manager selects "users" menu from list.
4. The system displays the list of users.
5. The manager clicks on the user who want delete it.
6. The manager clicks "delete" button.
7. The system displays massage "are you sure want delete this user".
8. The manager presses "yes" button.
9. The system informs that the user has been deleted.

Alternate/exceptional flows:

Not applicable

5.2.3 Activity Diagram

Activity diagrams are typically used for business process modelling which could be capturing a single use case (Ambler, 2009). In this study the activity diagrams are used to model each use case diagram as shown in this section.
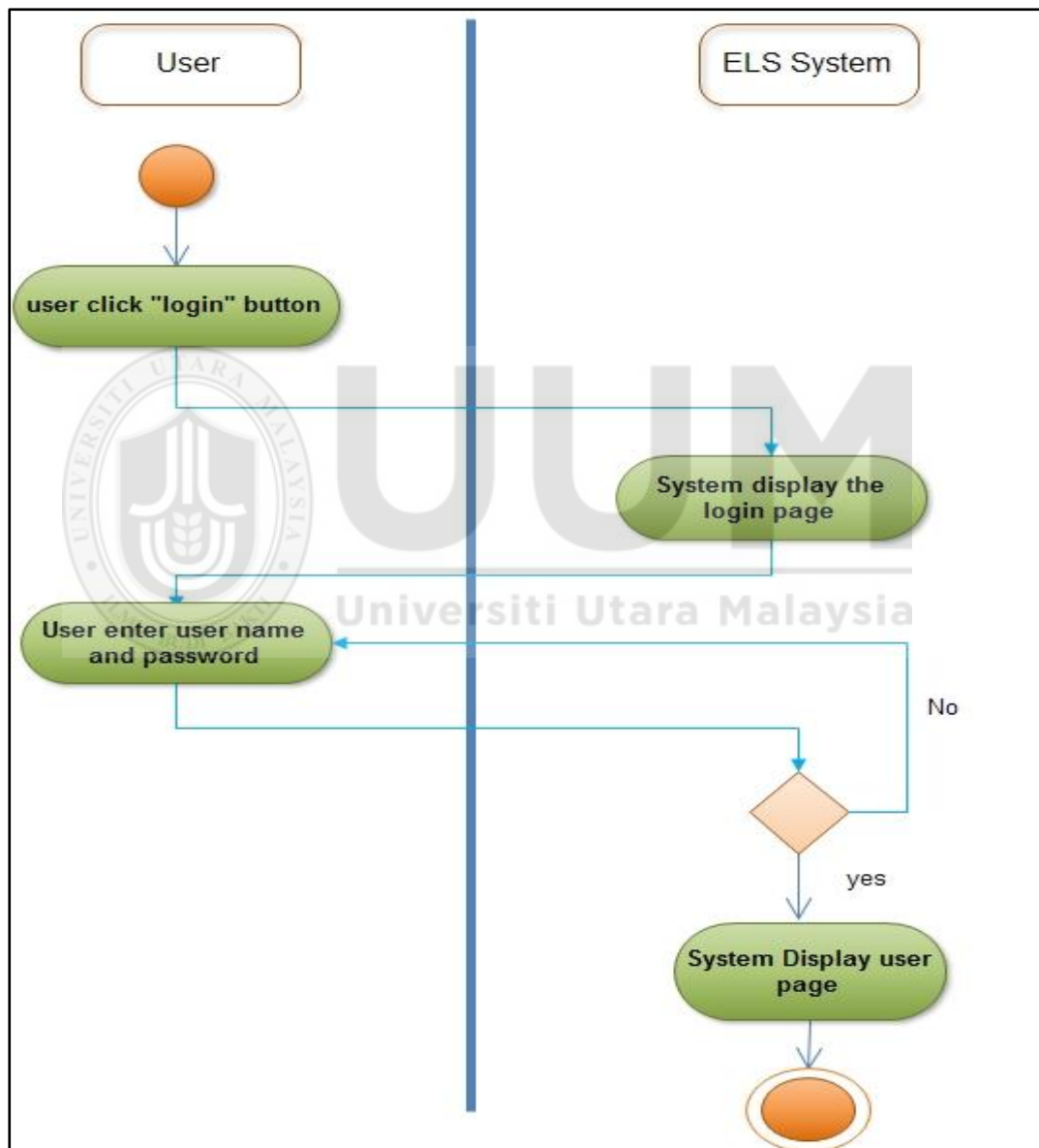
Figure 5. 9. Login Activity Diagram
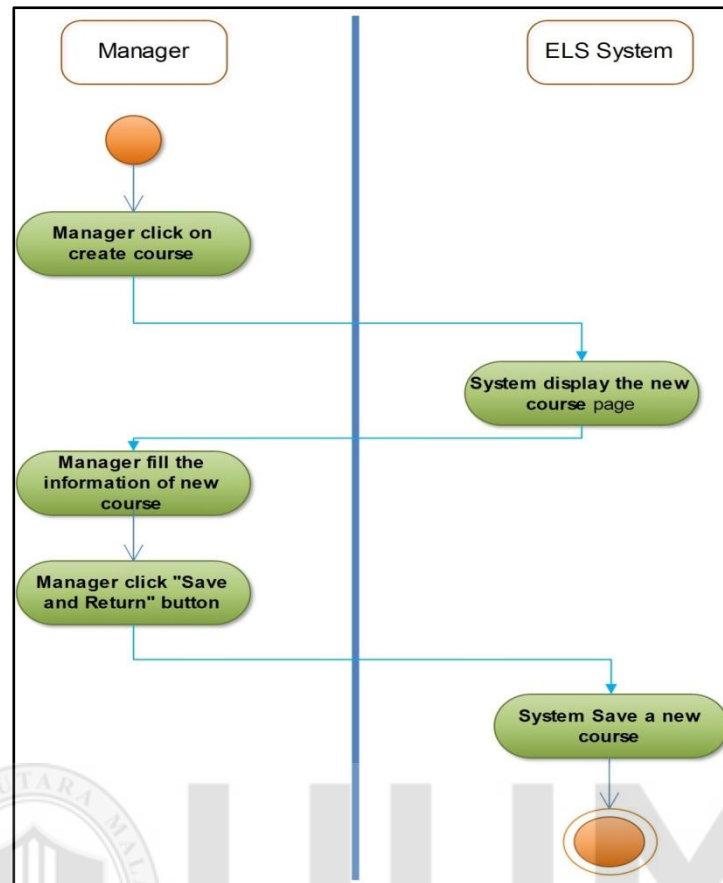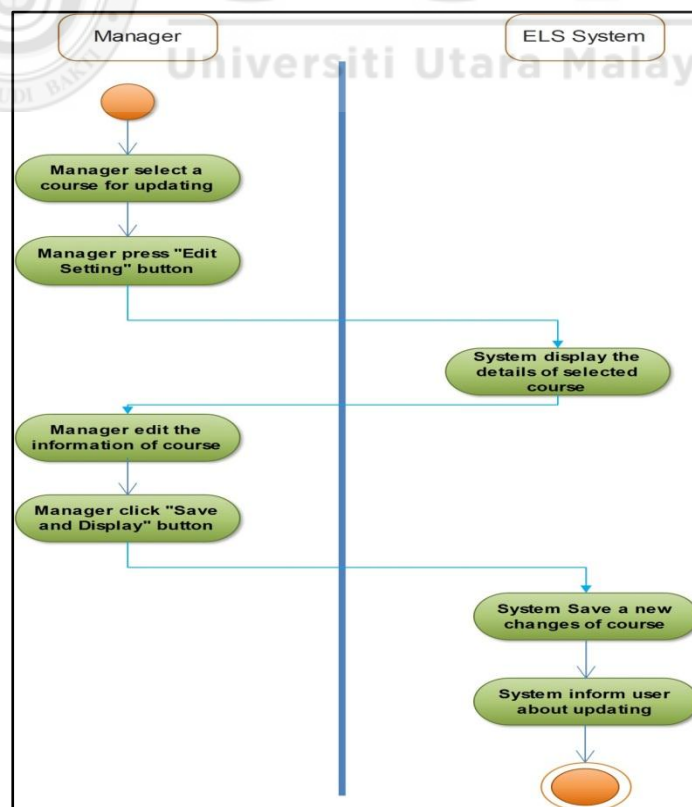
Figure 5. 10. Create course Activity Diagram
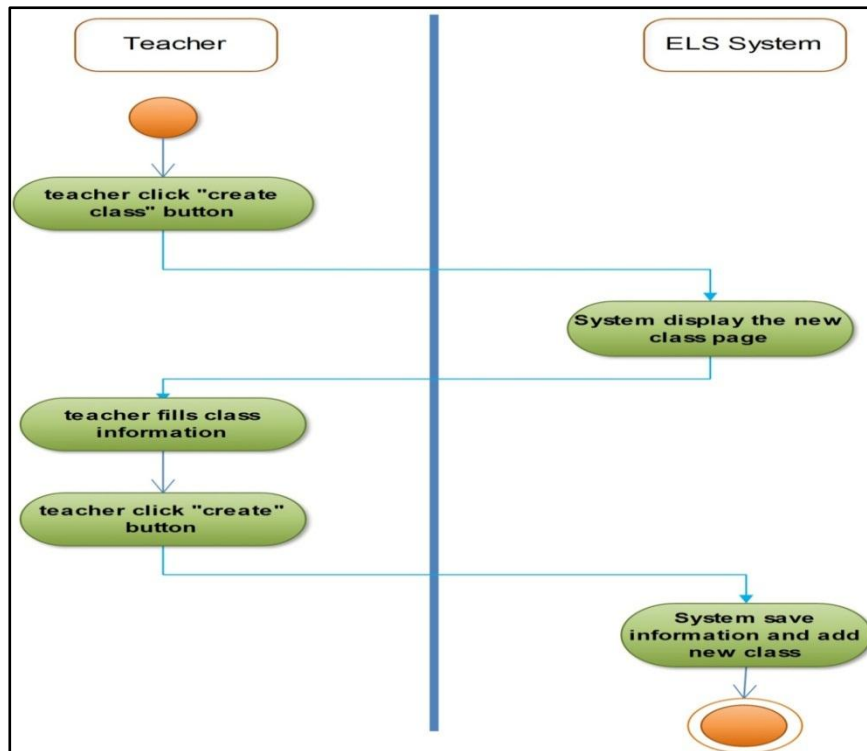

Figure 5. 11. Edit course Activity Diagram
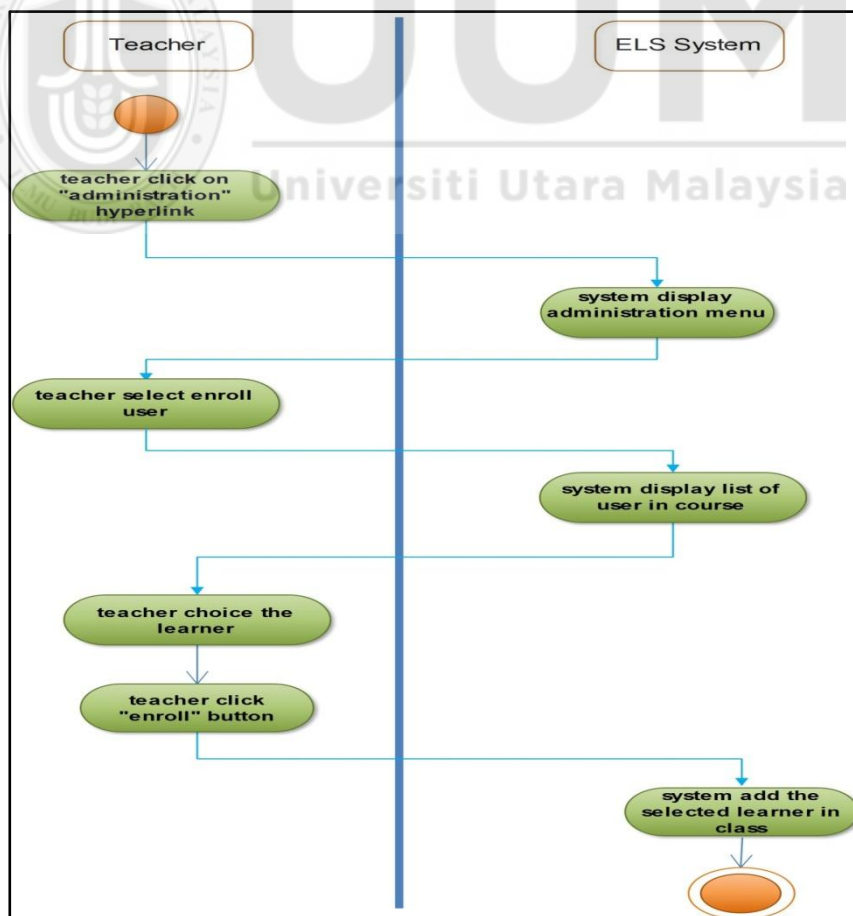
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Figure 5. 12. Create Class Activity Diagram

Figure 5. 13. Set Eligible User Activity Diagram
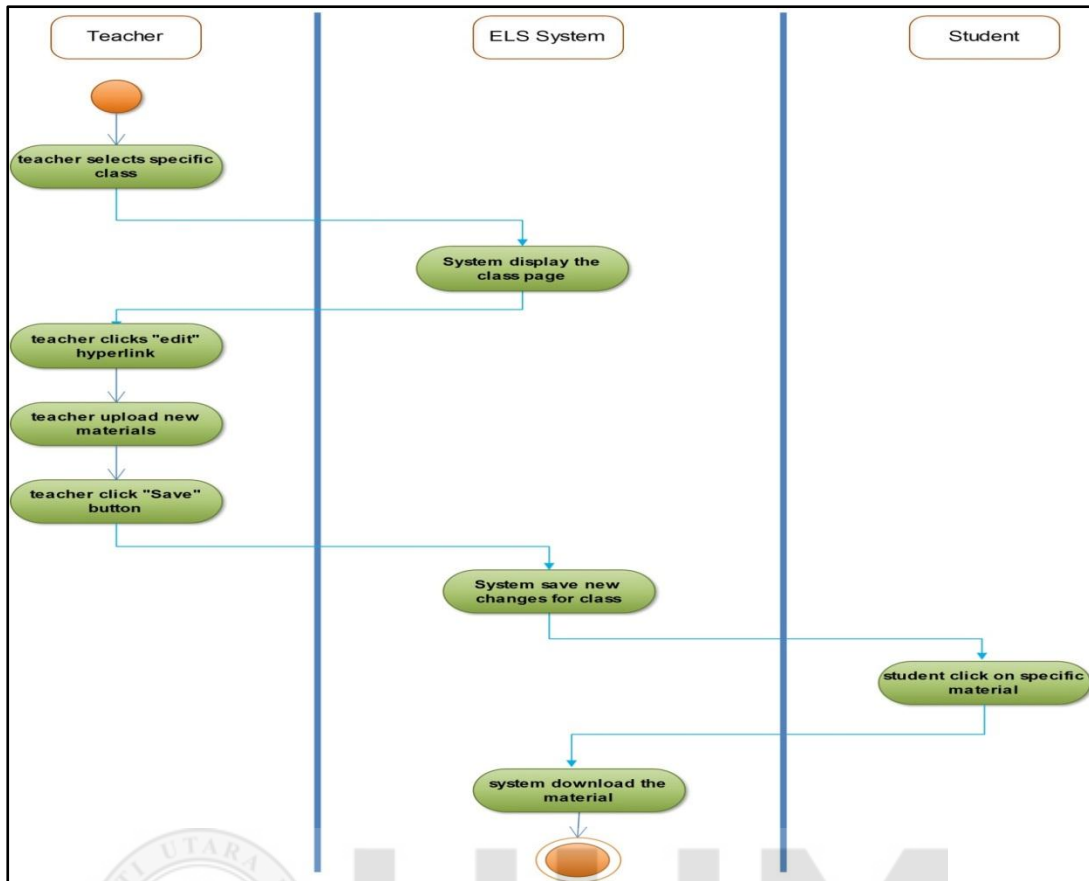
Figure 5. 14. Upload and Download Material Activity Diagram
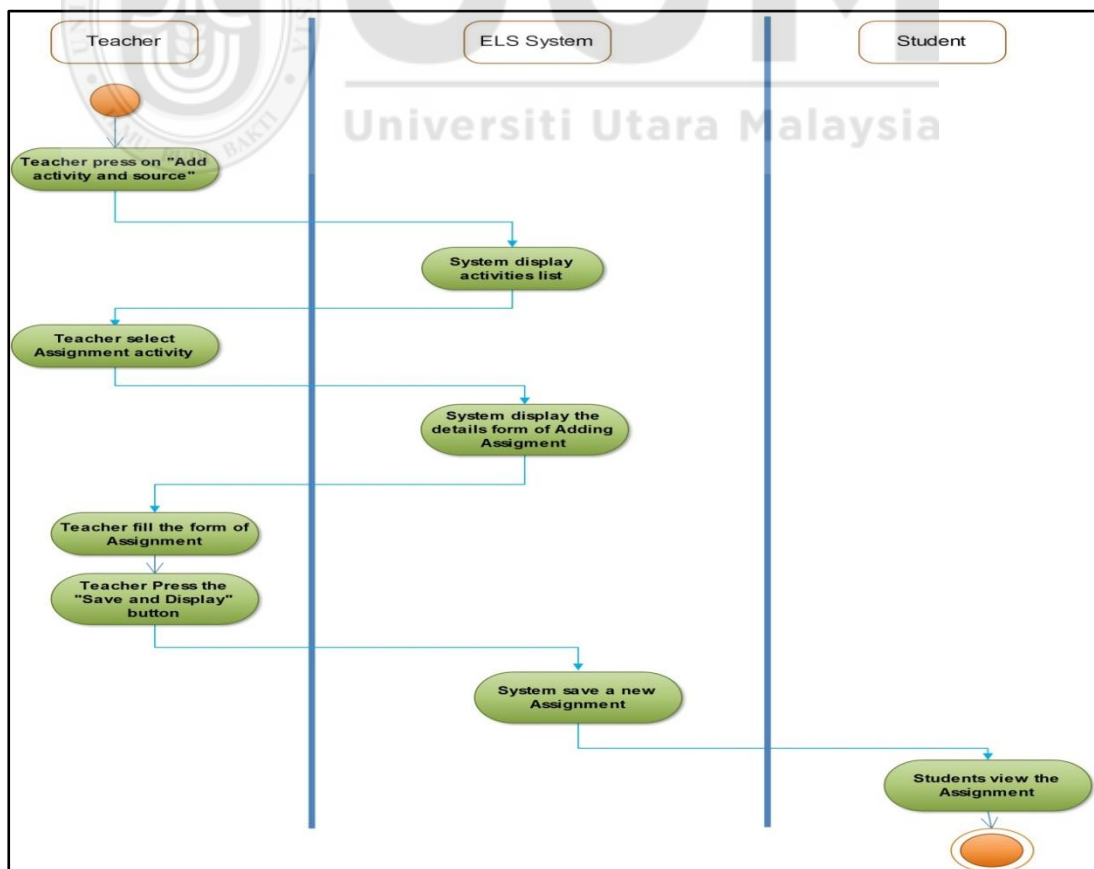
Figure 5. 15. Post/ Submit Assignment Activity Diagram

140
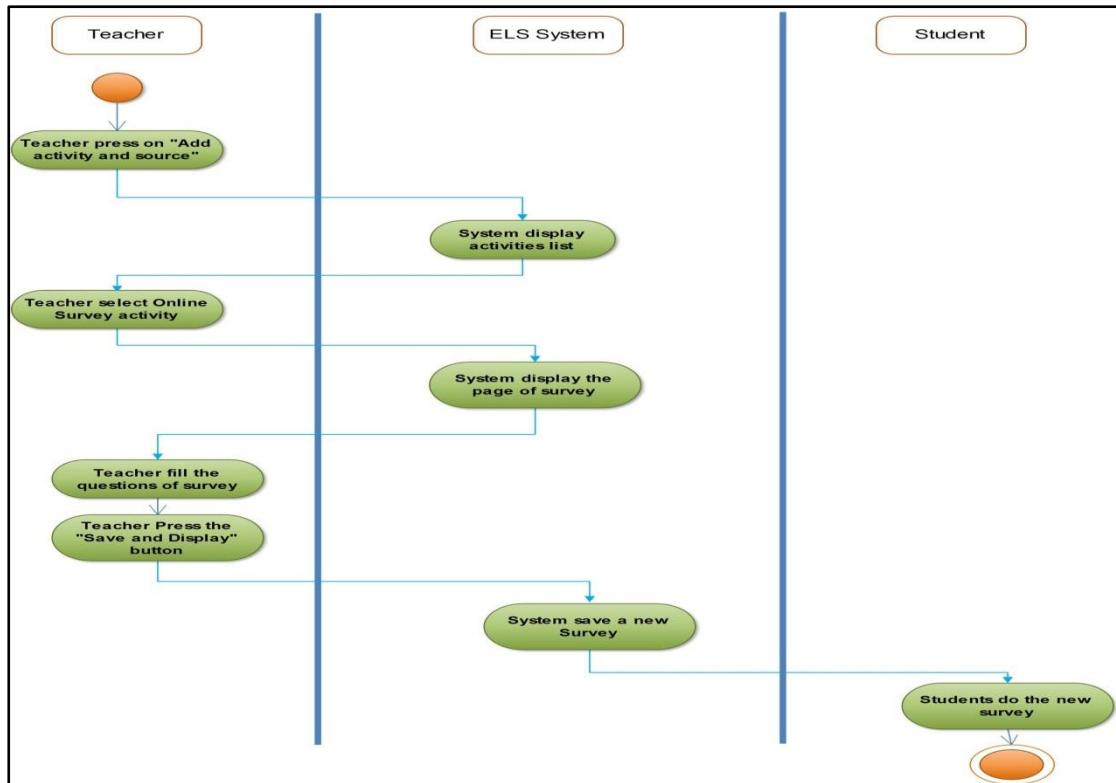
Figure 5. 16. Post/ Submit Online Survey Activity Diagram
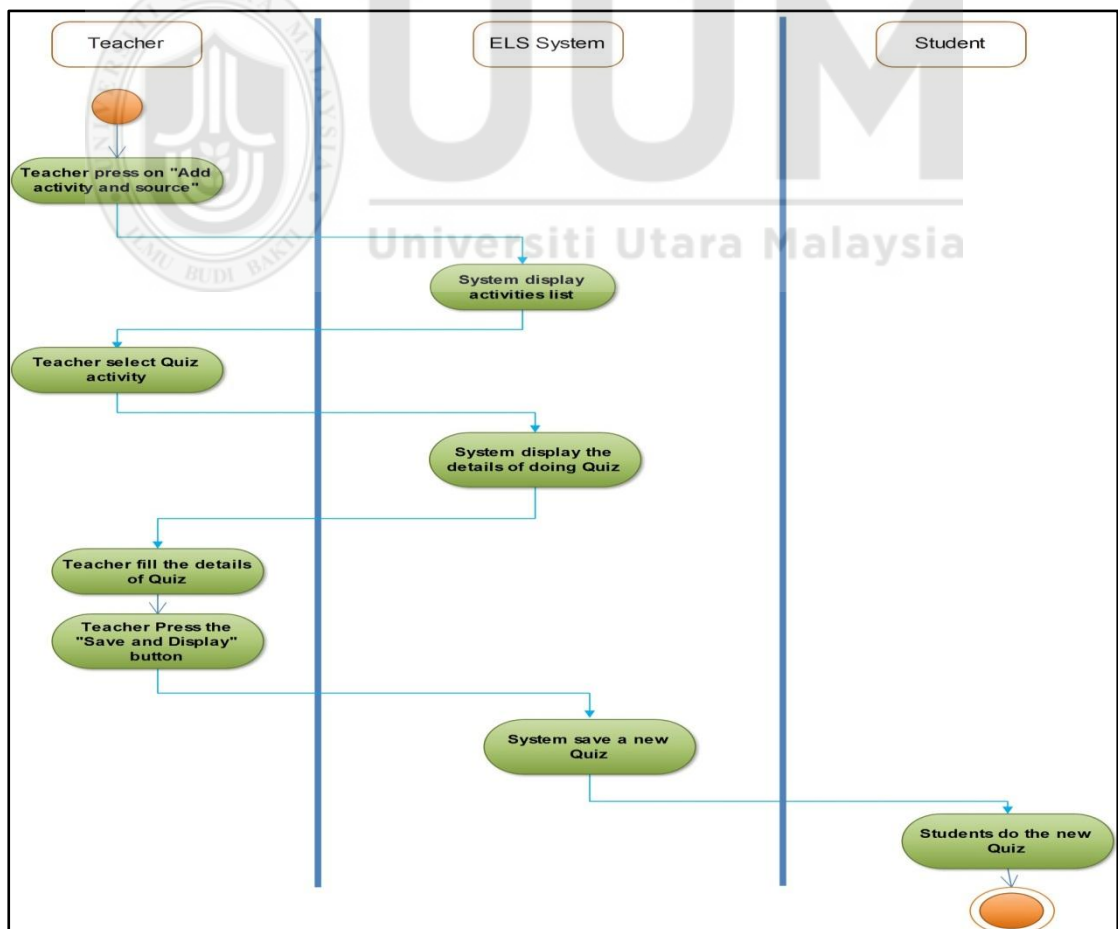
Figure 5. 17. Post/ Submit Quiz Activity Diagram

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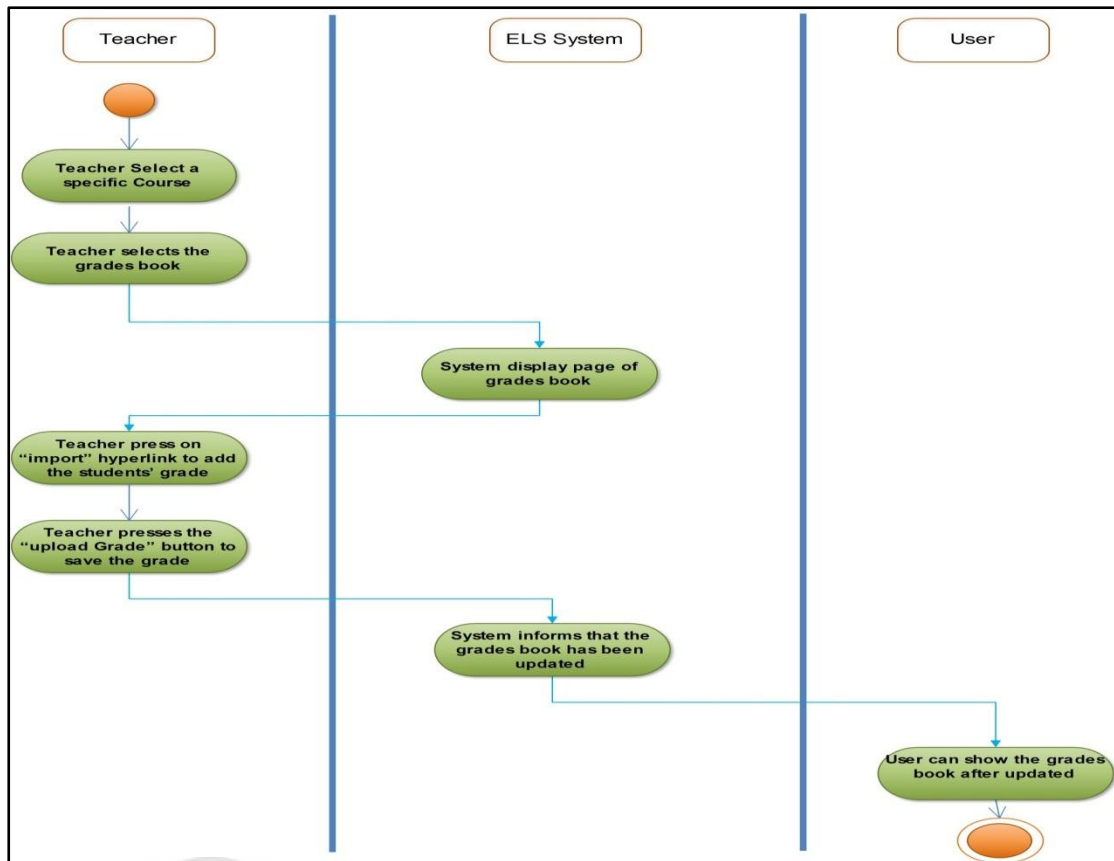
Figure 5. 18. Upload and View Grades Book Activity Diagram
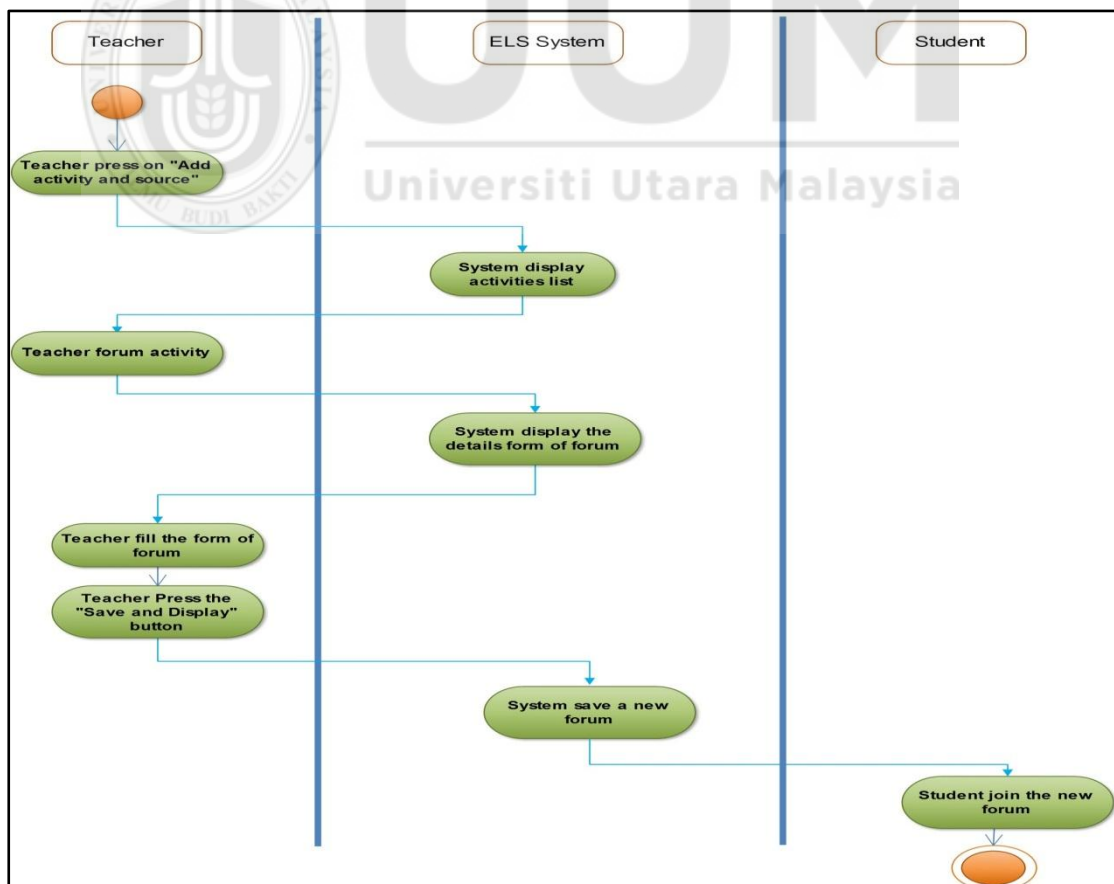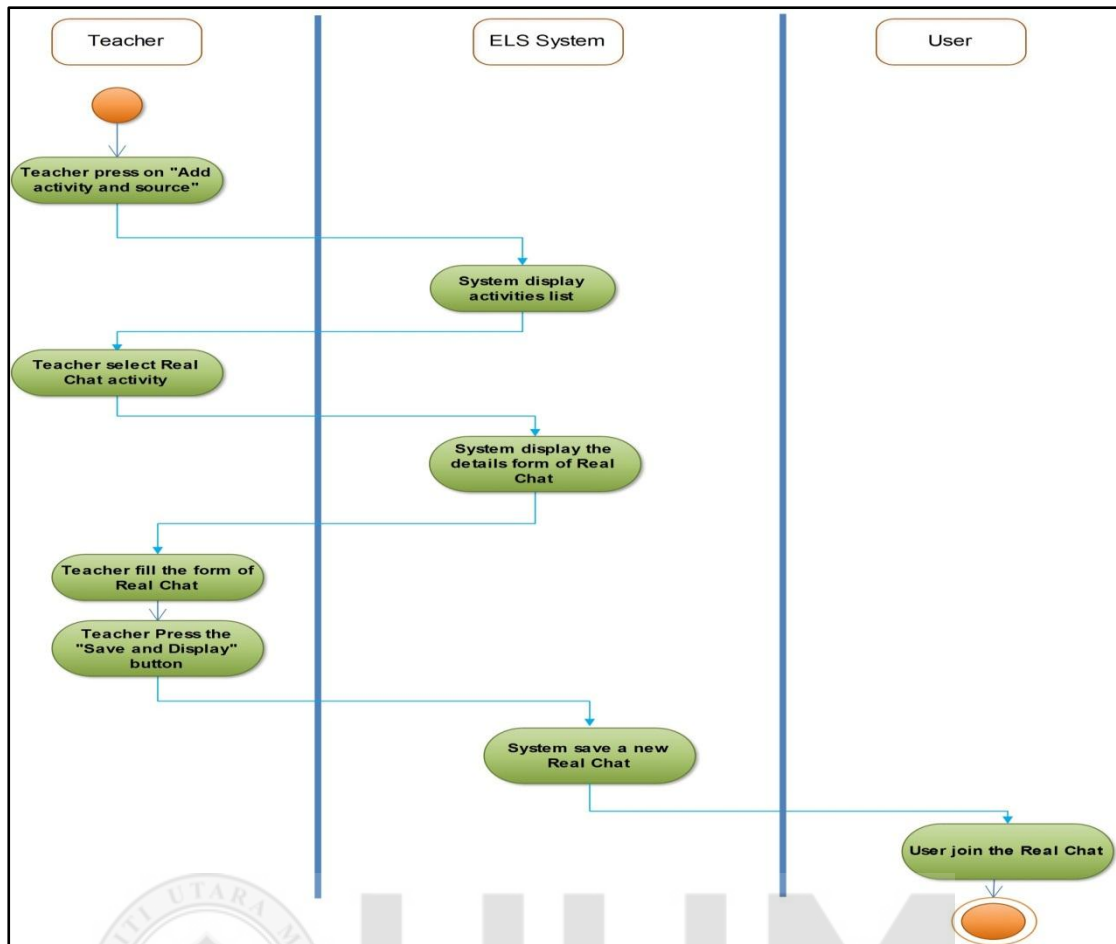

Figure 5. 19. Use Forum Activity Diagram
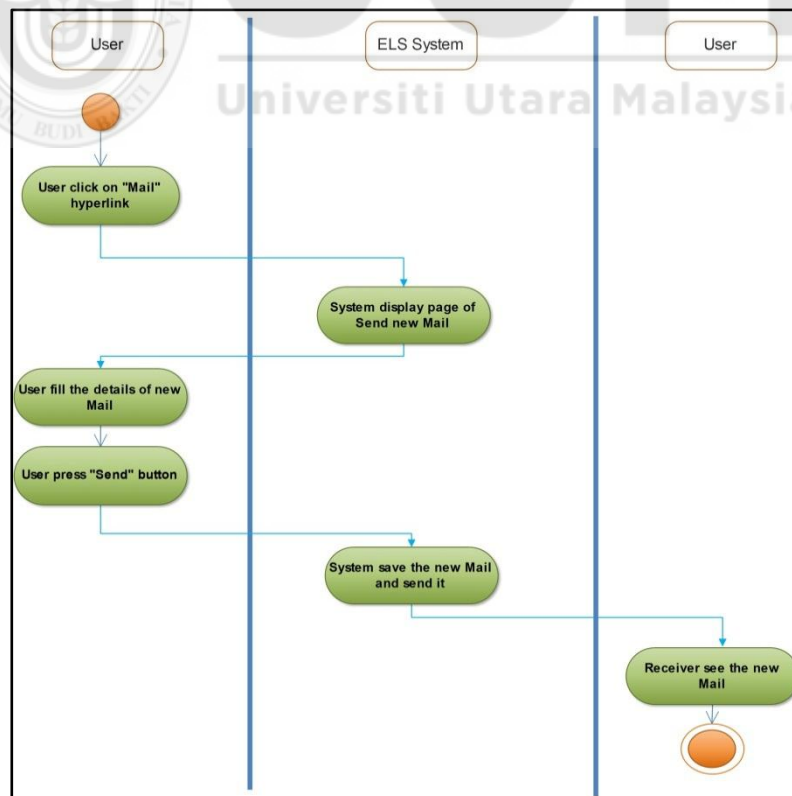
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Figure 5. 20. Use Real Time Chat Activity Diagram

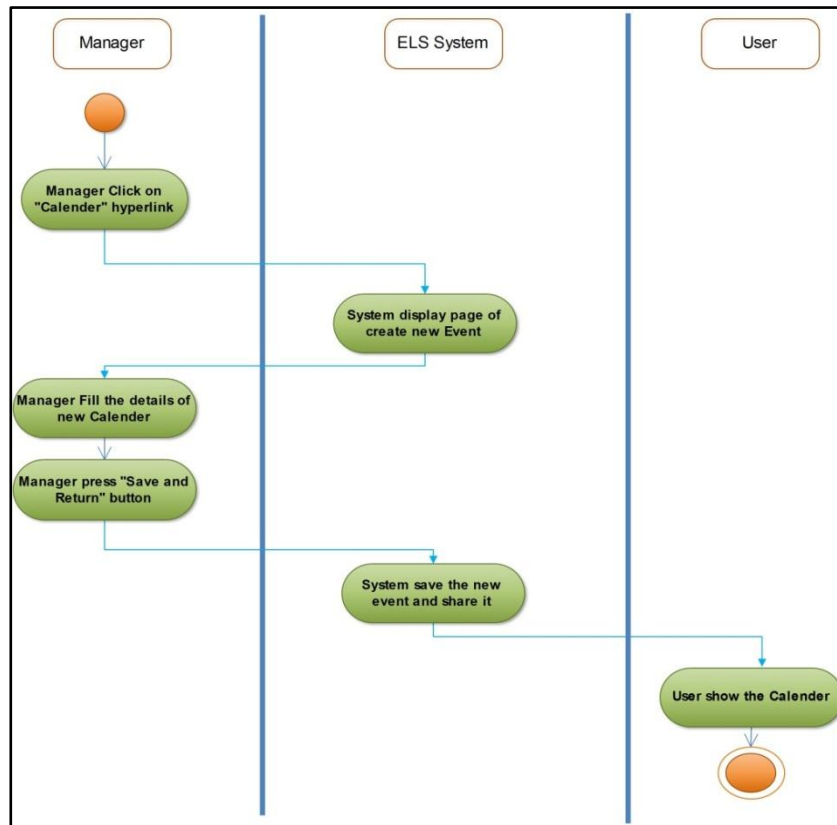*Figure 5. 21.* Send Mail Activity Diagram

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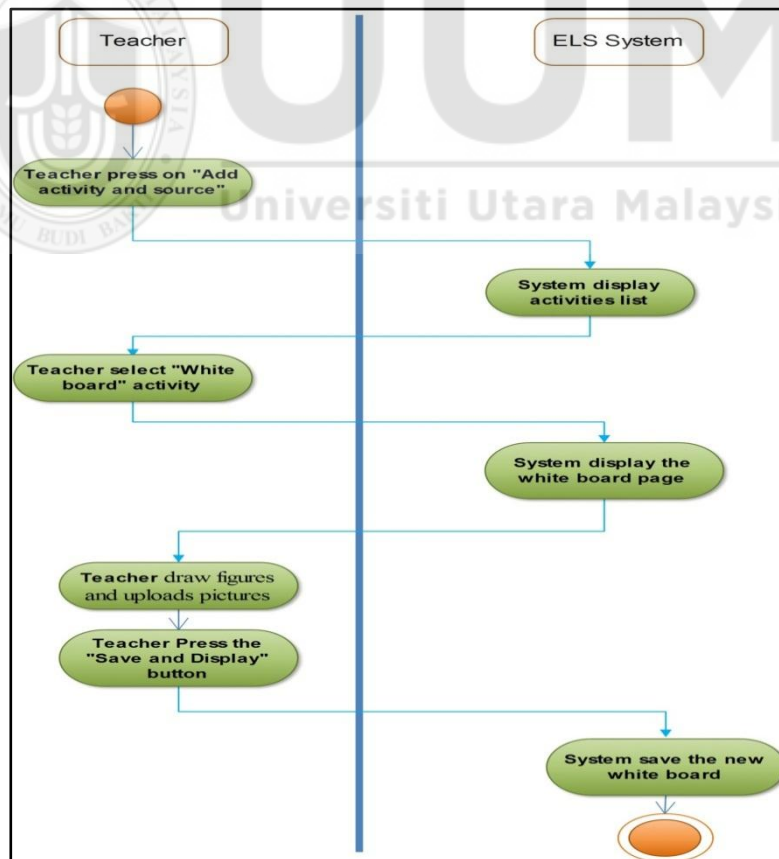*Figure 5. 22.* Manage Calendar Activity Diagram

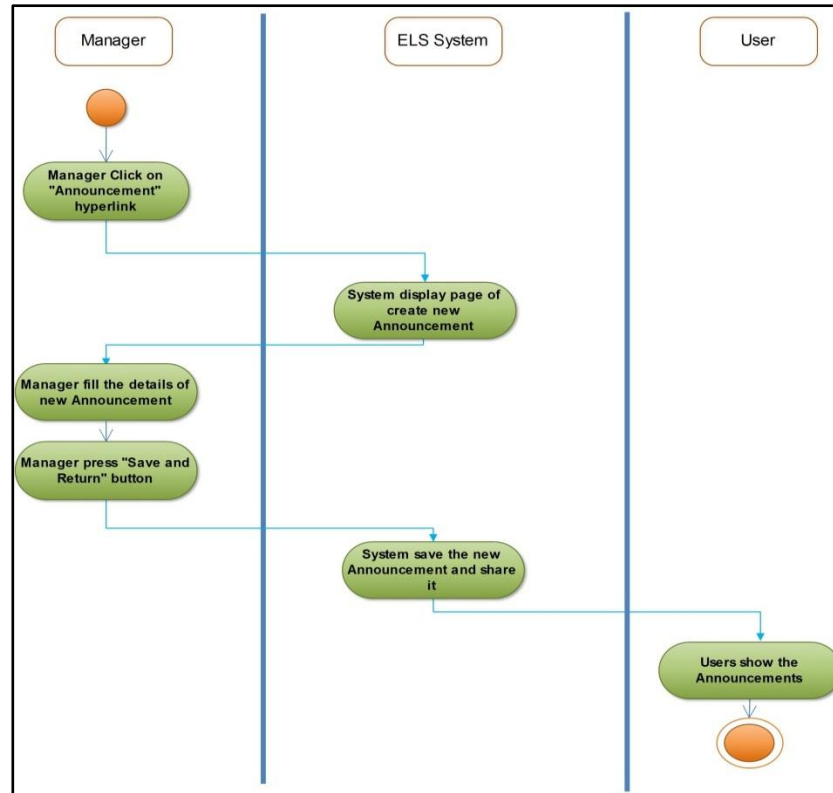*Figure 5. 23.* Share White Board Activity Diagram

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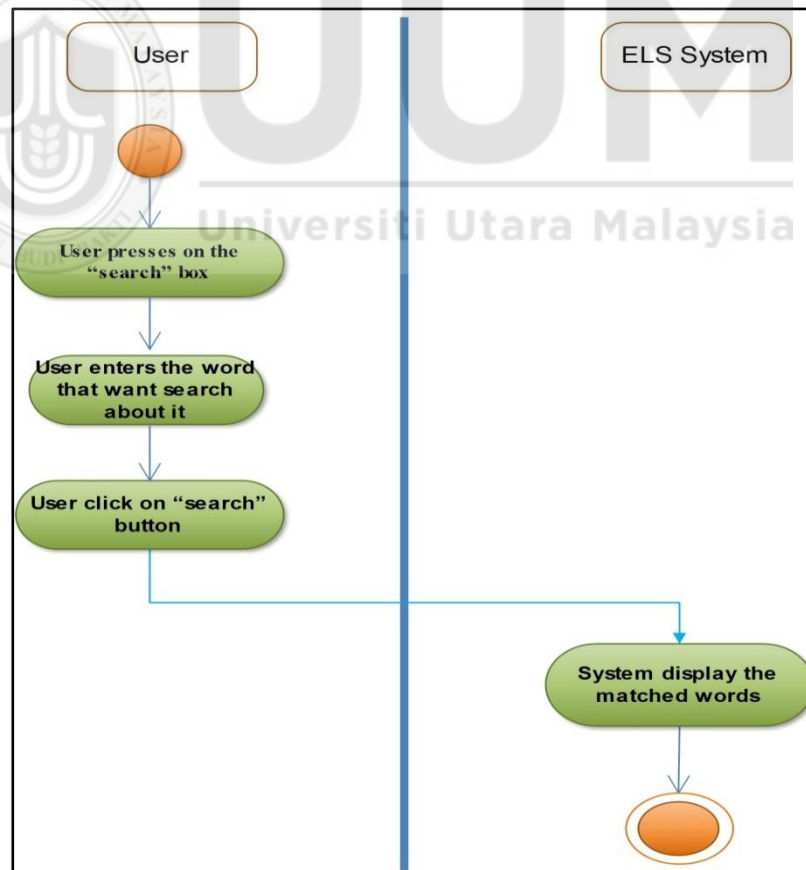*Figure 5. 24.* Publish Announcement Activity Diagram

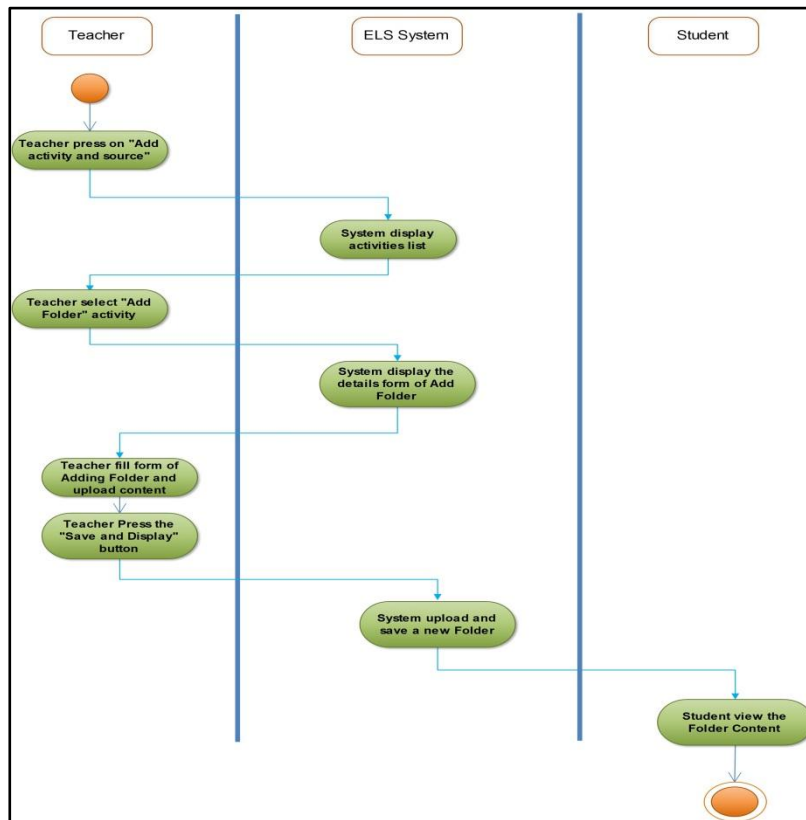*Figure 5. 25.* Search Facility Activity Diagram

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Figure 5. 26. Share Folder Content Activity Diagram
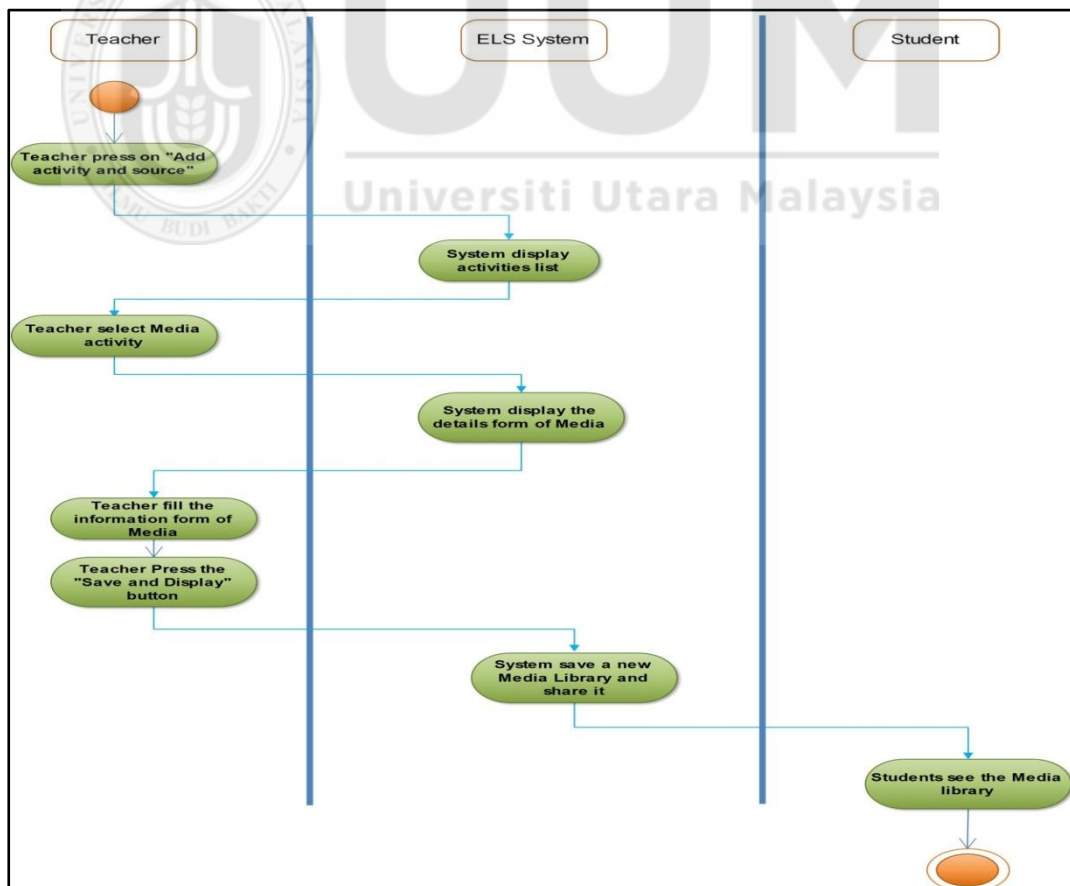
Figure 5. 27. Share Media Library Activity Diagram

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Figure 5. 28. Share Syllabus Activity Diagram
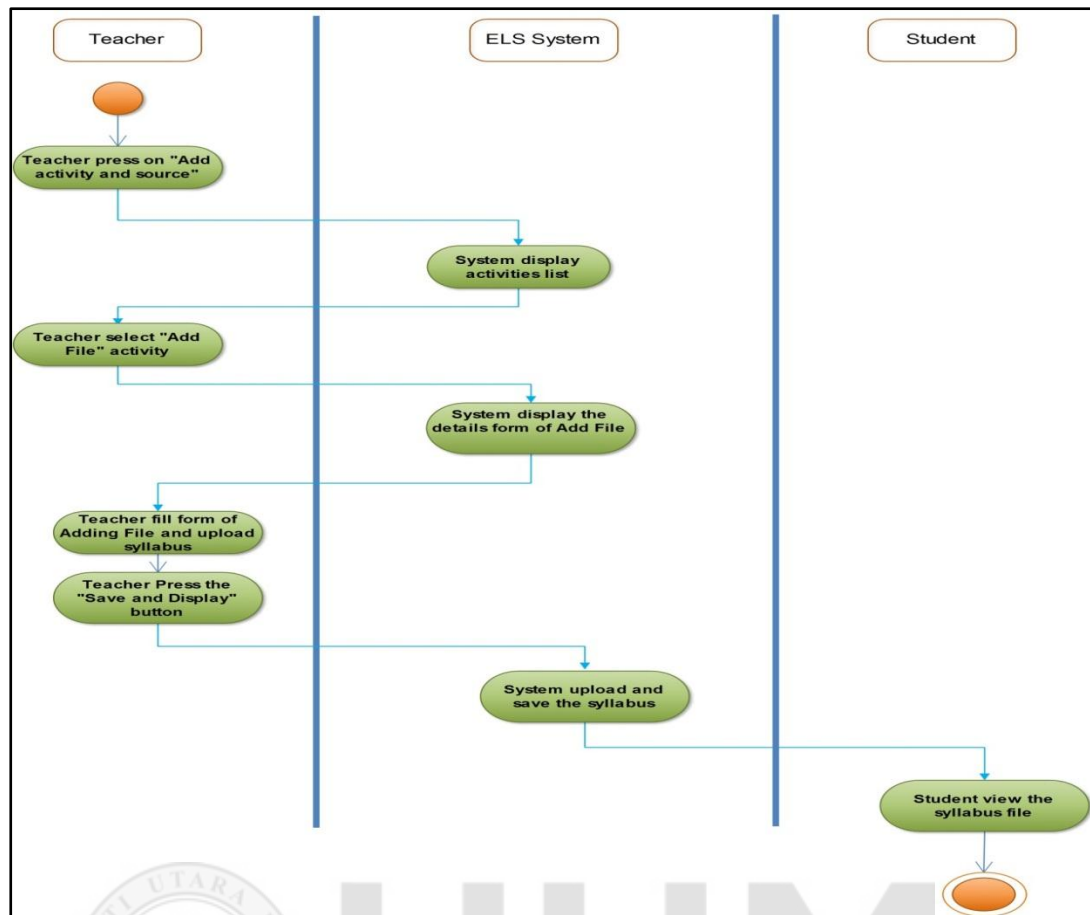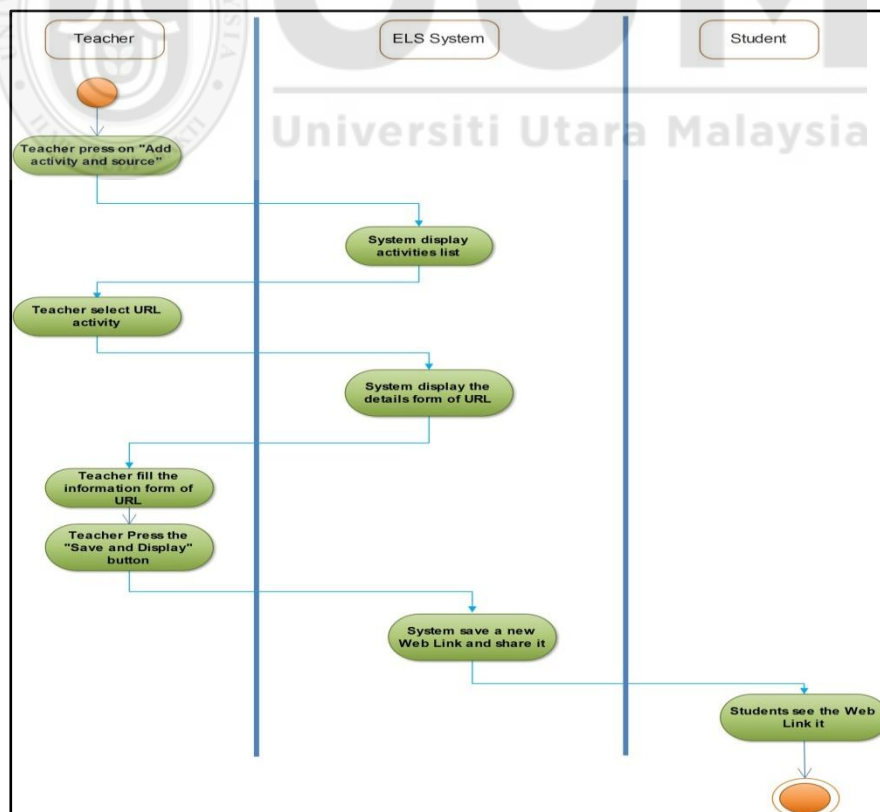

Figure 5. 29. Share Web Kink Activity Diagram
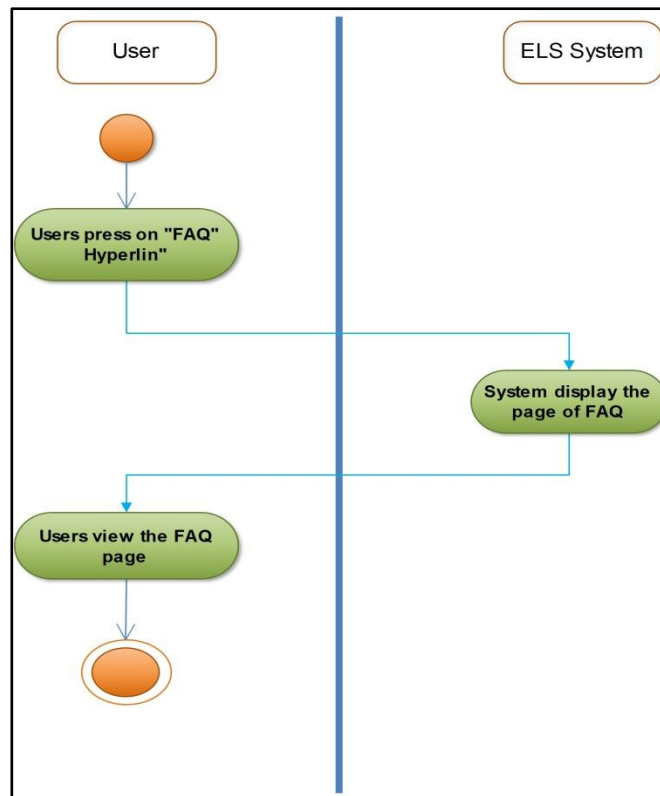
Figure 5. 30. Share Web Kink Activity Diagram
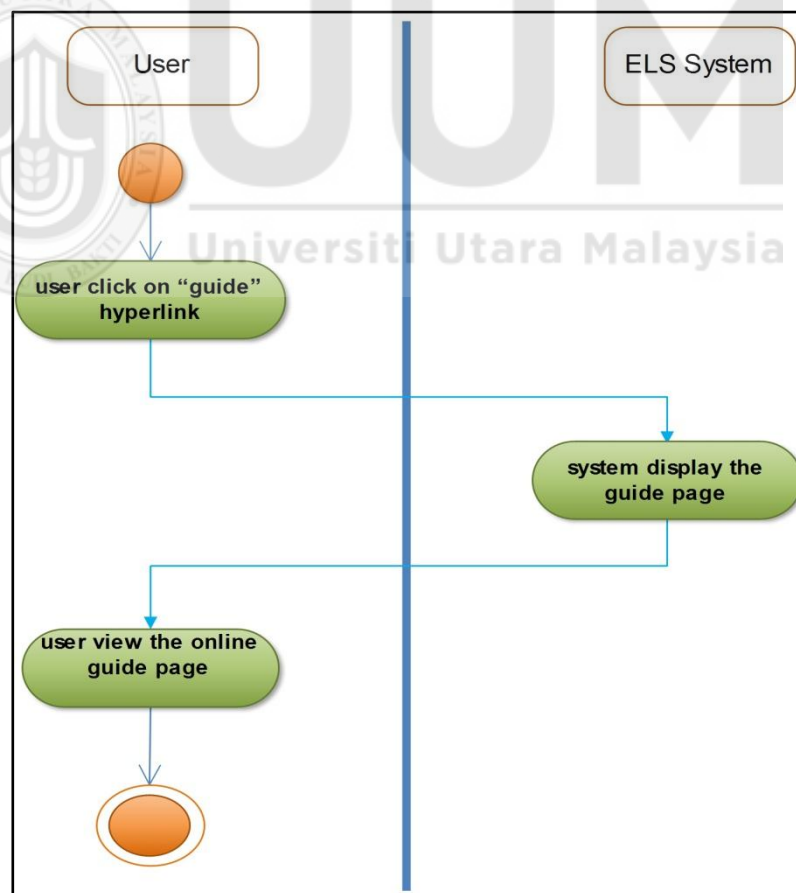
Figure 5. 31. View Online Guide Activity Diagram
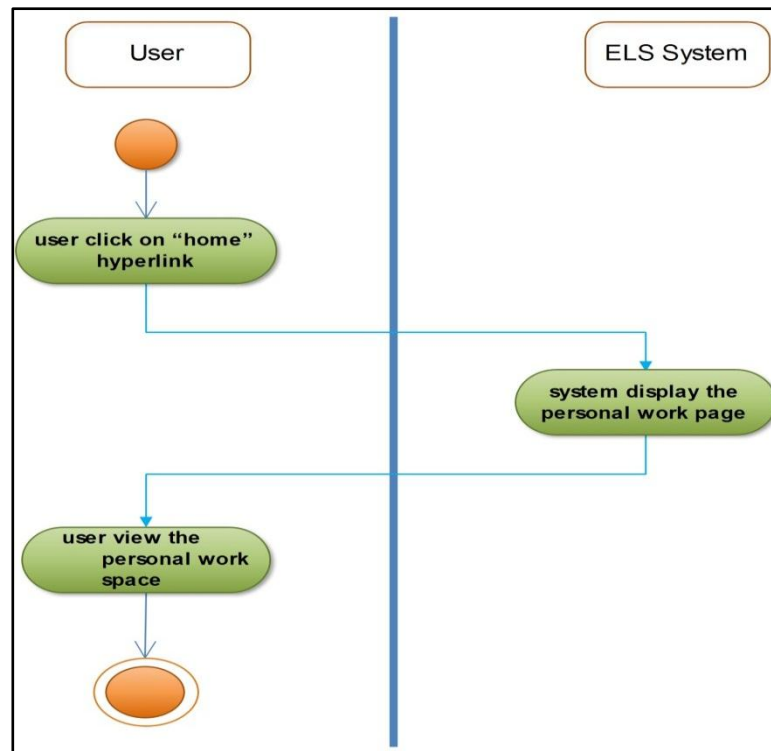
Figure 5. 32. View Personal Work Space Activity Diagram
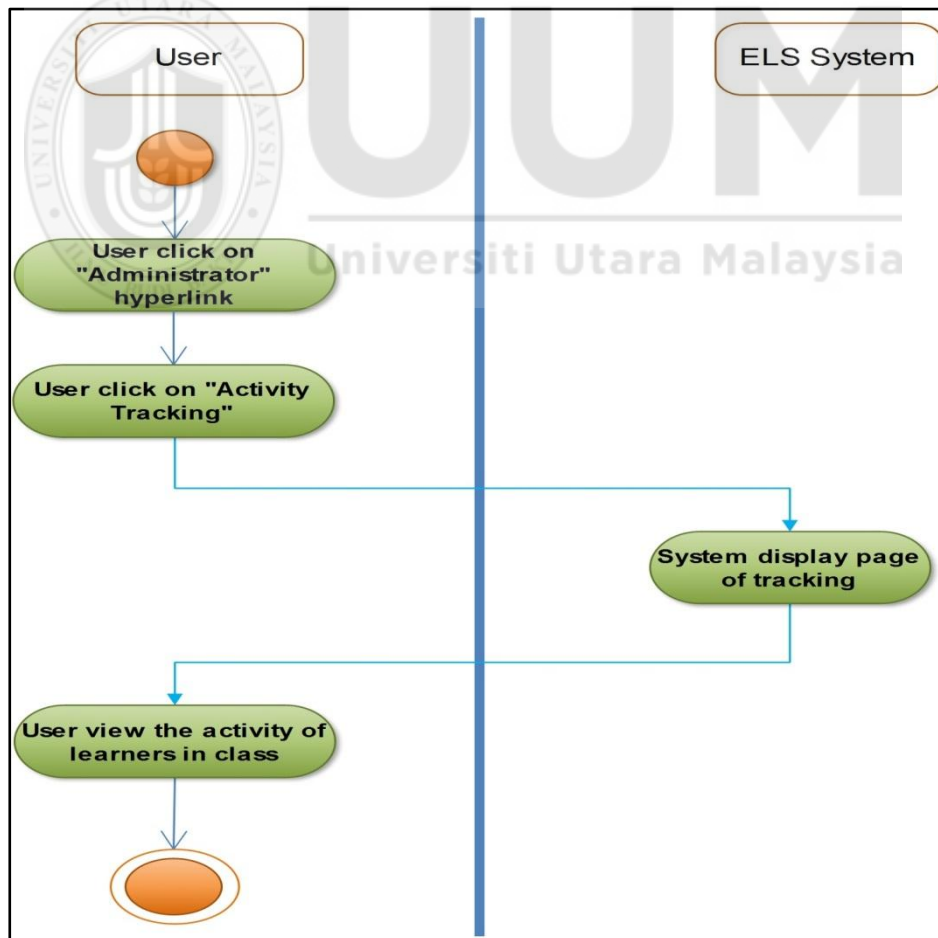
Figure 5. 33. View Activity Tracking Activity Diagram
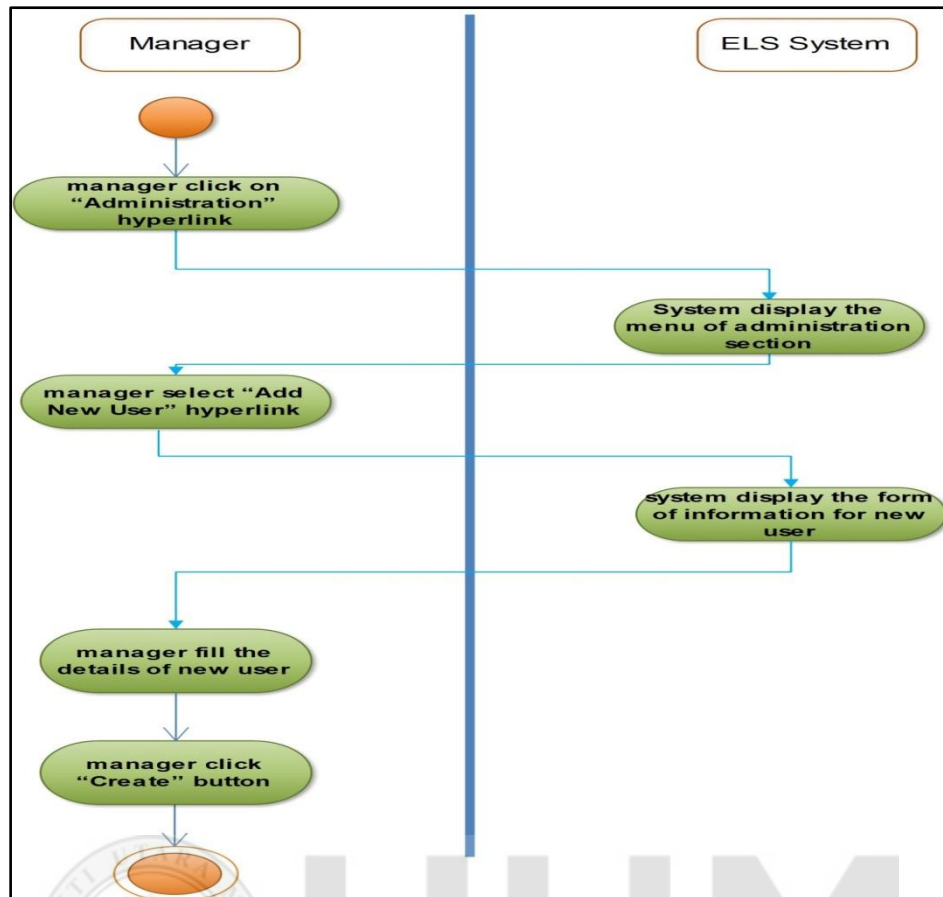
Figure 5. 34. Add New User Activity Diagram
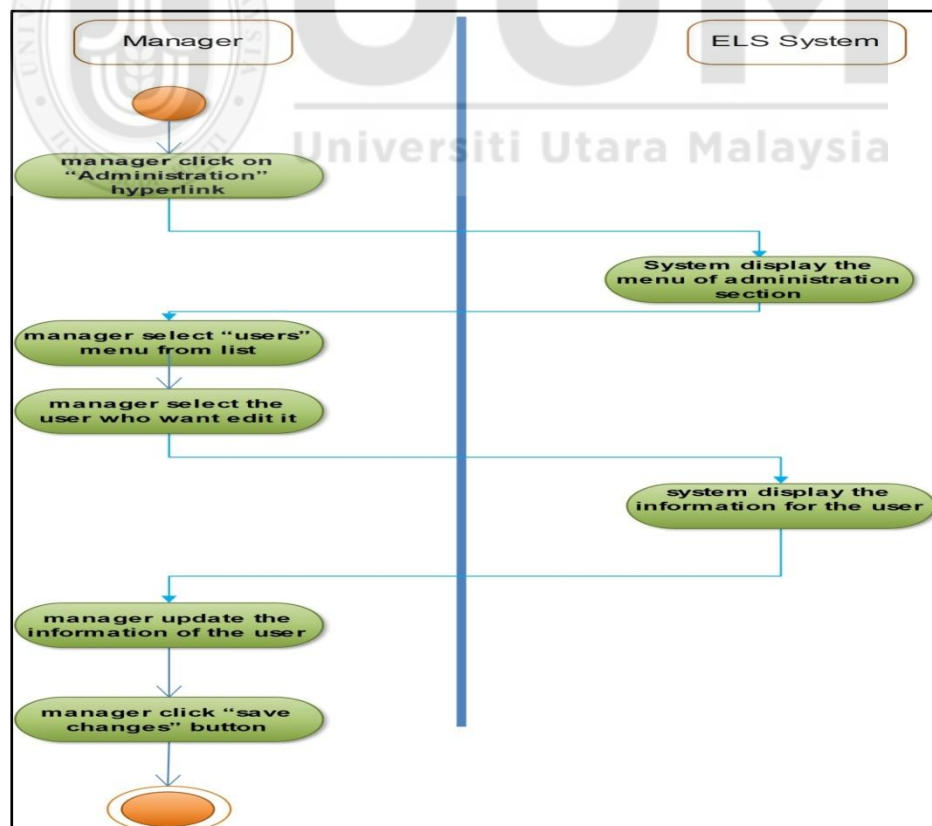
Figure 5. 35. Update User Information Activity Diagram

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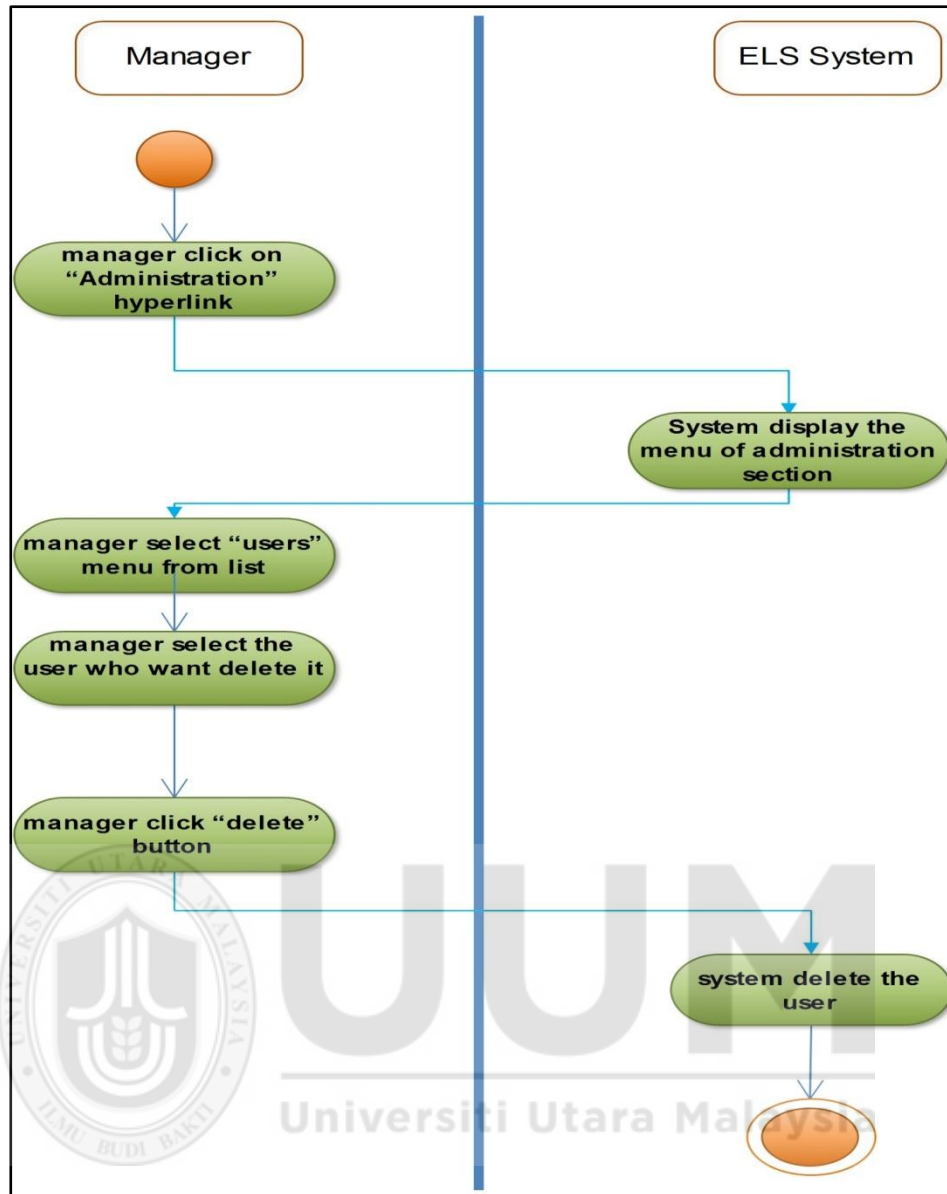
Figure 5. 36. Delete User Activity Diagram

5.2.3 Sequence Diagram

The sequence diagram presents the interaction among the objects participating in the use case and the message that is transmitted between them in a passage of time in a single use case. It is a model with dynamic character presented in a time sequence. It is basically utilized to show the interaction among the objects of classes in detail as opposed to the classes themselves. Moreover, it is utilized to present the behavior of a method as well as to present in-depth descriptions on the interaction of objects (Kern

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& Garrett, 2003). In this study the sequence diagrams modelling for each use case as shown in the following figures.
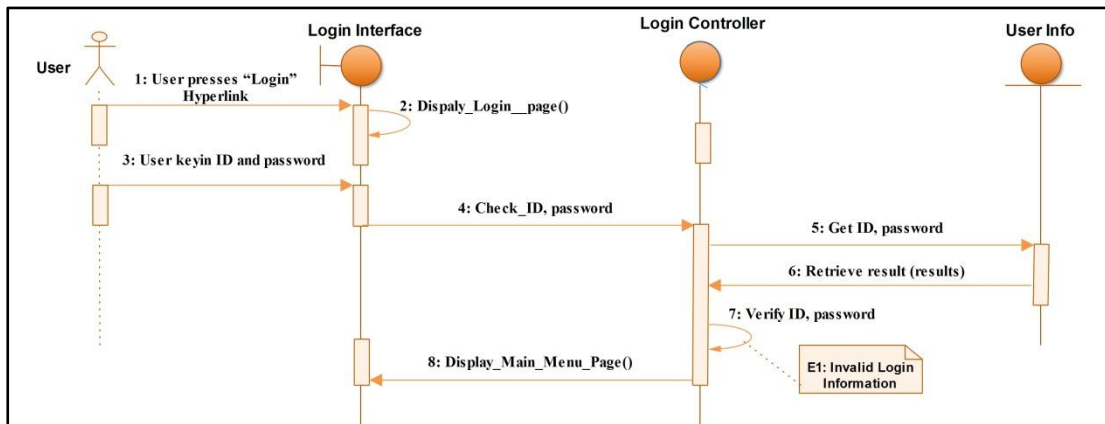
Figure 5. 37. Login Sequence Diagram
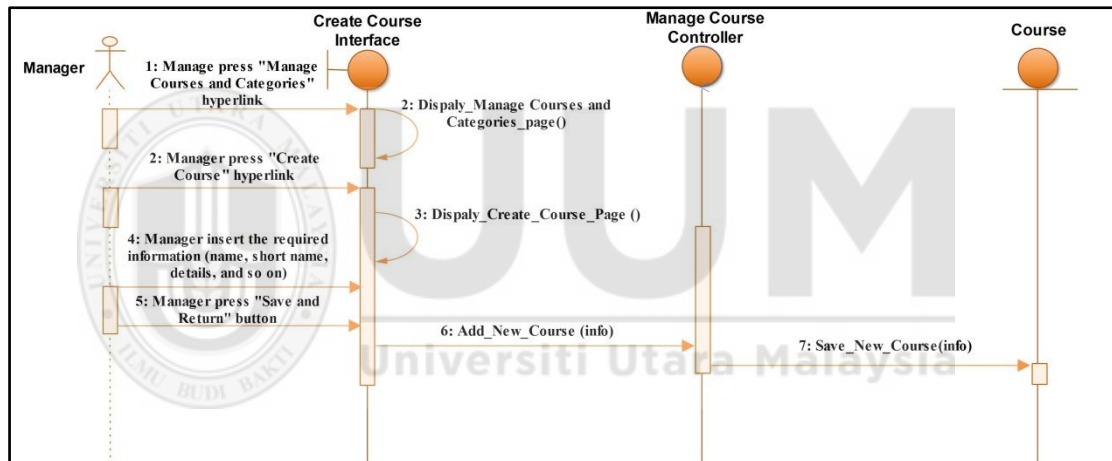
Figure 5. 38. Create Course Sequence Diagram
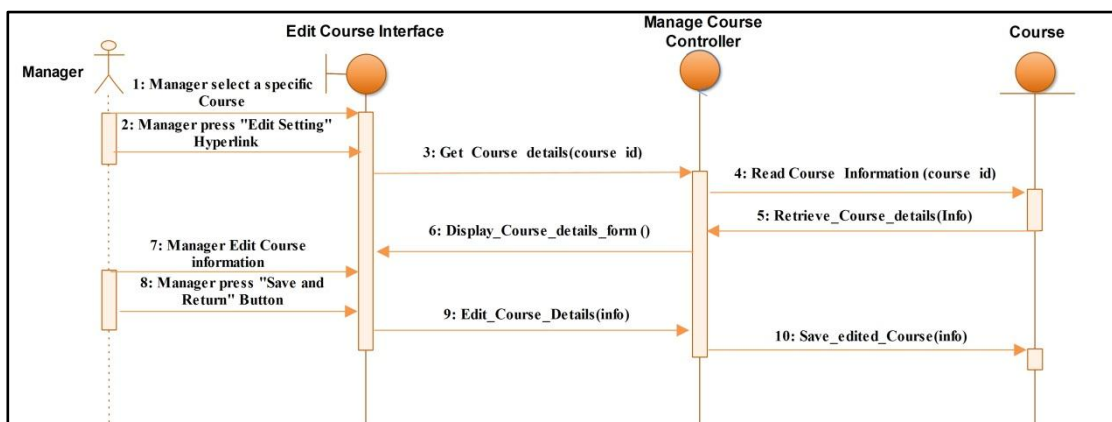
Figure 5. 39. Edit Course Sequence Diagram
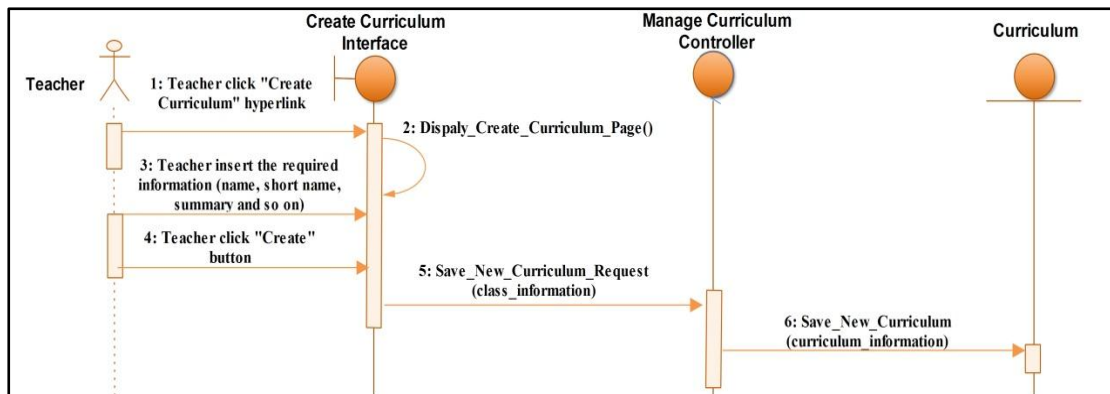
Figure 5. 40. Create Curriculum Sequence Diagram
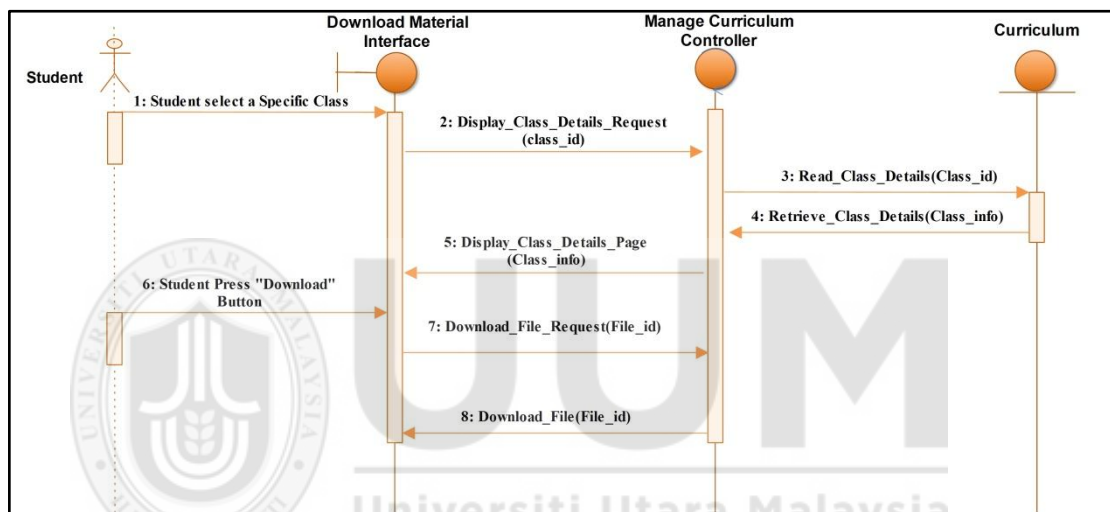
Figure 5. 41. Download Materials Sequence Diagram
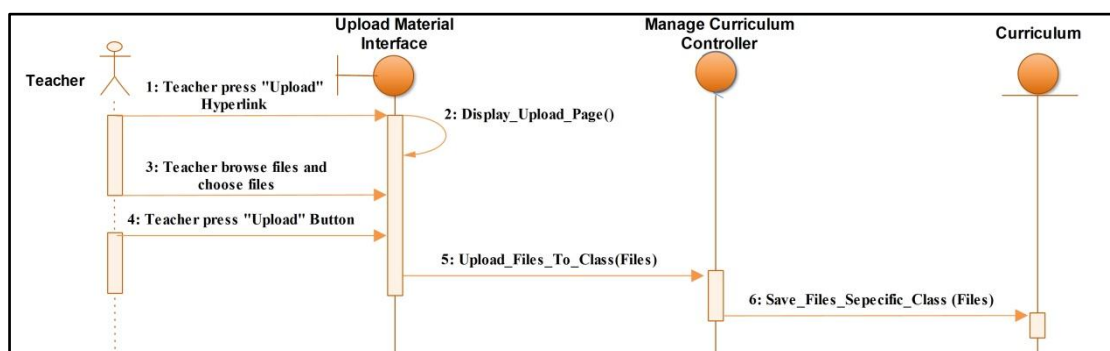
Figure 5. 42. Upload Materials Sequence Diagram
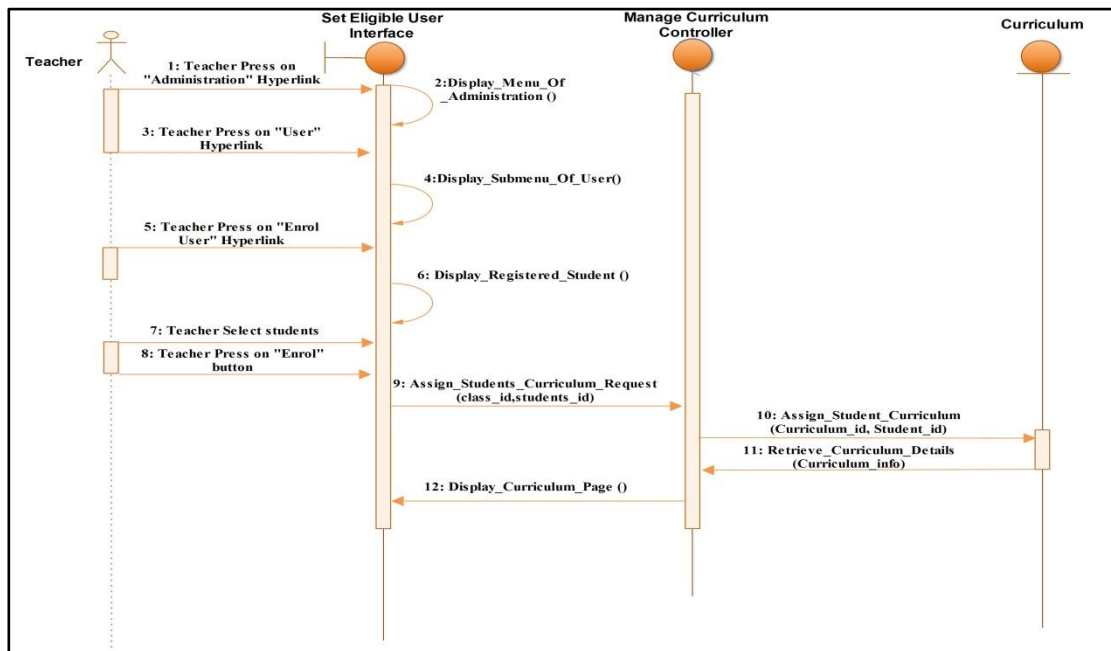
Figure 5. 43. Set Eligible User Sequence Diagram
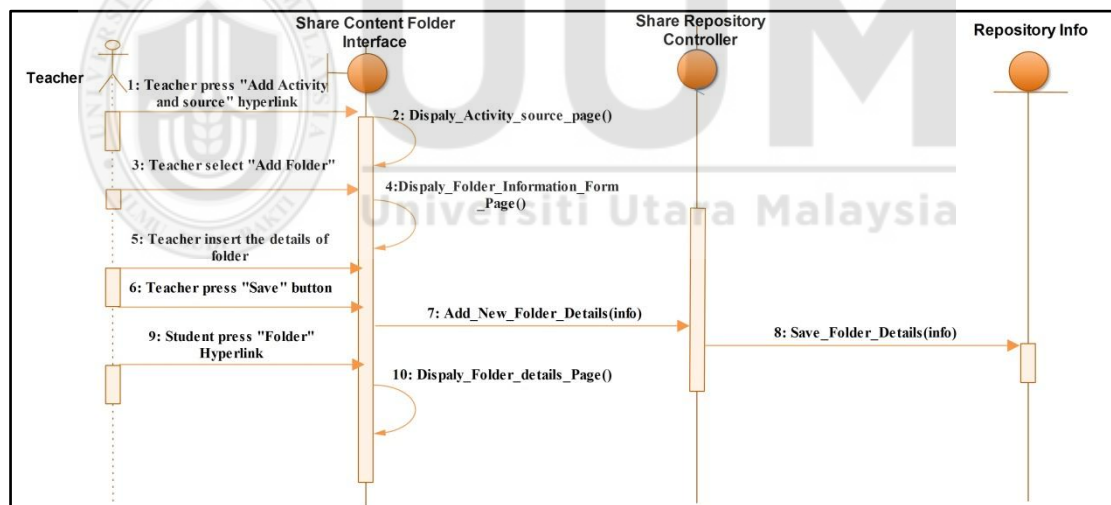
Figure 5. 44. Share Content Folder Sequence Diagram
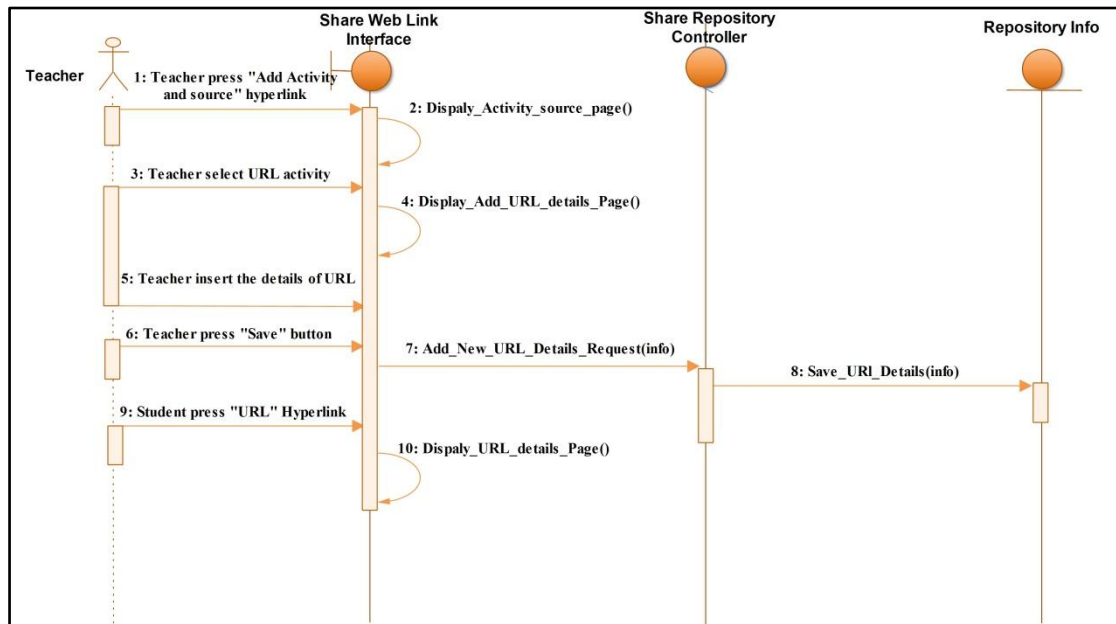
Figure 5. 45. Share Web Link Sequence Diagram
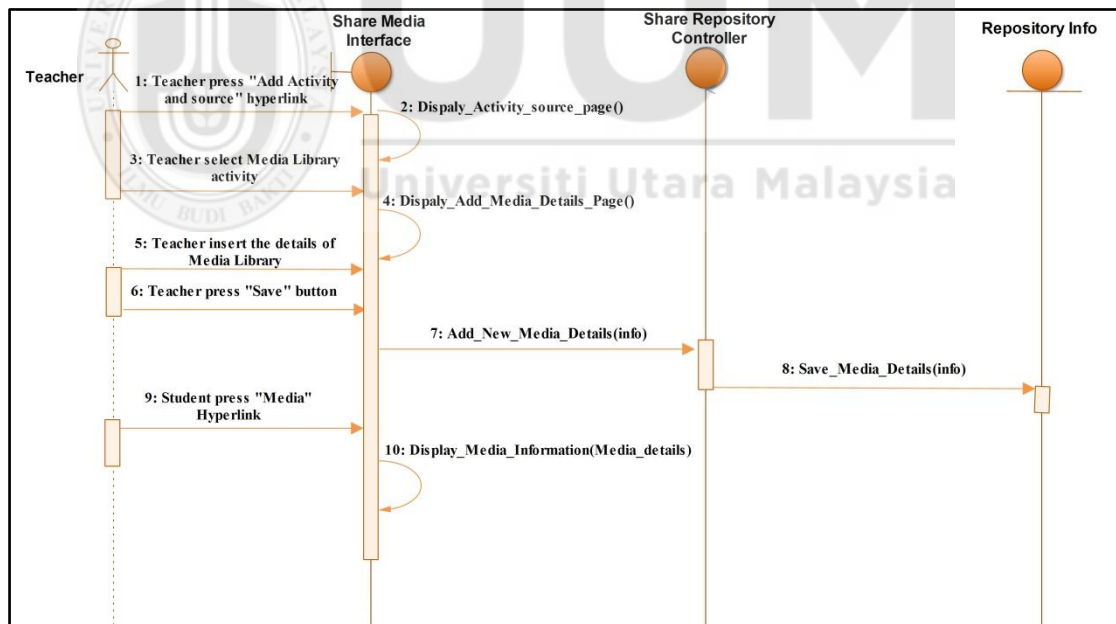
Figure 5. 46. Share Media Library Sequence Diagram
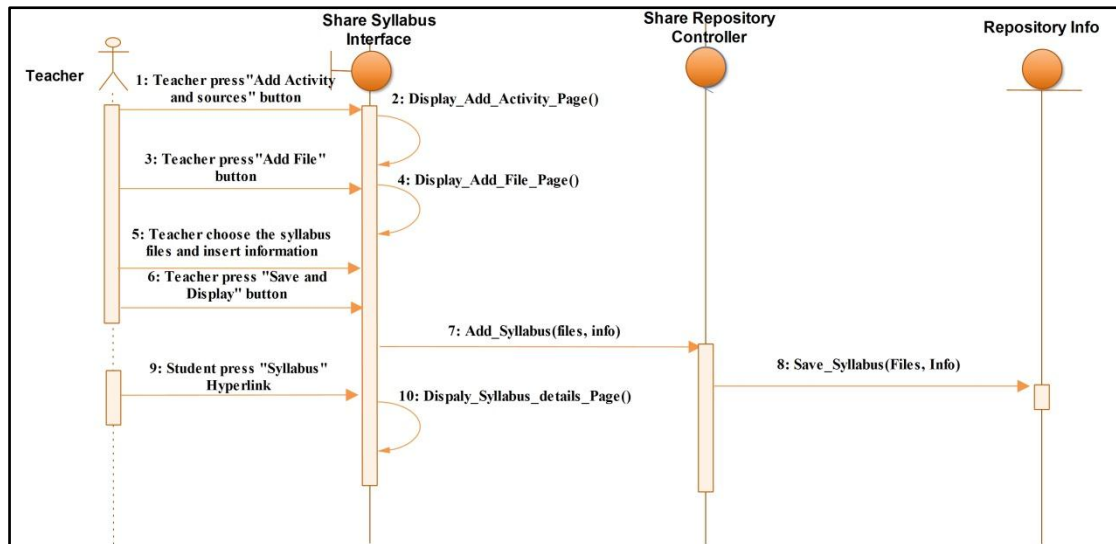
Figure 5. 47. Share Syllabus Sequence Diagram
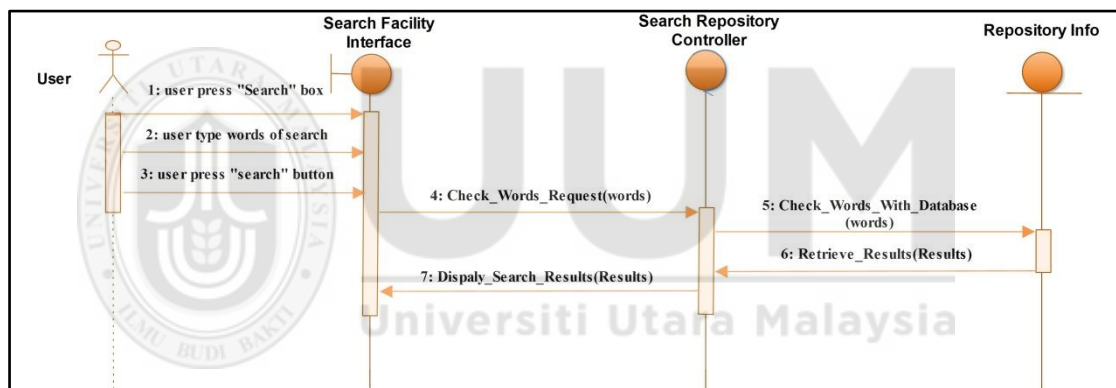
Figure 5. 48. Search Facility Sequence Diagram
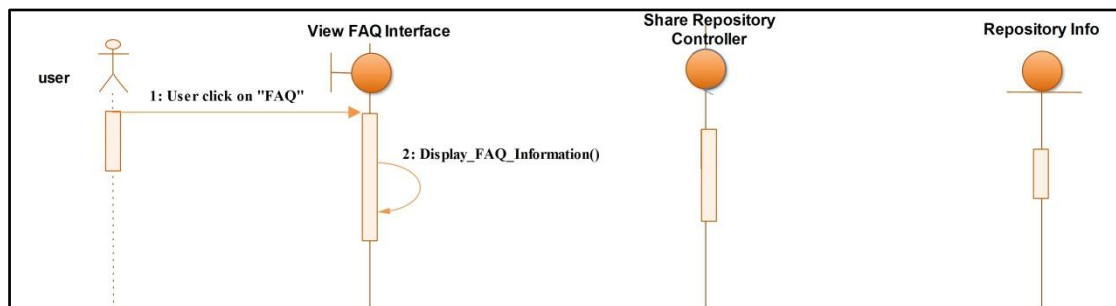
Figure 5. 49. View FAQ Sequence Diagram

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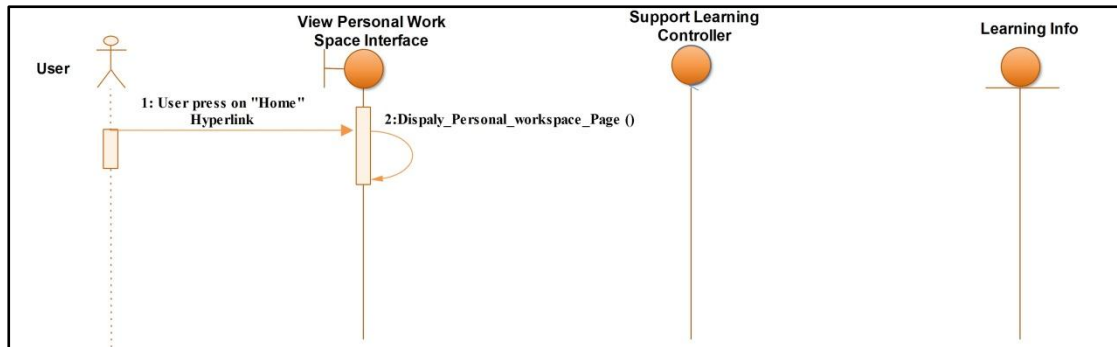
Figure 5. 50. View Personal Work Space Sequence Diagram
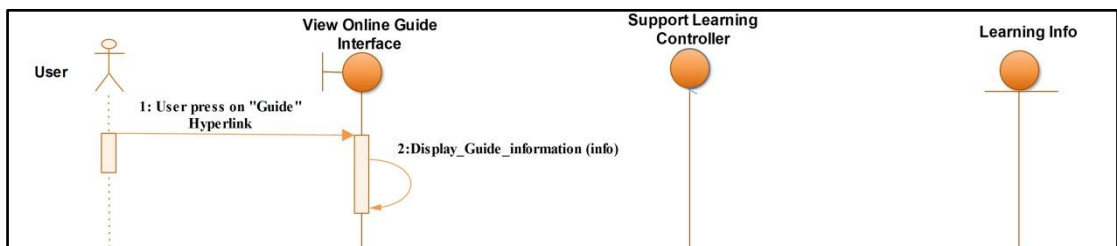
Figure 5. 51. View Online Guide Sequence Diagram
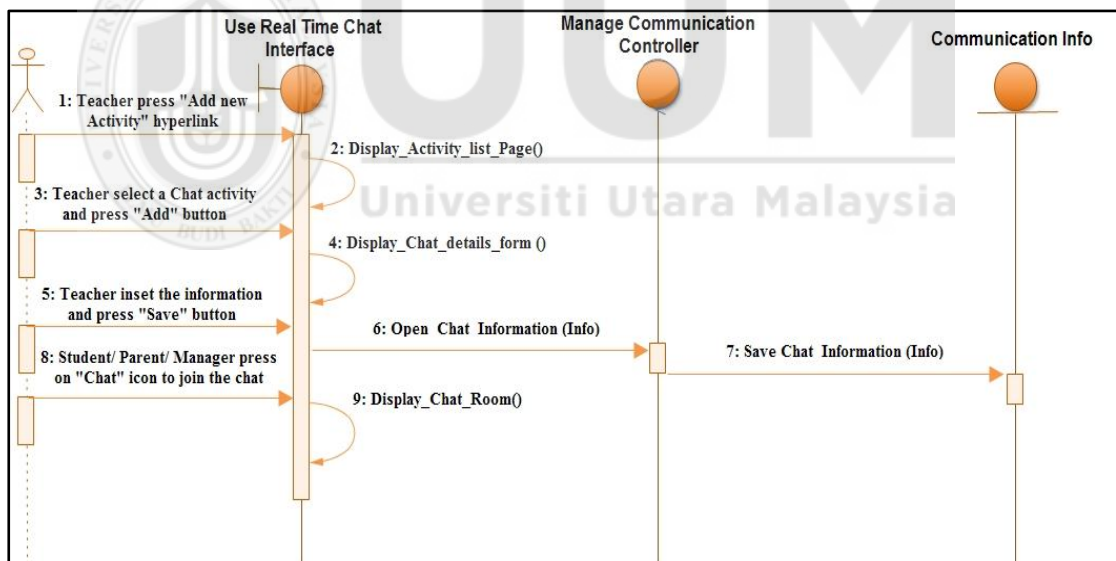
Figure 5. 52. Use Real Time Chat Sequence Diagram

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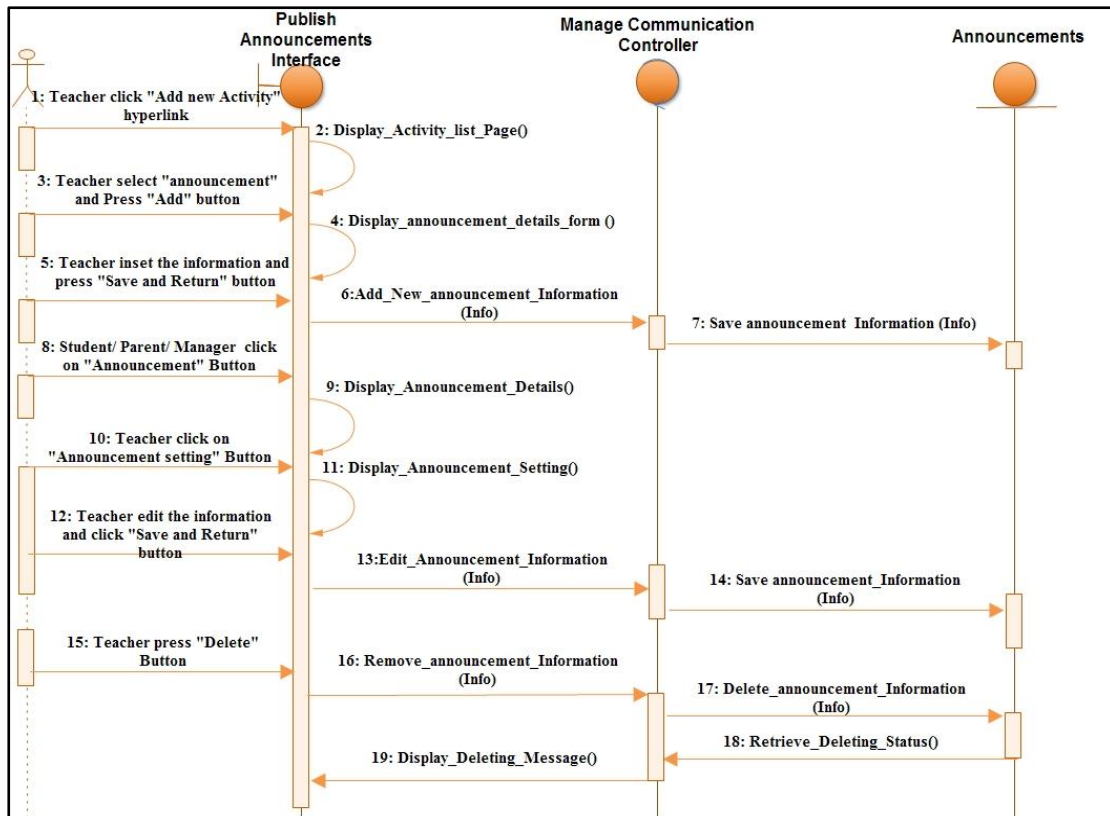
Figure 5. 53. Publish Announcement Sequence Diagram
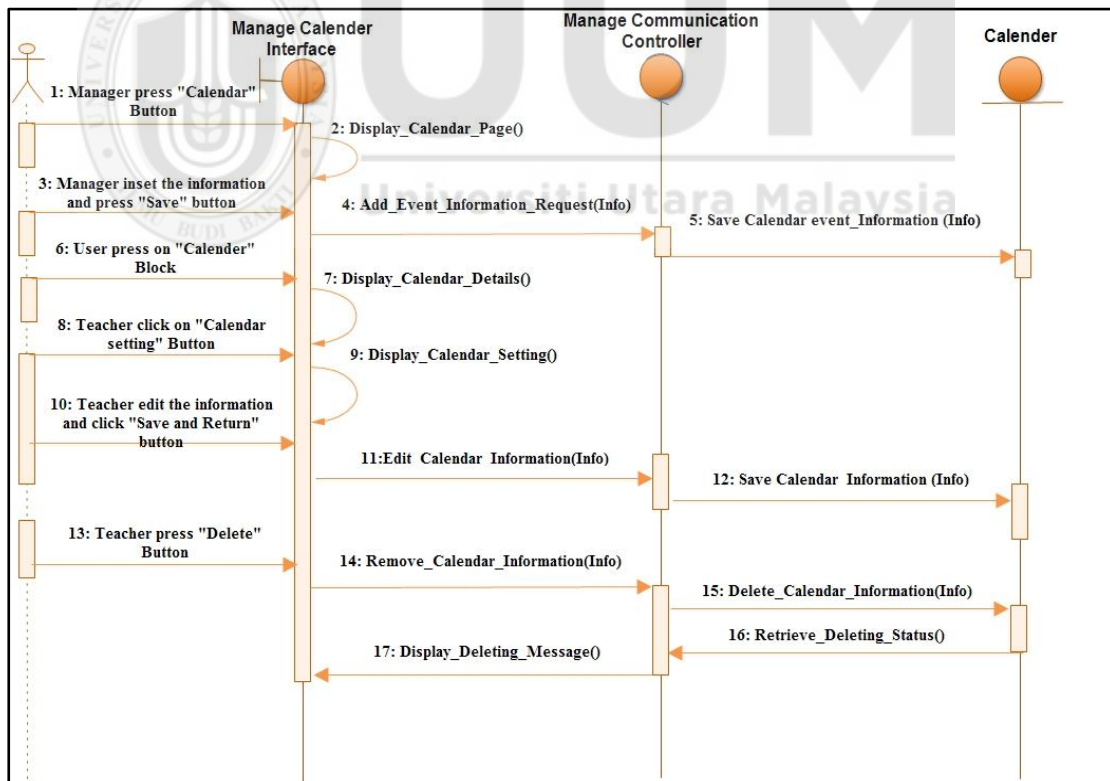
igure 5. 54. Manage Calendar Sequence Diagram

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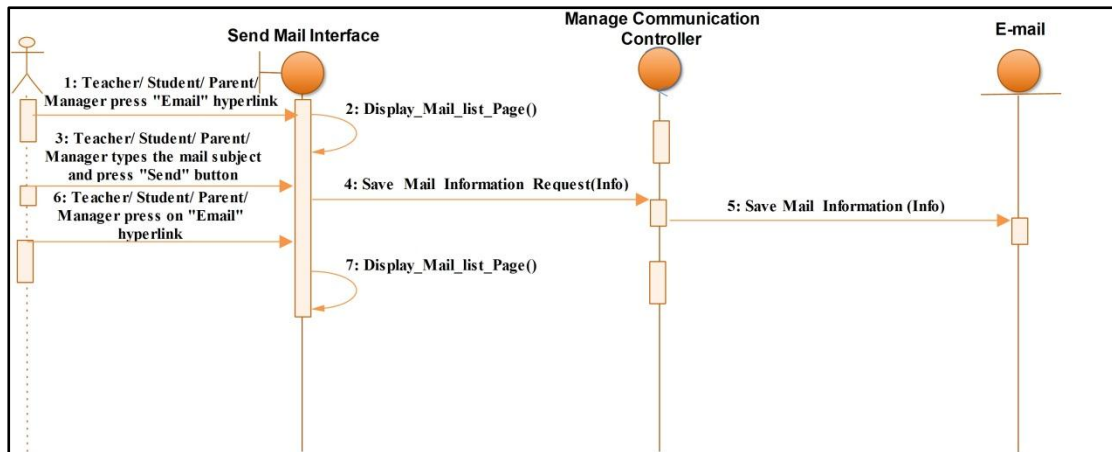
Figure 5. 55. Send Mail Sequence Diagram
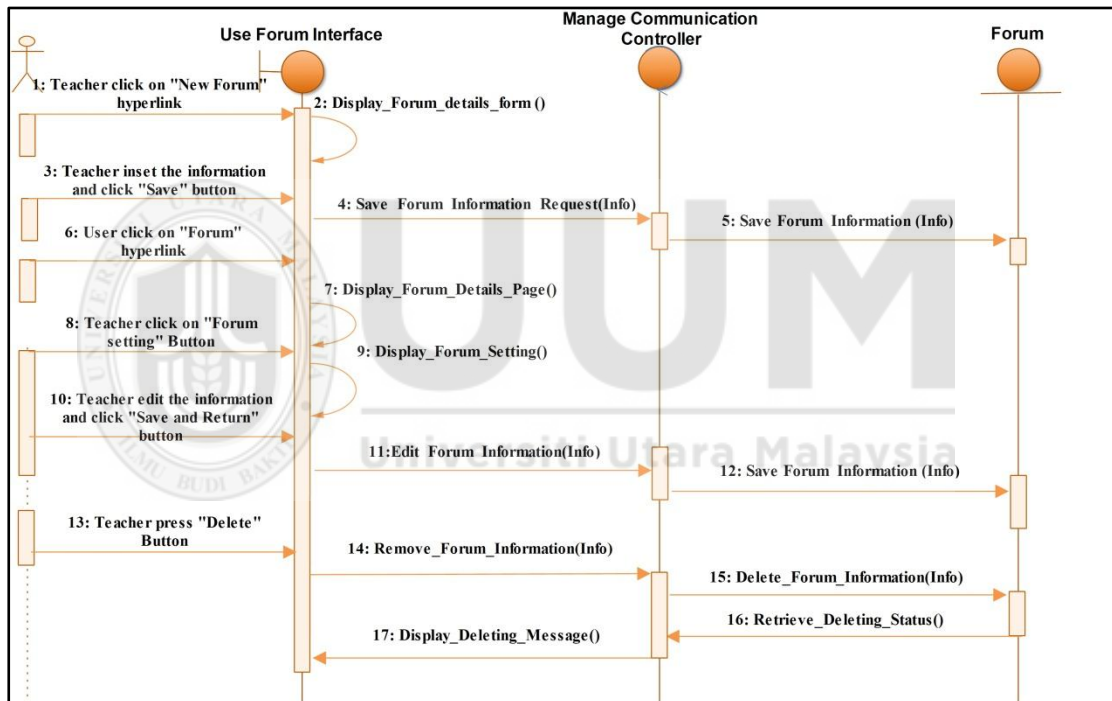
Figure 5. 56. Use Forum Sequence Diagram

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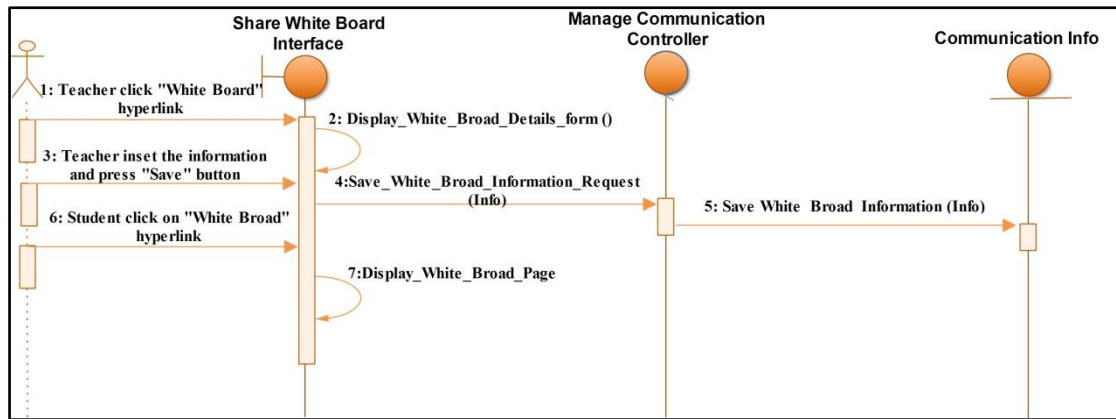
Figure 5. 57. Share White Board Sequence Diagram
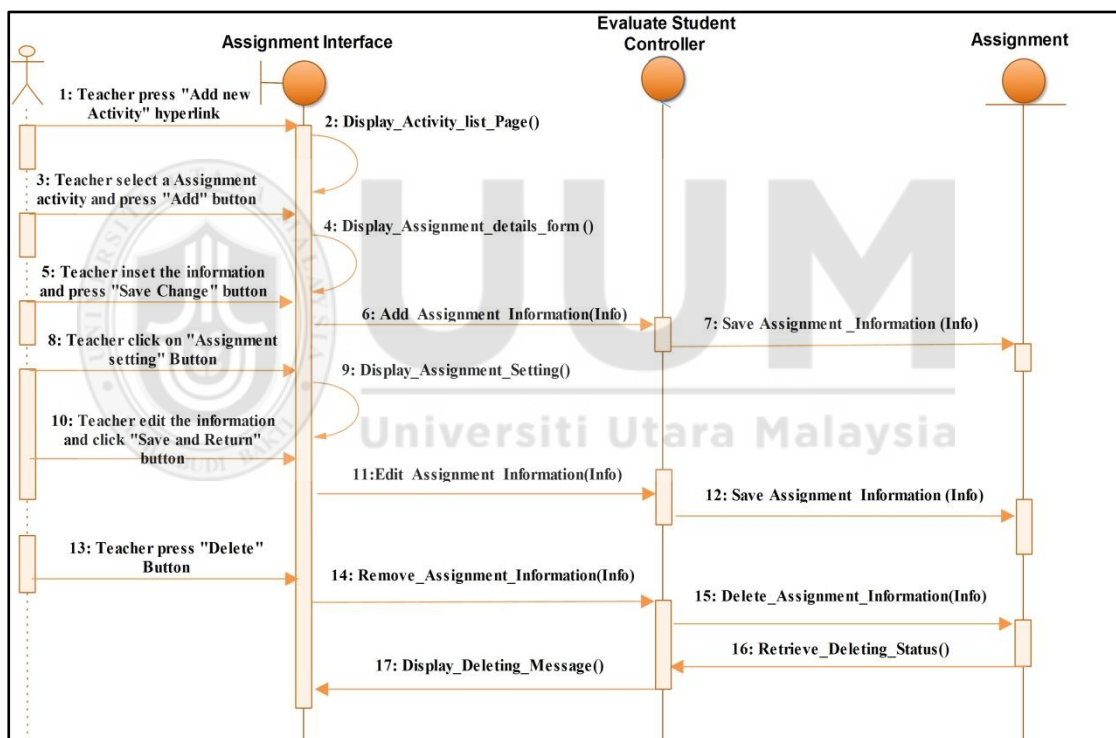
Figure 5. 58. Post Assignment Sequence Diagram

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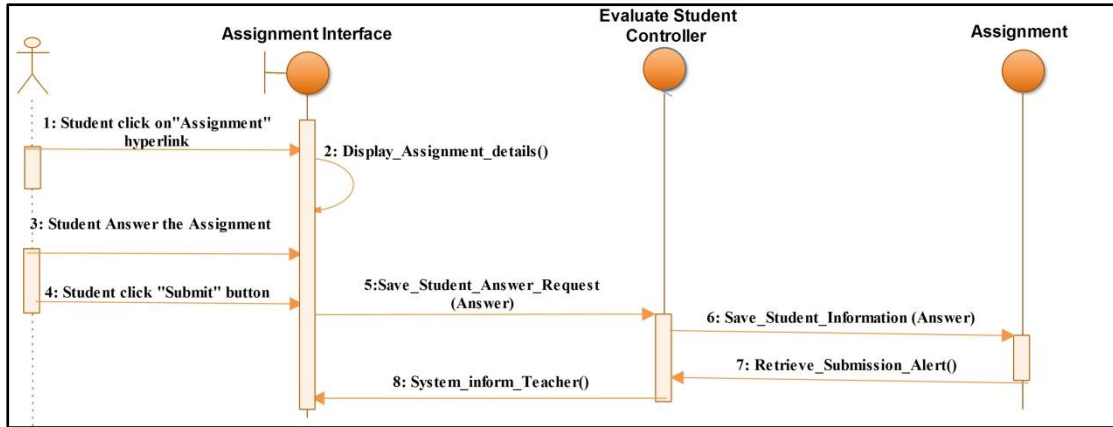
Figure 5. 59. Submit Assignment Sequence Diagram
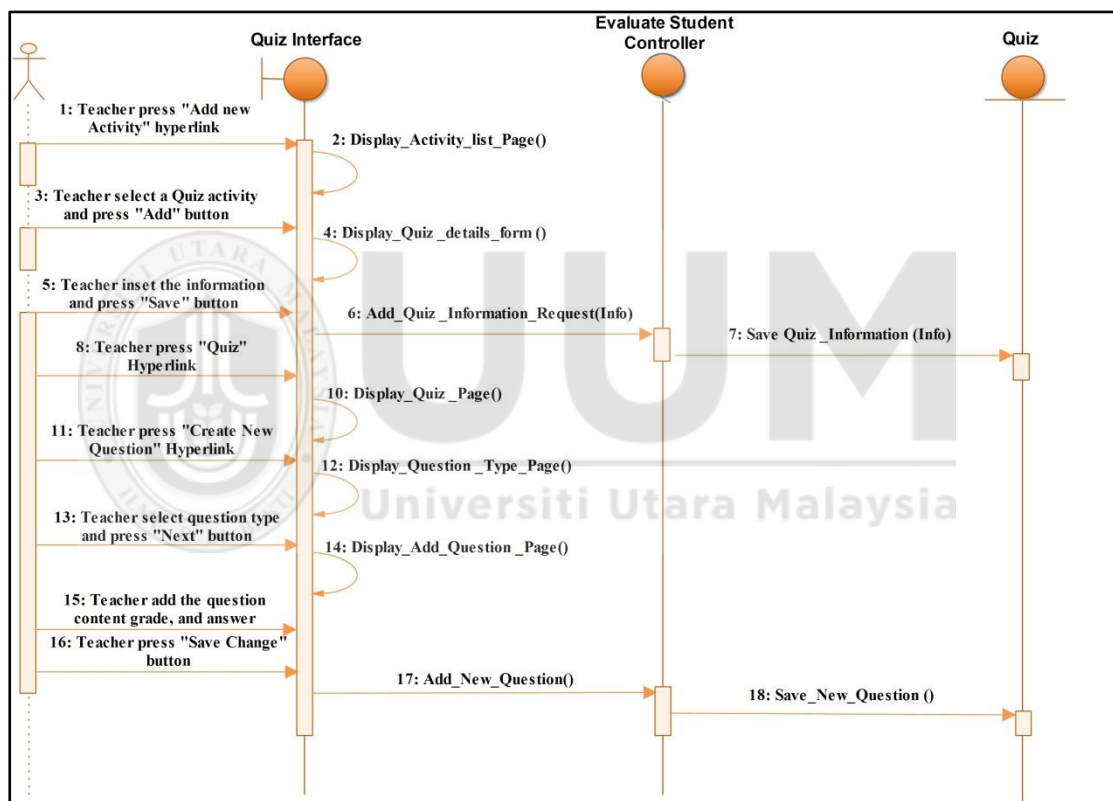
Figure 5. 60. Post Quiz Sequence Diagram
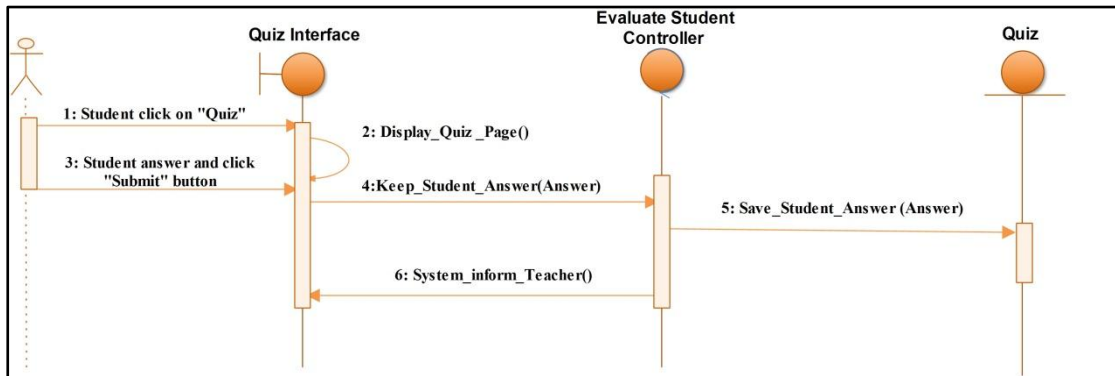
Figure 5. 61. Submit Quiz Sequence Diagram
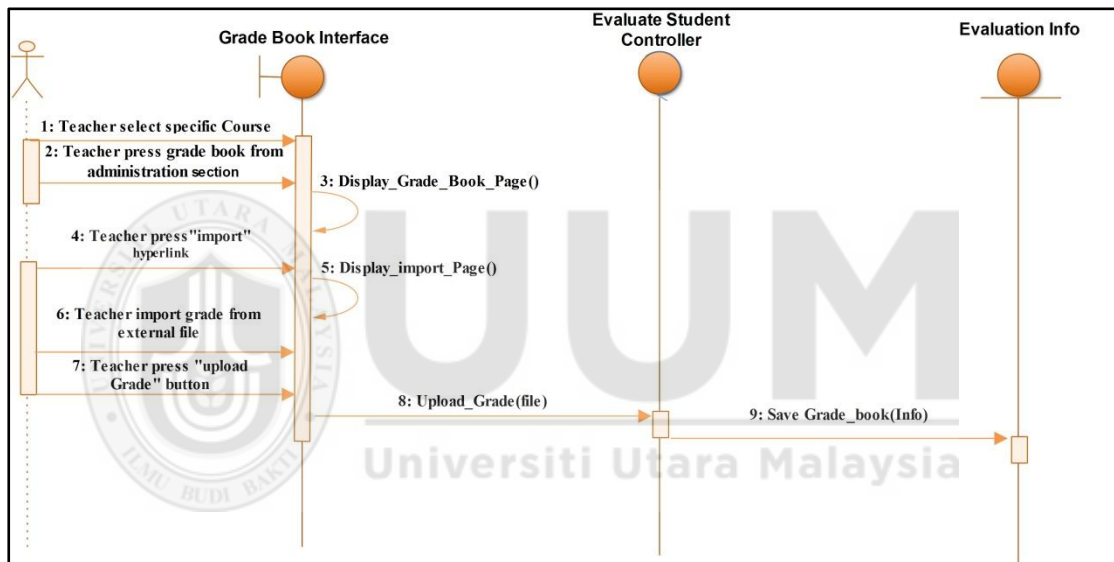
Figure 5. 62. Upload Grades Book Sequence Diagram
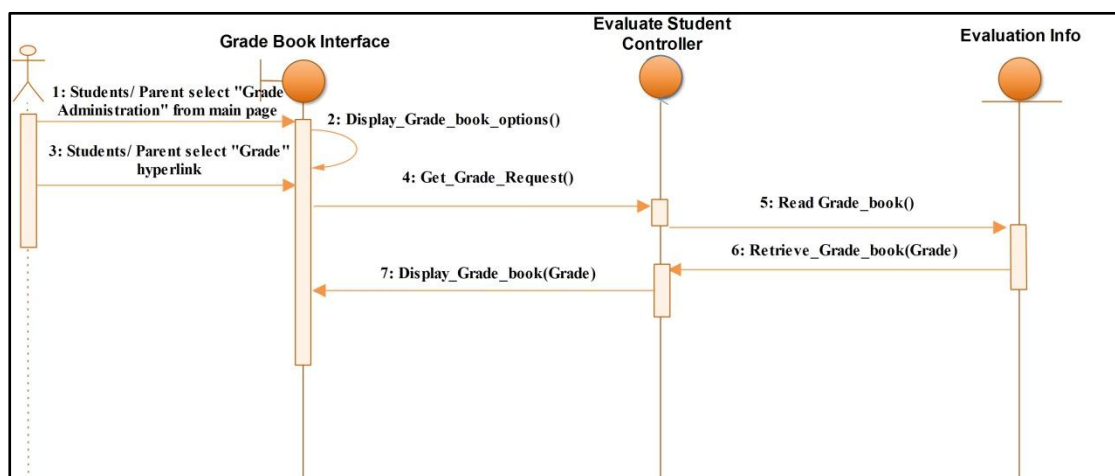
Figure 5. 63. View Grades Book Sequence Diagram
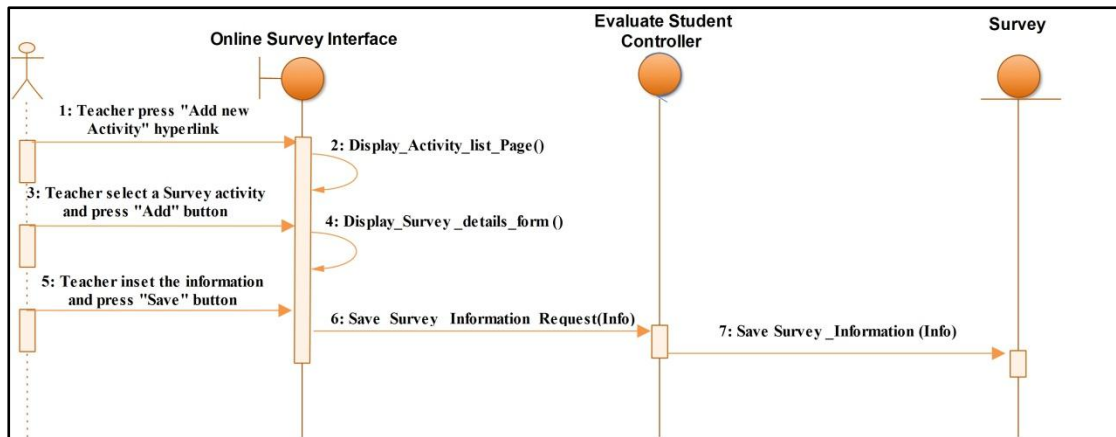
Figure 5. 64. Post Online Survey Sequence Diagram
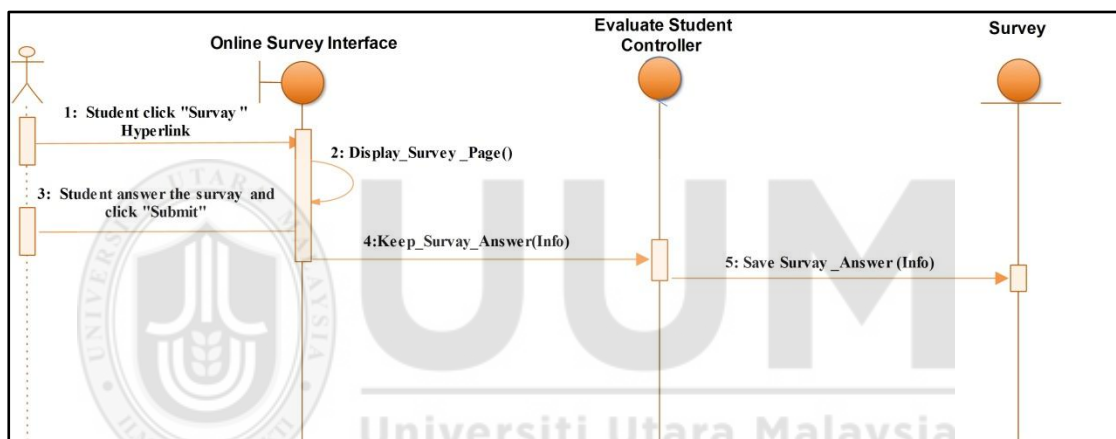
Figure 5. 65. Submit Online Survey Sequence Diagram
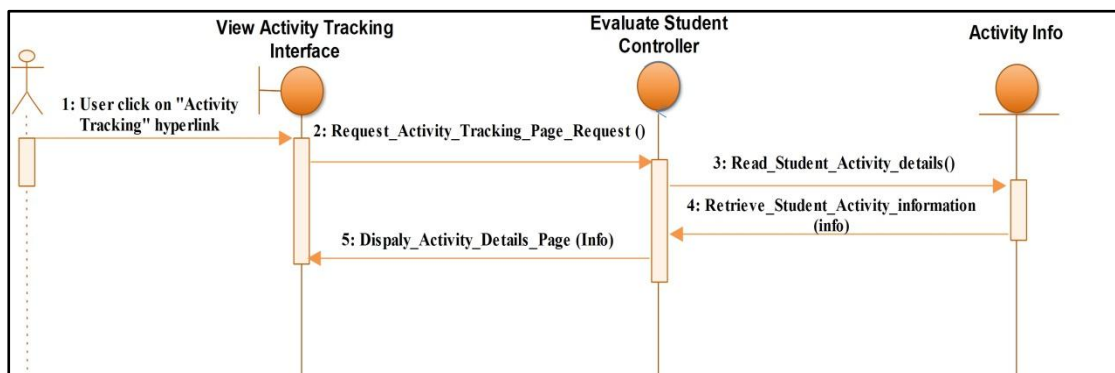
Figure 5. 66. View Activity Tracking Sequence Diagram

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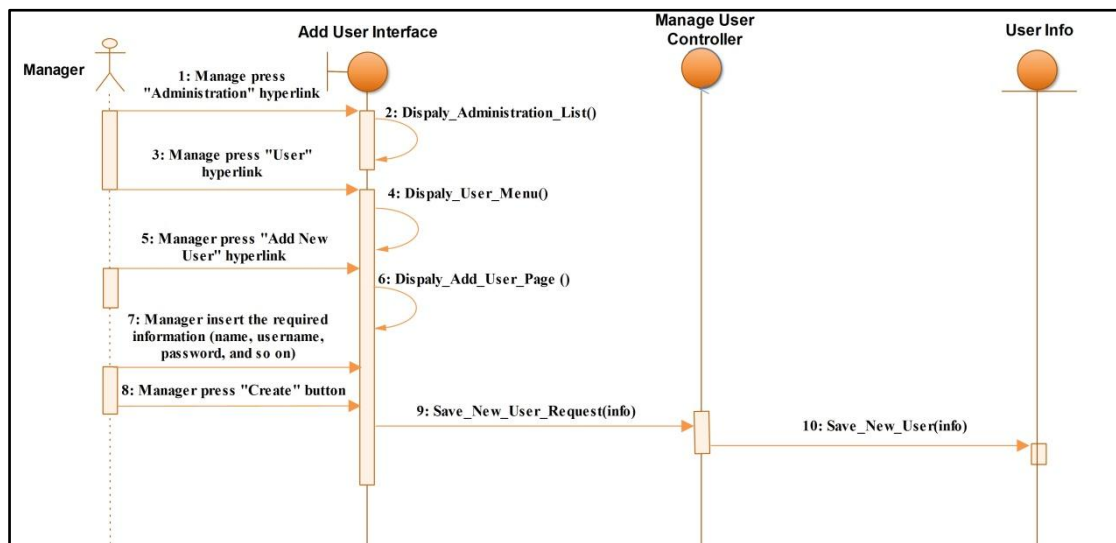
Figure 5. 67. Add User Sequence Diagram
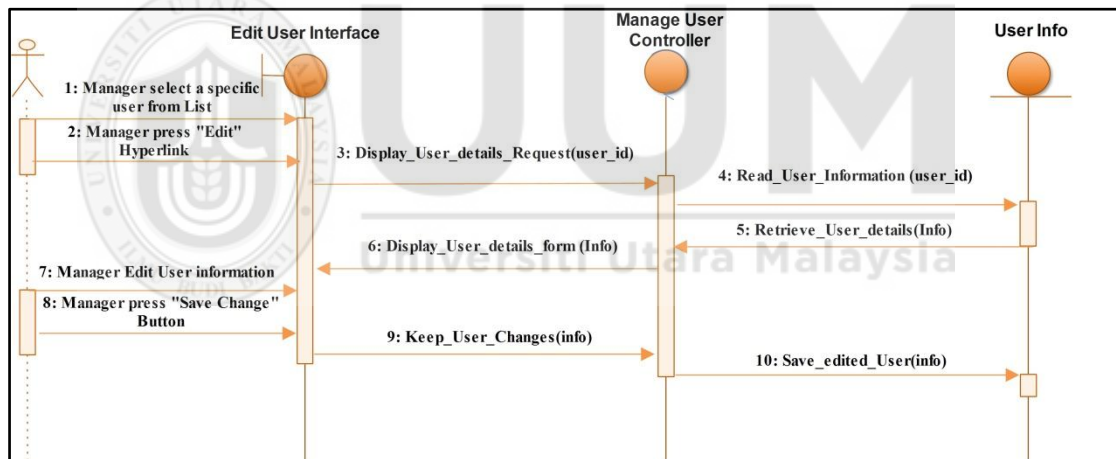
Figure 5. 68. Update User Information Sequence Diagram
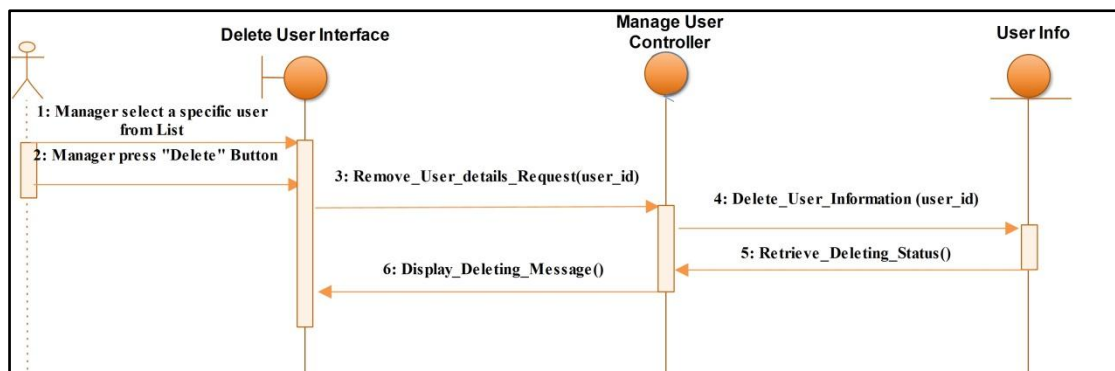
Figure 5. 69. Delete User Sequence Diagram

5.2.4 Class Diagram

Figure 5.16 depicts a start at a simple UML class diagram for the conceptual E-LS. Classes are represented as boxes with three sections; the top one indicates the name of the class, the middle one lists the attributes of the class, and the third one lists the methods.
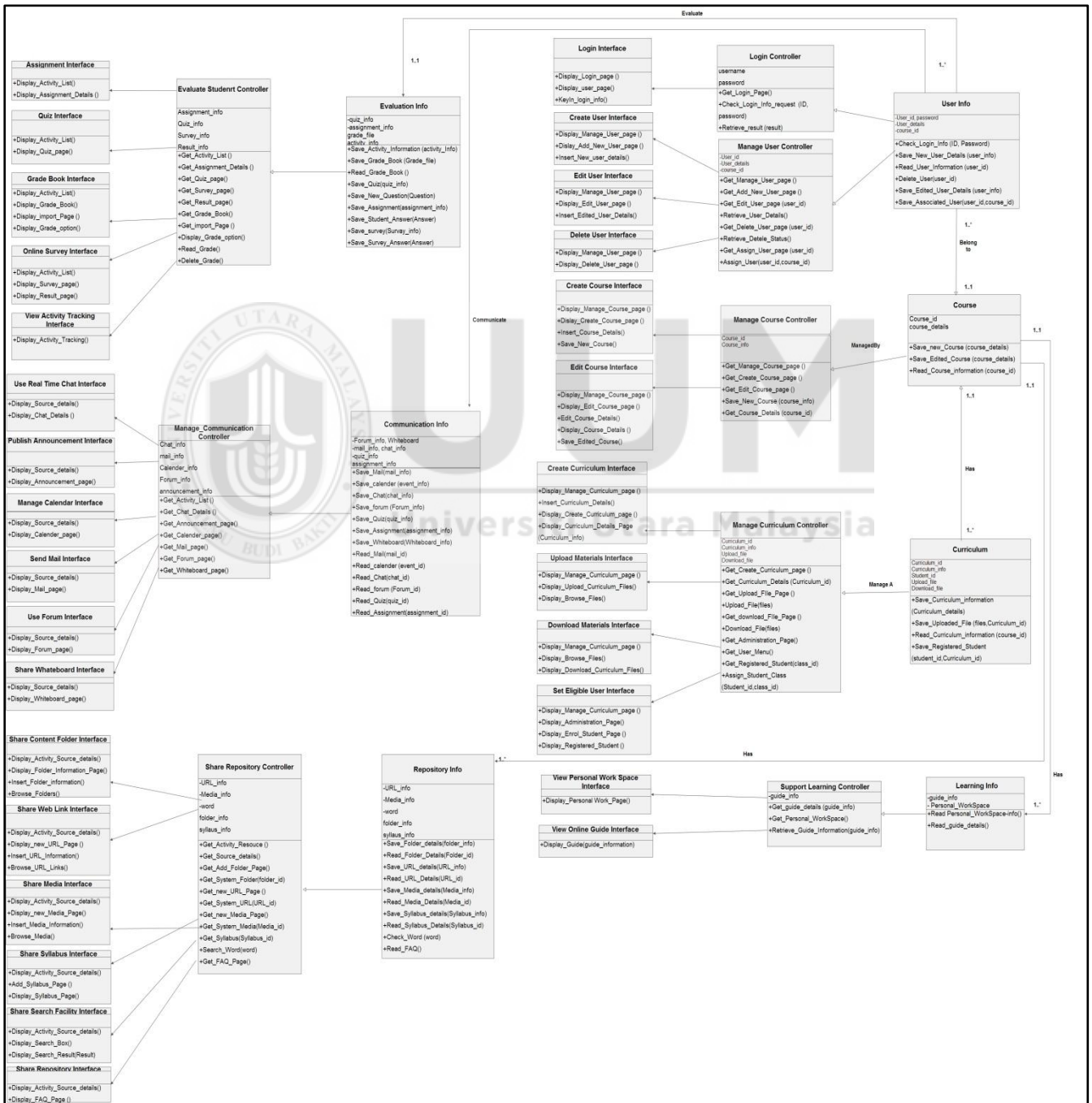
Figure 5. 70. Class Diagram

5.3 System Interfaces

After determine the requirements (as described in the Chapter 4), a system prototype has been successfully developed. The system incorporates all functional and non-functional requirements. Open source technology (Moodle) was used to develop the system.

1- **The Main Page:**

During this page the user can see the home page of E-LS that include course categories, navigation and calendar blocks as shown in Figure 5.71.
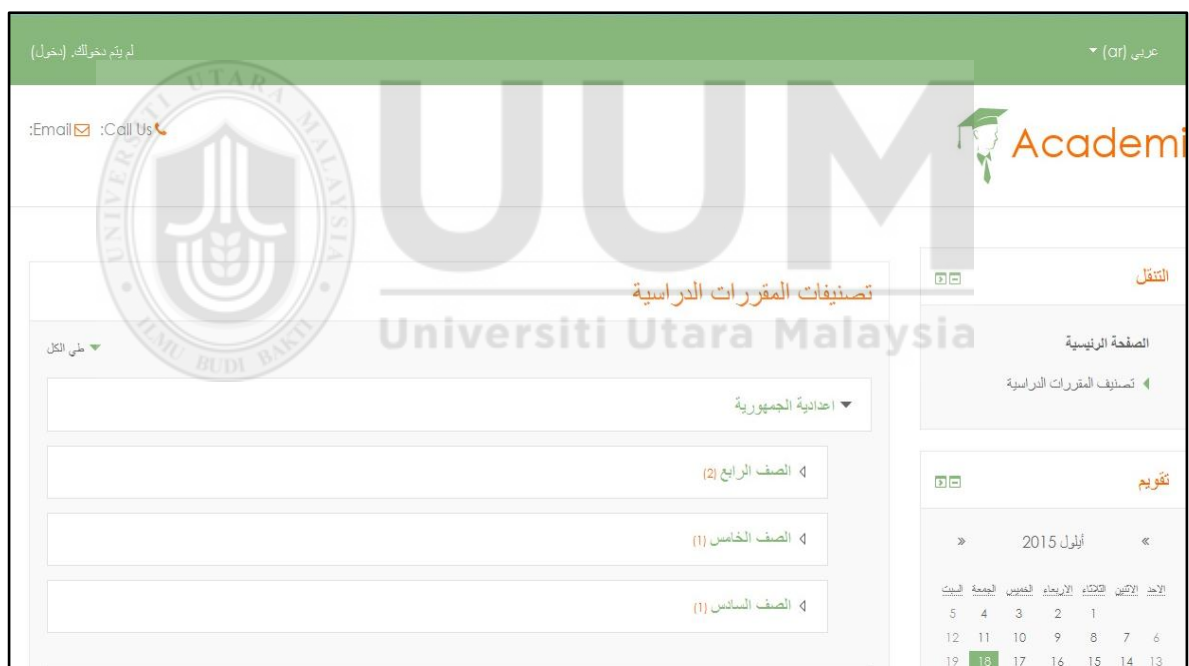
Figure 5. 71 The Main Page

2- **Login Page:**

In this page, the user can enter inside the system by using their user name and password. The user should be registered in the system and have user name and

password. If the user enters any error input, the system will give error massage. As shown in Figure 5.72.

Figure 5. 72. Login Page

3- **Teacher's Page**

As shows in Figure 5.73, this the main page of the teacher that shows course overview, personal files, online users and new events. From this page, the teacher can manage the course and interact with the students and their parents.
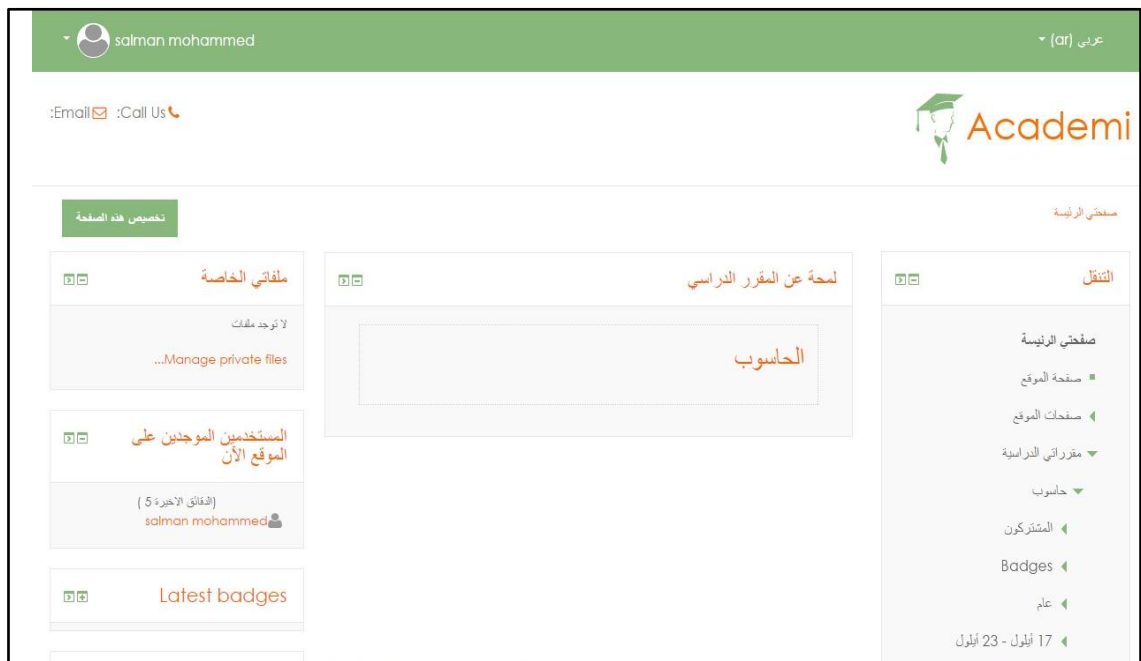
Figure 5. 73. Teacher Page

4- **Student's Page**

Figure 5.74 shows the main page of the student that includes personal files, student courses and calendar. Through this page the student will be able to interact with teachers and students as well as can take quizzes and assignments.
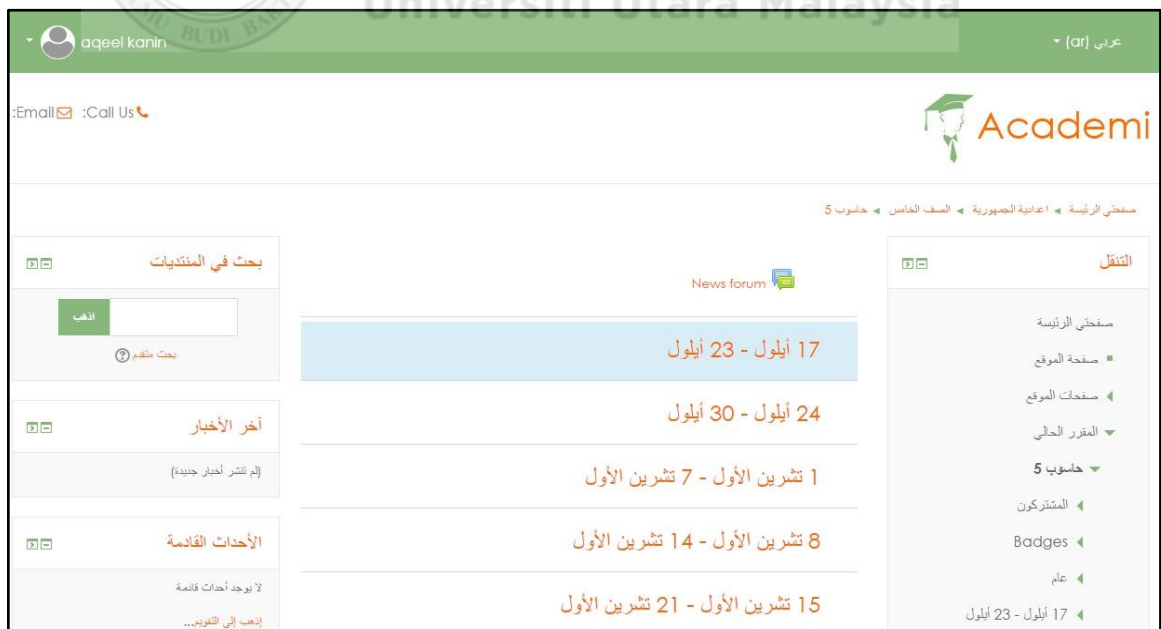
Figure 5. 74. Student Page

5- **Manager's Page**

In Manager's page, the manager can see and manage all the courses in the school. In addition, through this page the manager can submit the announcements, add course and add new user as well as interact with the users in the system.

Figure 5. 75. Manager Page

6- **Parent's Page**

Figure 5.76 shows the parent's page that involve on the announcements and events as well as grades and calendar. The parent can interact with teachers and management of school through this page.
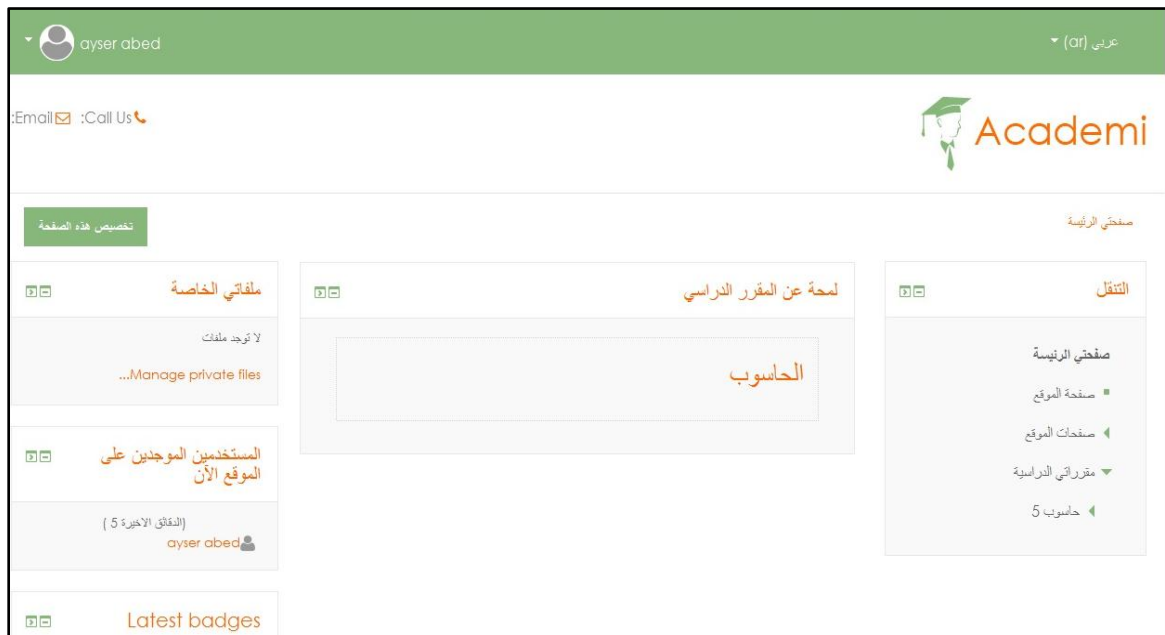
Figure 5. 76. Parent Page

5.4 Summary for Chapter Five

This chapter describes the details of the system design by construct the UML diagrams, including use case diagrams, activity diagrams, sequence diagrams and class diagram. The system prototype has been developed. Hence, the system has been explained with helps of snapshots.

CHAPTER SIX
VERIFICATION AND VALIDATION

6.1 Introduction

This chapter discusses the result of verification and validation of the functional requirement model. The model has been verified by using the expert review approach and validated using acceptance and usability evaluation by the users. Acceptance and usability evaluations were carried out to determine the acceptance and usability of E-LS. The acceptance evaluation is very important, because user acceptance is one the fundamental issue determining the success or failure of information systems (Davis & Venkatesh, 1996; Legris et al., 2002). Meanwhile, usability evaluation is carried out to gather data about how much users feel that E-LS is usable for them in their work (Preece et al., 1994).

6.2 Acceptance Evaluation

In this study, user acceptance evaluation was carried out specifically to acquire the feedback on the extent the users (students, teachers, parents and managers of schools) could accept the E-LS. Hence, their perceptions on the communication, usefulness, ease of use, and satisfaction of E-LS were gathered (see Appendix C).

6.3 Usability Evaluation

The usability evaluation was carried out to ensure that users feel that the E-LS (through the requirements as extracted and explained in Chapter 4) is useful and that they feel it is easy to use. A sample of 122 participants (students, teachers, parents and managers of schools) involved in both the acceptance and usability studies. A questionnaire that contains nineteen questions (Appendix D) was used to gather the data.

6.4 Results

This section describes the results gathered from the experts' verification for functional requirements model, acceptance evaluation and usability evaluation. The results are discussed separately. First, the results of experts review explained. Then, acceptance evaluation is described, followed by the results of usability evaluation.

6.4.1 The Results of Verification through Experts Review

The requirement model was verified by three experts as reviewers in terms of Completeness, Consistency and Unambiguous. Completeness describes that the requirement model has no missing component and information, and that it is sufficient to represent the system. Unambiguous qualifies that the model clearly provides information that are understandable with no multiple meaning or interpretations. Consistency means that the requirements enumerated in the model are not conflicting, can be annotated using the conventional naming style and conforms to the UML notation.

The reviewers gave valuable comments to improve the functional requirement model. The reviewers gave valuable comments to improve the functional requirement model. The reviewers suggested separate each use case of Assignment, Quiz and Online Survey into two use case diagrams. One diagram for teacher to post the activity and another one for student to submit the answer. Other comment was about how to present all the use cases in use case diagram, where, the experts suggest making each core use case as component and include all the sub use cases inside it. With regard to use case specification, the experts proposed to add link between main flow and sub flows through add condition to move or go to the sub use cases. The experts also suggested separating each flow in one sequence. In addition, the name of object or

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entity should be noun. The summary of the experts' review results is presented in Table 6.1.

Table 6. 1

Summary of Experts' Review

No	Characteristic	Conclusion
1	Completeness	In general, the requirements have been completed and have been modeled using the appropriate diagram. In addition, there is no missing requirement and each requirement does not need to further clarification. The functional requirement model is sufficient to represent the real system.
2	Consistency	Overall, all requirements do not conflict with each other and used the correct UML notation. All naming convention has been applied consistently.
3	Unambiguous	In general, each requirement has been provided with adequate information to avoid the ambiguity and each requirement stated has only one interpretation. In addition, each requirement is expressed using the terms which can be clearly understood.

On the other hand, the findings of the expert review rankings of the model's qualities are presented in Table 6.2. The mean values for the rankings are Expert A (4.44), Expert B (4.77), and Expert C (4.00). The findings showed that all the experts agreed with the listed qualities of the proposed requirement model.

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Table 6. 2

Mean Values of the Expert Review findings

Characteristic	Expert A	Expert B	Expert C	Mean
Completeness	4.33	4.66	4.00	4.33
Unambiguous	4.33	4.66	4.00	4.33
Consistency	4.66	5.00	4.00	4.55
Mean	4.44	4.77	4.00	4.4

The dimensions used to evaluate the proposed requirement model has nothing less than 4.00 (agree). Consistency has the highest ranking of 4.55. This implies that the model is found to be consistent with standard notation and UML, and also naming convention (e.g. use case) has been applied consistently. Other ranked dimension is completeness and unambiguous (4.33) and this also suggests that the requirement model has no missing component and information, and thus, sufficient to represent the system with provide sufficient information for each functional requirement presented in the model to avoid ambiguity. The least rank is completeness and unambiguous (4.33), but if placed on the maximum obtainable grade of 5.00, it is still a very good ranking. This also suggests that the requirement model makes complete and easily understandable presentation.

From the experts' perspective, both experts A and B ranked the model on more than 4.00, while expert C's rank is 4.00. The factor responsible could not be ascertained. In all, the cumulative mean of all the dimensions is 4.4, and this strongly suggests that the proposed functional requirement model is appropriate and satisfactory.

6.4.2 Results of User Acceptance Evaluation

Technology Acceptance Model (TAM) is an intention-based model, developed specifically for explaining user acceptance of computer technology (Masrom, 2007). The results of user acceptance evaluation begin with some personal information. Then, the results on perceived communication follow, which is followed next with the results on usefulness. After that, ease of use and satisfaction of E-LS are analysed. The questionnaire was randomly distributed to 122 participants that fulfilled the criteria discussed in Chapter 3 (see Section 3.6).

6.4.3 Reliability for Acceptance Evaluation

Cronbach's Alpha analysis is used to determine the internal reliability of each item measuring the participants' acceptance. For such purpose, Nunnally (1978) has indicated that 0.70 is the threshold. For this study, having run the test, the results are exhibited in Table 6.3. It could be seen that the values are between 0.714 and 0.755. This indicates that all dimensions in the instrument are reliable and that data are ready for further analysis.

Table 6. 3

Reliability for Acceptance Evaluation

Acceptance Perceives	Cronbach's Alpha
Communication	0.718
Usefulness	0.717
Ease of Use	0.714
Satisfaction	0.755

A. **Demographic Information**

The first section in the questionnaire focuses on general information about the region to understand about the participant's area. It could be seen in Table 6.4 and Figure 6.1 that 77 participants (63.1%) are from urban area, while 45 participants (36.9%) are from rural area.

Table 6. 4

Region Distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	urban	77	63.1	63.1	63.1
	rural	45	36.9	36.9	100.0
	Total	122	100.0	100.0	
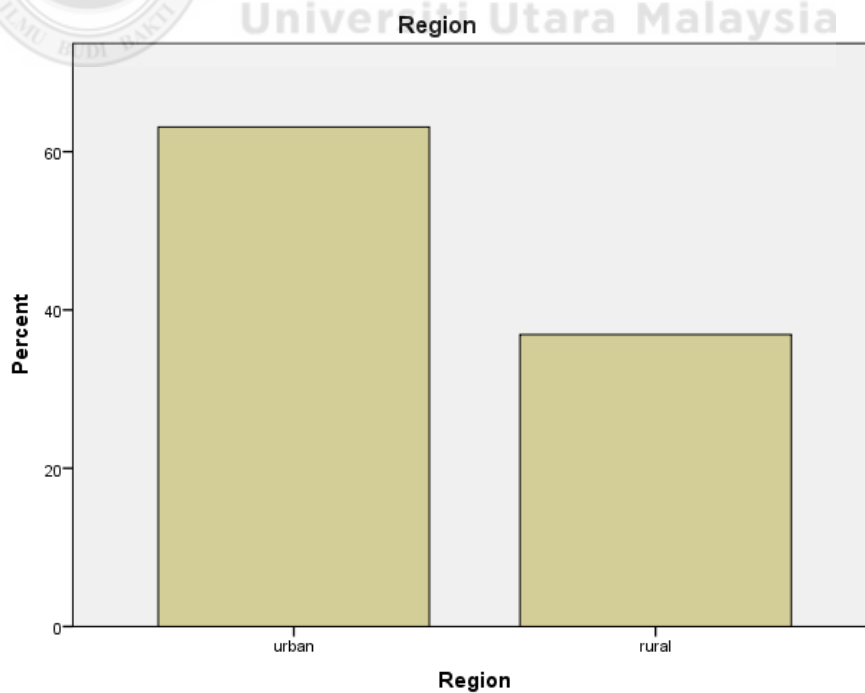
Figure 6. 1. Region Distribution

Furthermore, the roles of participants are also investigated. Accordingly, the details are exhibited in Table 6.5 and Figure 6.2. It is seen that most of the participants are students and parents (both are 47.5%). Meanwhile, 3.3% of the participants are teachers and 1.6% are the managers of the schools.

Table 6. 5

Users' Role

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Student	58	47.5	47.5	47.5
	Teacher	4	3.3	3.3	50.8
	Parent	58	47.5	47.5	98.4
	Manager	2	1.6	1.6	100.0
	Total	122	100.0	100.0	
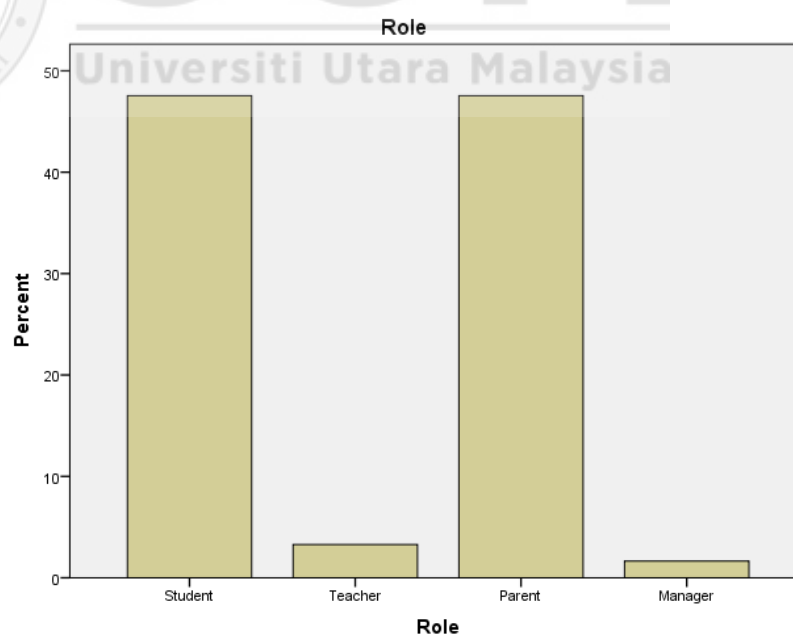
Figure 6. 2. Users' Role

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In terms of grade, the participants are students from three grades; Grade1, Grade2, and Grade3, in which the distribution is even with 35%, 35%, and 30% respectively. This is shown illustratively in Figure 6.3.
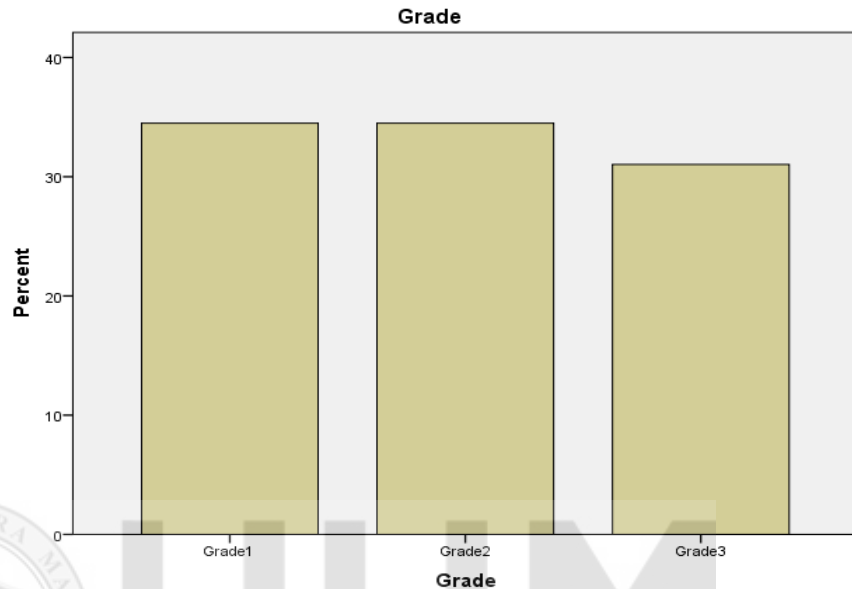
Figure 6. 3. Students' Grades

The previous paragraphs explain about the demographic information of the participants. It could be concluded that the participants in the data collection are representative enough for two schools from two different areas (urban and rural) in Dhi-Qar province. This portrays that the analysis of the collected data is convincing.

B. Communication, Usefulness, Ease of Use and Satisfaction

The second section of the questionnaire investigates on the extent the participants accept the E-LS. This is measured based on their perception, in which Likert scale is used (can be seen in Appendix C). Each question provides options between 1 (strongly disagree) and 5 (strongly agree).

(i) Perceived Communication

This section details the results for perceived communication of the E-LS. They are explained in detail by discussing each question individually.

Table 6. 6

Perceived Communication- Question1

Q1:- I think create an online collaborative learning environment through social software is a good idea.			
	Scale	**Frequency**	**Percentage**
	Strongly Disagree	0	0%
Communication	Disagree	0	0%
	Not Sure	11	9%
	Agree	72	59%
	Strongly Agree	39	32%
	Total	122	100%

The first question asks whether creating an online collaborative learning is considered a good idea. It could be seen in Table 6.6 that the results show that 59% of subjects agree that it does. On top of that 32% strongly agree that it is considered a good idea. While the remaining participants (9%) are not sure whether it is a good idea, none of the participants (0%) disagree nor strongly disagree that it is a good idea.

Next, the second question is related to whether the E-LS provides community environment. It can be noticed through the results in Table 6.7, that 57% of the subjects agree and 30% strongly agree that the E-LS provides collaborative learning and community environment. Meanwhile, others (13%) are not sure. This shows that there is no participant disagrees with the statement.

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Table 6. 7

Perceived Communication - Question2

Q2:- I think the IE-LS supports collaborative learning, knowledge sharing, exchange ideas, networking and community building.			
	Scale	**Frequency**	**Percentage**
	Strongly Disagree	0	0%
Communication	Disagree	0	0%
	Not Sure	16	13%
	Agree	70	57%
	Strongly Agree	36	30%
	Total	122	100%

Then, the third question asks on whether the E-LS helps the users to organize and exchange the personal knowledge with others. The results in Table 6.8 explain that 62% of the subjects agree and 27% strongly agree that the E-LS helps them to share the knowledge with others. On top of that, no participant disagrees with the statement, while 11% of the participants are not sure.

Table 6. 8

Perceived Communication - Question3

Q3:- I think the IE-LS helps me to organize and exchange my personal knowledge with others.			
	Scale	**Frequency**	**Percentage**
	Strongly Disagree	0	0%
Communication	Disagree	0	0%
	Not Sure	13	11%
	Agree	76	62%
	Strongly Agree	33	27%
	Total	122	100%

In question 4, subjects are asked whether the E-LS provides users with the opportunity to communicate with others. Table 6.9 exhibits the results, showcasing that 60.6% of subjects agree and 27.9% strongly agree that the system gives them the

opportunity to communicate with others. Meanwhile, 11.5% ware ere not sure. With that, there is no participant disagrees that the system provides users with the opportunity to communicate with others

Table 6. 9

Perceived Communication - Question4

Q4:- I think the IE-LS gives me opportunity to communicate with others

	Scale	Frequency	Percentage
	Strongly Disagree	0	0%
Communication	Disagree	0	0%
	Not Sure	14	11.5%
	Agree	74	60.6%
	Strongly Agree	34	27.9%
	Total	122	100%

Responding to question 5, most of the subjects agree (68.9% agree and 22.1% strongly agree) that the E-LS supports personalized learning resources that are able to connect people with right knowledge. Meanwhile, only 9% are not sure, while there is no participant disagrees (see Table 6.10).

Table 6. 10

Perceived Communication - Question5

Q5:- I think the IE-LS supports personalized learning resources which are able to connect people with right knowledge.

	Scale	Frequency	Percentage
	Strongly Disagree	0	0%
Communication	Disagree	0	0%
	Not Sure	11	9.0%
	Agree	84	68.9%
	Strongly Agree	27	22.1%
	Total	122	100%

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Table 6. 11

Perceived Communication - Question6

Q6:- I think the IE-LS increases interest, motivation and learning achievement in a collaborative learning environment.			
	Scale	**Frequency**	**Percentage**
	Strongly Disagree	0	0%
Communication	Disagree	0	0%
	Not Sure	16	13.1%
	Agree	70	57.4%
	Strongly Agree	36	29.5%
	Total	122	100%

Nevertheless, the instrument also asks on whether the E-LS increases interest and motivation in collaborative learning. The results are detailed in Table 6.11. With reference to the results, it can be concluded that more than 85% of subjects agree (57.4% agree and 29.5% strongly agree) that the E-LS can increase motivation to learning. Meanwhile, there is no participant disagrees with the statement, while only 13.1% are not sure.

(ii) Perceived Usefulness

In terms of perceived usefulness, question 7 precisely asks whether the use of social networking features in the E-LS is useful to share knowledge and exchange ideas with others. With reference to the results displayed in Table 6.12, it can be concluded that more that 80% of the subjects agree (60.7% agree and 22.1% strongly agree) that it is useful. In addition, the rest (17.2%) are not sure.

Table 6. 12

Perceived Usefulness - Question7

Q7:- I think using social networking features in the IE-LS are useful to share knowledge and exchange ideas with others			
	Scale	**Frequency**	**Percentage**
	Strongly Disagree	0	0%
Usefulness	Disagree	0	0%
	Not Sure	21	17.2%
	Agree	74	60.7%
	Strongly Agree	27	22.1%
	Total	122	100%

Besides, the instrument also asks on whether the E-LS is useful for conversation and interaction through discussions with others. The results are exhibited in Table 6.13, which showcase that more than 80% of the subjects agree that the system is useful for conversation and interaction through discussions with others. In fact, out of that, 27.9% of the subjects strongly agree. Meanwhile, the rest (18.9%) are not sure, and there is no subject disagrees.

Table 6. 13

Perceived Usefulness – Question 8

Q8:- I think using the IE-LS is useful for conversation and interaction through discussions with others			
	Scale	**Frequency**	**Percentage**
	Strongly Disagree	0	0%
Usefulness	Disagree	0	0%
	Not Sure	23	18.9%
	Agree	65	53.2%
	Strongly Agree	34	27.9%
	Total	122	100%

Table 6. 14

Perceived Usefulness – Question 9

Q9:- I think using the IE-LS is useful to support networking and community building with others.			
	Scale	**Frequency**	**Percentage**
	Strongly Disagree	0	0%
Usefulness	Disagree	0	0%
	Not Sure	23	18.9%
	Agree	65	53.2%
	Strongly Agree	34	27.9%
	Total	122	100%

Table 6.14 details the results for question 9, which asks whether the E-LS is useful to support networking and community building with others. It is seen that the results are similar with question 8, where, 53.2% of subjects agree and 27.9% strongly agree, while the others are not sure.

Next, question 10 asks whether the E-LS is useful to activities and performances. The details are shown in Table 6.15. Based on the results, more than three quarters of participants (77.9%) agree that the system is useful in general. Meanwhile, the others (22.1%) are not sure.

Table 6. 15

Perceived Usefulness – Question 10

Q10:- Overall, I think using the IE-LS is useful to my learning activities and performances.			
	Scale	**Frequency**	**Percentage**
	Strongly Disagree	0	0%
Usefulness	Disagree	0	0%
	Not Sure	27	22.1%
	Agree	72	59.0%
	Strongly Agree	23	18.9%
	Total	122	100%

(iii) Perceived Ease of Use

With regards to perceived ease of use, question 11 asks whether the E-LS is easy to share knowledge and exchange ideas. Referring to the results in Table 6.16, it can be concluded that more than 82% of the participants agree (54.9% agree and 28.7% strongly agree) that it is easy to share the knowledge in the E-LS. Only 11.5% of the participants are not sure. However, 4.9% of the participants disagree with the statement.

Table 6. 16

Perceived Ease of Use – Question 11

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Q11:- I think it is easy to share knowledge and exchange ideas in the IE-LS.

	Scale	Frequency	Percentage
	Strongly Disagree	0	0%
Ease of Use	Disagree	6	4.9%
	Not Sure	14	11.5%
	Agree	67	54.9%
	Strongly Agree	35	28.7%
	Total	122	100%

The ability to communicate and interact with others is very important in the system. Hence, question 12 asks whether it is easy to communicate and interact with others in the E-LS. Most of participants agree (52.5% agree and 15.6% strongly agree) that it is easy to communicate and interact with others in the E-LS. Meanwhile, 23.7% of participants are not sure. In fact, 8.2% of the participants state that it is not easy to communicate and interact with others in the E-LS.

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Table 6. 17

Perceived Ease of Use – Question 12

Q12:- I think it is easy to communicate and interact with others in the IE-LS

	Scale	Frequency	Percentage
	Strongly Disagree	0	0%
Ease of Use	Disagree	10	8.2%
	Not Sure	29	23.7%
	Agree	64	52.5%
	Strongly Agree	19	15.6%
	Total	122	100%

Table 6. 18

Perceived Ease of Use – Question 13

Q13:- I think it is easy to network and create a community with others in the IE-LS.

	Scale	Frequency	Percentage
	Strongly Disagree	0	0%
Ease of Use	Disagree	8	6.6%
	Not Sure	26	21.3%
	Agree	62	50.8%
	Strongly Agree	26	21.3%
	Total	122	100%

Question 13 asks whether it is easy to create a community with others in the E-LS. It is seen in Table 6.18 that more than half of participants agree with the statement. On top of that, 21.3% of the participants strongly agree. In the remaining, only 6.6% of the participants disagree, while the rest (21.3%) are not sure with the statement.

Further, Table 6.19 details the results for question 14, which asks whether the E-LS is easy to access and to find the user's way. The results show that most of participants agree (57.4% agree and 24.6% strongly agree) that it is easy to find the right buttons

in the E-LS. Meanwhile, 13.1% of the participants are not sure, and the rest (4.9%) disagree with the statement.

Table 6. 19

Perceived Ease of Use – Question 14

Q14:- I think the system is easy to access and navigate to find my way (i.e. to find the right buttons) in the IE-LS.

	Scale	Frequency	Percentage
Ease of Use	Strongly Disagree	0	0%
	Disagree	6	4.9%
	Not Sure	16	13.1%
	Agree	70	57.4%
	Strongly Agree	30	24.6%
	Total	122	100%

Table 6. 20

Perceived Ease of Use – Question 15

Q15:- I think it is easy to use the IE-LS even though there is no guidance from instructor.

	Scale	Frequency	Percentage
Ease of Use	Strongly Disagree	0	0%
	Disagree	8	6.5%
	Not Sure	13	10.7%
	Agree	76	62.3%
	Strongly Agree	25	20.5%
	Total	122	100%

Further, question 15 asks on whether the E-LS can be used easily without guidance. The results are shown in Table 6.120. From the table, it is seen that more than 82% of participants agree that it is. Meanwhile, 10.7% are not sure it is easy or not. In contrast, 6.5% of the participants do not find it easy.

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(iv) Perceived Satisfaction

In terms of perceived satisfaction, question 16 asks on whether the E-LS allows for sharing knowledge and ideas. The results are shown in detail in Table 6.21. It is seen that 102 of the participants (83.6%) participants are satisfied that the E-LS allows for sharing knowledge and ideas. Meanwhile, 20 participants (16.4%) are not sure.

Table 6. 21

Perceived Satisfaction – Question 16

Q16:- I am satisfied with the sharing knowledge and exchanging ideas features in the IE-LS

	Scale	Frequency	Percentage
	Strongly Disagree	0	0%
Satisfaction	Disagree	0	0%
	Not Sure	20	16.4%
	Agree	69	56.6%
	Strongly Agree	33	27.0%
	Total	122	100%

Then, question 17 precisely asks on whether the E-LS provides enough communication and interaction with others. Referring to the results detailed in Table 6.22, it is seen that most of the participants are satisfied with the communication and interaction in the E-LS. The rest are not sure.

Table 6. 22

Perceived Satisfaction – Question 17

Q17:- I am satisfied with the communication and interaction with others in the IE-LS

	Scale	Frequency	Percentage
	Strongly Disagree	0	0%
Satisfaction	Disagree	0	0%
	Not Sure	21	17.2%
	Agree	66	54.1%
	Strongly Agree	35	28.7%
	Total	122	100%

Next, Table 6.23 showcases the results of question 18, which asks on whether the users have satisfied with the networking and community in the E-LS. It is seen that 82.8% of the participants are satisfied (57.4% agree and 25.4% strongly agree). Meanwhile, the remaining (17.2%) are not sure, without anyone disagrees.

Table 6. 23

Perceived Satisfaction – Question 18

Q18:- I am satisfied with the networking and community with others in the IE-LS.

	Scale	Frequency	Percentage
Satisfaction	Strongly Disagree	0	0%
	Disagree	0	0%
	Not Sure	21	17.2%
	Agree	70	57.4%
	Strongly Agree	31	25.4%
	Total	122	100%

Nevertheless, flexibility is very important in a system for teaching and learning purposes. Hence, it is asked in question 19. With reference to the results in Table 6.23, 57.4% of the subjects satisfy with the flexible access in the E-LS. In fact, 29.5% of the participants strongly agree, meanwhile the other 13.1% have not decided.

Table 6. 24

Perceived Satisfaction – Question 19

Q19:- I am satisfied with the flexible accessibility of the IE-LS anytime and anywhere.			
	Scale	**Frequency**	**Percentage**
Satisfaction	Strongly Disagree	0	0%
	Disagree	0	0%
	Not Sure	16	13.1%
	Agree	70	57.4%
	Strongly Agree	36	29.5%
	Total	122	100%

On top of that, the mean for each question is also investigated. The results are exhibited in Table 6.25. It is seen that all questions have high mean score, which is either close to 4 or greater than 4. The standard deviations are small, less than 1. This explains that all statements regarding the E-LS in the questionnaire are agreed by the subjects with very small bias or influence of other factors. Most of the participants using the E-LS, which reported that they "agree or strongly agree" with that statement with Mean score (M=4.23) and Standard Deviation (SD=0.600).

Table 6. 25

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
COM1	122	3	5	4.23	0.600
COM2	122	3	5	4.16	0.635
COM3	122	3	5	4.16	0.594
COM4	122	3	5	4.16	0.608
COM5	122	3	5	4.13	0.545
COM6	122	3	5	4.16	0.635
UF1	122	3	5	4.05	0.628
UF2	122	3	5	4.09	0.680
UF3	122	3	5	4.09	0.680
UF4	122	3	5	3.97	0.642
EOU1	122	2	5	4.07	0.773
EOU2	122	2	5	3.75	0.816
EOU3	122	2	5	3.87	0.823
EOU4	122	2	5	4.02	0.760
EOU5	122	2	5	3.97	0.760
STF1	122	3	5	4.11	0.653
STF2	122	3	5	4.11	0.670
STF3	122	3	5	4.08	0.650
STF4	122	3	5	4.16	0.635
Valid N (listwise)	122				

6.4.4 Results of Usability Evaluation

The usability evaluation includes the results on 19 questions related to efficiency and effectiveness of the E-LS. The questionnaire was distributed to those who participated in the acceptance evaluation. The results of usability of the E-LS are discussed in this section. They are detailed by noting each question individually.

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Question 1 precisely asks on whether the E-LS is easy to use. As the results are analysed (displayed in Table 6.26), it is seen that more than 87% of the participants agree (62.3% agree and 25.4% strongly agree) that the E-LS is easy to use. Meanwhile, the rest (12.3%) are not sure.

Table 6. 26

Question 1

Q1:- Overall, I am satisfied with how easy it is to use the IE-LS

Scale	Frequency	Percentage
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	15	12.3%
Agree	76	62.3%
Strongly Agree	31	25.4%
Total	122	100%

Then, Question 2 asks on whether the E-LS can be used easily. With reference to the results in Table 6.27, 88.5% of the participants agree that it is simple to use the E-LS, while the other (11.5%) are not sure about that. Meanwhile, there is no participant disagree about the ease of the system.

Table 6. 27

Question 2

Q2:- It is simple to use the IE-LS

Scale	Frequency	Percentage
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	14	11.5%
Agree	78	63.9%
Strongly Agree	30	24.6%
Total	122	100%

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The next question asks the user whether the E-LS could effectively complete their work. Based on the results in Table 6.28, 65.6% of the participants found it is effective. Particularly, 20.5% strongly agree, meanwhile 13.9% have not decided, and there is no participant disagrees.

Table 6. 28

Question 3

Q3:- I can effectively complete my work using the IE-LS.

Scale	Frequency	Percentage
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	17	13.9%
Agree	80	65.6%
Strongly Agree	25	20.5%
Total	122	100%

Table 6. 29

Question 4

Q4:- I am able to complete my work quickly using IE-LS.

Scale	Frequency	Percentage
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	20	16.4%
Agree	75	61.5%
Strongly Agree	27	22.1%
Total	122	100%

Further, Question 4 asks on whether users are able to complete their work quickly and saves their time. As seen in Table 6.29, the results show that 61.5% of the participants agree and 22.1% strongly agree that the E-LS saves their time. Meanwhile, another 16.4% are not sure, but there is no participant disagrees.

Next, question 5 asks the users whether they can complete their work efficiently using the E-LS. The results are displayed in Table 6.30. From the table, it is seen that more than 90% of the participants are able to efficiently complete their work using the E-LS. Meanwhile, the others (9.8%) are not sure, and no participant disagrees.

Table 6. 30

Question 5

Q5:- I am able to efficiently complete my work using the IE-LS.

Scale	Frequency	Percentage
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	12	9.8%
Agree	82	67.2%
Strongly Agree	28	23.0%
Total	122	100%

Table 6. 31

Question 6

Q6:- I feel comfortable using the IE-LS.

Scale	Frequency	Percentage
Strongly Disagree	0	0%
Disagree	3	2.5%
Not Sure	12	9.8%
Agree	78	63.9%
Strongly Agree	29	23.8%
Total	122	100%

Table 6.31 explains the results of Question 6, which asks the users whether they feel comfortable with the E-LS. It is seen that 87.7% of the participants are comfortable when using the system. In contrast, there is 2.5% of the participants feel uncomfortable with the system. Meanwhile, the rest are not sure.

Further, Question 7 asks whether the users can learn how use the E-LS easily. The results are displayed in Table 6.32. Based on the results, it is seen that 58.2% of the participants agree that it is. On top of that, 25.4% of the participants strongly agree that it is easy to learn to use the E-LS. Meanwhile, 2.5% of the participants found it as not easy, and the other (13.9%) are not sure whether it is easy or not.

Table 6. 32

Question 7

Q7:- It was easy to learn to use the IE-LS.

Scale	Frequency	Percentage
Strongly Disagree	0	0%
Disagree	3	2.5%
Not Sure	17	13.9%
Agree	71	58.2%
Strongly Agree	31	25.4%
Total	122	100%

Table 6. 33

Question 8

Q8:- I believe I became productive quickly using the IE-LS.

Scale	Frequency	Percentage
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	19	15.6%
Agree	76	62.3%
Strongly Agree	27	22.1%
Total	122	100%

Then, Question 8 asks on whether the E-LS makes users productive quickly. It can be noticed through the results in Table 6.33 that majority of participants agree (62.3%

agree and 22.1% strongly agree) that they became productive quickly by using the E-LS. Additionally, 15.6% are not sure.

Actually, most of human make errors. Hence, the E-LS should anticipate for human errors. Thus, it should assist the users when they make any error. For such purpose, Question 9 asks whether the error messages are clear, and the results are displayed in Table 6.34. The results in Table 6.34 explain that the error messages in the E-LS are clear because 16.4% of the participants strongly agree with the statement. Also, 65.6% of the participants agree. Meanwhile only 18% have not decided.

Table 6. 34

Question 9

Q9:- The IE-LS gives error messages that clearly tell me how to fix problems.

Scale	Frequency	Percentage
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	22	18.0%
Agree	80	65.6%
Strongly Agree	20	16.4%
Total	122	100%

In addition, when the error messages are clear and help the user to solve the problem, the actions in recovering from the error must be easy. This aspect is asked in question 10, in which the results are explained in Table 6.35. With reference to the results, majority of the participants (84.6%) feel that the recovery from mistake is easy. While the rest (16.4%) are, no participant has expressed disagreement.

Table 6. 35

Question10

Q10:- Whenever I make a mistake using the IE-LS, I recover easily and quickly.		
Scale	**Frequency**	**Percentage**
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	20	16.4%
Agree	84	68.9%
Strongly Agree	18	14.7%
Total	122	100%

Next, Question 11 asks on whether the E-LS provides clear information to the users. The results in Table 6.36 show that the information is clear in the E-LS. Particularly, 82% of the participants agree with this statement. Meanwhile, the others (18%) are not sure.

Table 6. 36

Question 11

Q11:- The information (such as on-line help) provided with the IE-LS is clear.		
Scale	**Frequency**	**Percentage**
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	22	18.0%
Agree	75	61.5%
Strongly Agree	25	20.5%
Total	122	100%

Next, Table 6.37 details the results for Question 12, which asks on whether the E-LS provides clear information, meeting users' desire. It is seen that 57.4% of the participants agree and 18% strongly agree that it is easy to find the information. It is seen also that there is no participant disagrees, while the rest are not sure.

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Table 6. 37

Question 12

Q12:- It is easy to find the information I need.		
Scale	**Frequency**	**Percentage**
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	30	24.6%
Agree	70	57.4%
Strongly Agree	22	18.0%
Total	122	100%

Besides that, the information that the E-LS provides should be easy and understandable by the users. This is asked in Question 13, and the results are displayed in Table 6.38. It is seen that more than 77% of the participants agree (61.5% agree and 15.6% strongly agree) that the E-LS provide clear and understandable information. Meanwhile, the remaining (23%) are not sure.

Table 6. 38

Question 13

Q13:- The information provided with the IE-LS is easy to understand.		
Scale	**Frequency**	**Percentage**
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	28	23.0%
Agree	75	61.5%
Strongly Agree	19	15.5%
Total	122	100%

In addition, question 14 asks on whether the information that the E-LS provides helps the users in completing their works. As shown in Table 6.39, most of the participants agree with this statement (62.3% agree and 17.2% strongly agree). Meanwhile, 20.5% are not sure.

Table 6. 39

Question 14

Q14:- The information is effective in helping me complete my work.		
Scale	**Frequency**	**Percentage**
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	25	20.5%
Agree	76	62.3%
Strongly Agree	21	17.2%
Total	122	100%

On top of that, the organization of on-screen information in the E-LS should be clear. In accordance to that, Question 15 asks users on whether the organization of on-screen information in the E-LS is clear. With reference to the results in Table 6.40, majority of the participants agree (68.9% agree and 14.8% strongly agree) that the E-LS organizes its' on-screen information clearly. The remaining (16.3%) are not sure.

Table 6. 40

Question 15

Q15:- The organization of information on the IE-LS screens is clear.		
Scale	**Frequency**	**Percentage**
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	20	16.3%
Agree	84	68.9%
Strongly Agree	18	14.8%
Total	122	100%

Additionally, most of the participants agree that the interface of the E-LS is pleasant. This is deduced through the answers for Question 15 that asks whether the interface is pleasant. Particularly, more than 86% of participants agree to this question. Meanwhile, the rest (13.9%) are not sure.

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Table 6. 41

Question 16

Q16:- The interface of the IE-LS is pleasant.		
Scale	Frequency	Percentage
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	17	13.9%
Agree	75	61.5%
Strongly Agree	30	24.6%
Total	122	100%

Another, majority of the participants like using the interface of the E-LS. As shown in Table 6.42, there are more than 81% of the participants like the interface of the system (57.4% agree and 23.8% strongly agree). However, the others are not sure.

Table 6. 42

Question 17

Q17:- I like using the interface of the IE-LS.		
Scale	Frequency	Percentage
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	23	18.8%
Agree	70	57.4%
Strongly Agree	29	23.8%
Total	122	100%

Next, Question 18 asks on whether the E-LS provides all the functions and capabilities as desired by the users. Table 6.43 details the results, in which 68% of the participants agree and 18.9% strongly agree that this system has all the functions and capabilities that the users expect it to have. Meanwhile, the rest are not sure.

Table 6. 43

Question 18

Q18:- The IE-LS has all the functions and capabilities I expect it to have.		
Scale	**Frequency**	**Percentage**
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	16	13.1%
Agree	83	68.0%
Strongly Agree	23	18.9%
Total	122	100%

Then, the last question on usability asks on the satisfaction with the E-LS overlay. Table 6.44 shows that majority of participants (94.3%) satisfy with the E-LS. Meanwhile, 5.7% of the participants are not sure whether they satisfy.

Table 6. 44

Question 19

Q19:- Overall, I am satisfied with IE-LS.		
Scale	**Frequency**	**Percentage**
Strongly Disagree	0	0%
Disagree	0	0%
Not Sure	7	5.7%
Agree	92	75.4%
Strongly Agree	23	18.9%
Total	122	100%

Having explored the percentages, the mean for each question is also investigated. The results are tabled in Table 6.45. It is seen that all questions have high mean scores, which are either close to 4 or greater than 4. Moreover, the standard deviations are small, less than 1.

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Table 6. 45

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Q1	122	3	5	4.13	0.602
Q2	122	3	5	4.13	0.588
Q3	122	3	5	4.07	0.585
Q4	122	3	5	4.06	0.621
Q5	122	3	5	4.13	0.560
Q6	122	2	5	4.09	0.656
Q7	122	2	5	4.07	0.701
Q8	122	3	5	4.07	0.613
Q9	122	3	5	3.98	0.589
Q10	122	3	5	3.98	0.560
Q11	122	3	5	4.02	0.623
Q12	122	3	5	3.93	0.652
Q13	122	3	5	3.93	0.619
Q14	122	3	5	3.97	0.616
Q15	122	3	5	3.98	0.560
Q16	122	3	5	4.11	0.614
Q17	122	3	5	4.05	0.654
Q18	122	3	5	4.06	0.565
Q19	122	3	5	4.13	0.480
Valid N (listwise)	122				

6.4.5 Reliability for Usability Evaluation

Usability questionnaire yields a Cronbach's Alpha of 0.910 (shown in Table 6.46), which according to Nunnally (1978) is reliable because it is greater than the threshold of 0.70. Hence, the result demonstrates that the survey questionnaire is a reliable measurement instrument.

Table 6. 46

Reliability for Usability Evaluation

Cronbach's Alpha	No. of Item
0.910	19

6.5 Summary

This chapter analyzes the collected data. Both evaluation types, acceptance and usability have been discussed in detail in terms of their procedure and results. While the procedures are clear, the results are reliable. Hence, this study is confident that the results are highly representing the feedbacks for the requirement model obtained and discussed in Chapter 4, which has been translated into a prototype visualized and discussed in Chapter 5.

CHAPTER SEVEN
CONCLUSION

7.1 Introduction

This chapter recaps the whole study, particularly on the accomplishment of the objectives. A requirement model of an electronic system for teaching and learning purposes has been determined and described in Chapter 4. Afterwards, the prototype was developed, and is called E-LS, as showcased in Chapter 5. Following that, acceptance and usability evaluations were carried out, in which the results are discussed in Chapter 6. Generally, the whole process in this study from identifying the problem until the analysis of the results is detailed structurally in Chapter 3.

7.2 Review the Research Objectives

Based on the activities outlined in Chapter 3 and explained in Chapters 4, 5, and 6, this study has achieved all the mentioned objectives in Chapter 1. In general, they are discussed in the following section.

Objective 1: To identify the functional requirements of e-learning system for secondary schools in the Dhi-Qar Province, Iraq.

The proposed requirements have been conducted by using two methods (Literature review and interviews). The interviews involved 24 participants (12 students, 6 parents, 4 teachers, and 2 managers) from two secondary schools as representations of two regions (rural and urban) to determine the final requirements as explained in Chapter 4.

Objective 2: To construct the functional requirement model of e-learning for secondary schools in the Dhi-Qar Province, Iraq.

After identifying the requirements, the next step is to construct the functional requirement model for e-learning system in secondary school. UML diagrams are used to represent the functional requirement model. The UML diagrams provide the clear representation for requirements model to be easy to understand, where, use case diagrams, use case specification, sequence diagrams and class diagrams are the commonly created diagrams when modelling systems. Then, experts reviewed the functional requirements model form completeness, consistency and unambiguous aspects.

Objective 3: To evaluate the functional requirement model of e-learning for secondary schools in the Dhi-Qar Province, Iraq.

Before the evaluation, the E-LS system was designed. Having finalized the design, it was translated into a working prototype system, the open sources Moodle was exploited for this study. It incorporates the constructed requirement model derived in Chapter 4. It is important because without a working prototype, users will not be able to understand the model. Then, the system was published online to allow all participants to use the system and they did all the required activities. After that, they answered a questionnaire for measuring user acceptance published through Google Form. Next, the usability evaluation was conducted to determine whether the system is easy and simple as well as to ensure all the instructions and messages are clear. The usability questionnaire contains 19 questions and it was responded by all the 122 participants who involved in this study. Chapter 6 details the results of the usability evaluation.

7.3 Contribution of Study

The results of this study show the confidence that the contributions are significant. It gathers requirements from various studies as well as the interviews with the users in constructing the proposed model, which stands as a significant contribution to the body of knowledge. Other researchers may use the proposed model to further enhance in the future. On top of that, this study examines the existing e-learning models by looking at the strengths and weaknesses. Hence, this study identified the appropriate functional requirements model that fits the needs of system's stakeholders (students, teachers, parents, and managements of schools) in secondary school in Dhi-Qar province, Iraq. Therefore, such model can be used for particular education institutions and other conflict areas. Moreover, this study attempts to offer a better solution through customizing an e-learning system as a complementary to traditional classes, which can overcome the time limitation allocated by the teachers for their students (due to limited school period).

Moreover, this study contributes on how such e-learning system get acceptance and usability from the stakeholders (students, teachers, parents and managers of schools). The results of this study proved that such e-learning system is well accepted and usable from the users in secondary school in the conflict area like Iraq.

7.4 Limitations and Future Works

The findings obtained in this study are convincing. However, a few influences may have influenced the generalizability. Perhaps, there are some of the aspects, which may be possibly improved in the future such as:

1- The open source (Moodle) is used to design the prototype in this study. Hence, future studies could consider using appropriate programming languages for better utilities and functionalities.

2- This study determines only the user acceptance and usability aspects of the E-LS. Perhaps, future studies could look into more aspects such as functionality and non-functionality aspects of such system.

3- This study focused on functional requirement of e-learning. Perhaps, future studies could look into non- functional requirement.

7.5 Conclusion

This study starts with requirement identification. The documents review and semi-structured interview were conducted to elicit the requirements model from the main actors in education process (students, teachers, parents and managers of schools), as well as the experts' review. Thereafter, it was followed by the construction of the functional requirement model for e-learning system in secondary school. UML diagrams were used to represent the functional requirement model. Barclay and Savage (2004) stated that the UML diagrams provide developers of software systems to look at the systems developed from different perspectives and varying degrees of abstraction use case diagrams, sequence diagrams and class diagrams are the commonly created diagrams when modelling systems. Then, the experts reviewed the functional requirements model form completeness, consistency and unambiguous aspects. Followed by, building the prototype system by using open source Moodle. Finally, the prototype evaluated from the stakeholders (students, teachers, parents and managers of schools) using two types of evaluation (acceptance and usability). The requirement model is hoped to be a useful reference to other researchers in similar domain or for developers who are interested in developing similar product.

References

Abdullahi, H. (2011). Requirement Model of School Management System for Adult Commercial Secondary School in Somalia (ACSSMS). Universiti Utara Malaysia.

Al-Ajlan, A. S. (2012). *A Comparative Study Between E-Learning Features*: INTECH Open Access Publisher.

Al-Badri, W. (2014). Shortage of the teachers in the Soq-Alshiyookh, from http://www.nasiriyah.org/ara/post/56187

Alexander, S., & Golja, T. (2007). Using students' experiences to derive quality in an e-learning system: An institution's perspective. Educational Technology & Society, 10(2), 17-33.

Algahtani, A. (2011). *Evaluating the Effectiveness of the E-learning Experience in Some Universities in Saudi Arabia from Male Students' Perceptions.* Durham University.

Al-Gazi, A. S. (2014). Interview with Administrative Assistant in the Directorate of Education in the province of DhiQar (Mr.Jabbarwasham), from http://althaqb.com/2011-12-31-10-32-26/2011-12-31-10-29-09/487. Accesses date 23 Jan 2015.

Alhir, S. S. (2003). *Learning UML*. Sebastopol, CA: O'Reilly Online Books

Alkharang, M. M., & Ghinea, G. (2013). E-learning in Higher Educational Institutions in Kuwait: Experiences and Challenges. *E-learning*, 4(4).

Alqurtasnews. (2014). A new school year in Dhi-Qar. Tri-time schools, from http://www.alqurtasnews.com/news/58399/Accesses date 18 Jan 2015.

Alsaadat, K. (2009). Methods in distance learning. *ICERI2009 Proceedings*, 3238-3244.

Alsaleh, S., & Haron, H. (2015). The Most Important Functional and Non-Functional Requirements of Knowledge Sharing System at Public Academic Institutions: A Case Study. Lecture Notes on Software Engineering, 4(2), 157.

208

Alzaza, N., &Zulkifli, A. (2007). *Mobile Based Library Loan Service (MBLLS).* Paper presented at the Proceeding of the Rural ICT Development Conference.

Ambler, S. (2009). The Elements of UML(TM) 2.0 Style. New York: Cambridge University.

Appana, S. (2008). A Review of Benefits and Limitations of Online Learning in the Context of the Student, the Instructor and the Tenured Faculty. *International Journal on E-learning, 7*(1), 5-22.

Arthurs, J. B. (2007). A juggling act in the classroom: Managing different learning styles. *Teaching and learning in nursing, 2*(1), 2-7.

Aynaliraqnews. (2014). Minister of Education discusses the reality of education in the province of Dhi-Qar, from http://aynaliraqnews.com/index.php?aa=news&id22=25543. Accesses date 12 Jan 2015.

Badri, M., Al Rashedi, A., Yang, G., Mohaidat, J., & Al Hammadi, A. (2014). Students' intention to take online courses in high school: A structural equation model of causality and determinants. Education and Information Technologies, 1-27.

Bahadon, A. B. (2014). Requirement Model for Labour Case Management System. Degree of Master, Universiti Utara Malaysia, Kedah.

Barclay, K., & Savage, J. (2004). Object-Oriented Design with UML and Java.Burlington, USA: Elsevier Butterworth-Heinemann.

Beckmann, E A 2010 Learners on the move: mobile modalities in development studies. Distance Education, 31 (2), pp. 159–173. DOI: http://dx.doi.org/ 10.1080/01587919.2010.498081

Beetham, H. & Sharpe, R. (2013), Rethinking pedagogy for a digital age: designing for 21st century learning, 2nd edn,Routledge, UK.

Behar, P. (2011). Constructing pedagogical models for e-learning. *International Journal of Advanced Corporate Learning (iJAC), 4*(3), 16-22.

Beldagli, B., &Adiguzel, T. (2010). Illustrating an ideal adaptive e-learning: A conceptual framework. *Procedia-Social and Behavioral Sciences, 2*(2), 5755-5761.

Benadikar, T. C. (2011). Managing software requirements for small sized companies.

Blau, I., &Hameiri, M. (2012). Teacher–families online interactions and gender differences in parental involvement through school data system: Do mothers want to know more than fathers about their children? *Computers & Education, 59*(2), 701-709.

Booch, G. (2005). The unified modeling language user guide. Pearson Education India.

Brown, A. R., &Voltz, B. D. (2005). Elements of effective e-learning design. *The International Review of Research in Open and Distributed Learning, 6*(1).

Brown, T. H. (2003). *The role of m-learning in the future of e-learning in Africa.* Paper presented at the 21st ICDE World Conference. Hong Kong: ICDE.

Brown, T. H. (2005). Towards a model for m-learning in Africa. *International Journal on E-learning, 4*(3), 299-315.

Brumbulli, M., Topçiu, B., &Dalaçi, A. (2008). *SMIS: A Web-Based School Management Information System.* Paper presented at the International Scientific Conference Computer Science.

Burstein, F., & Gregor, S. (1999). *The systems development or engineering approach to research in information systems: An action research perspective.* Paper presented at the Proceedings of the 10th Australasian Conference on Information Systems.

Buzzetto-More, N. A. (2007). *Principles of effective online teaching*: Informing Science.

Cavanaugh, C. S. (2001). The Effectiveness of Interactive Distance Education Technologies in K-12 Learning: A Meta-Analysis. *International Journal of Educational Telecommunications, 7*(1), 73-88.

Cavus, N., & Zabadi, T. (2014). A Comparison of Open Source Learning Management Systems. *Procedia-Social and Behavioral Sciences, 143*, 521-526.

Cheng, B. H., & Atlee, J. M. (2007, May). Research directions in requirements engineering. In 2007 Future of Software Engineering (pp. 285-303). IEEE Computer Society.

Chizmar, J. F., &Walbert, M. S. (1999). Web-based learning environments guided by principles of good teaching practice. *The Journal of Economic Education, 30*(3), 248-259.

Coakes, S. J., & Steed, L. (2009). SPSS: Analysis without anguish using SPSS version 14.0 for Windows. John Wiley & Sons, Inc.

Conrad, R.-M., & Donaldson, J. A. (2011). *Engaging the online learner: Activities and resources for creative instruction* (Vol. 38): John Wiley & Sons.

Coppola, N. W., & Starr Roxanne Hiltz, N. G. R. (2002). Becoming a virtual professor: Pedagogical roles and asynchronous learning networks. *Journal of Management Information Systems, 18*(4), 169-189.

Damkhi, M. (2012). *Mobile Based Linear Programming Solver Application (MBLPSA).* Degree of Master Universiti Utara Malaysia, Kedah.

David, S. (2011). Architecture design model for E-Iearning (Doctoral dissertation, Strathmore University).

Davis, A. M. (1993). Software requirements: objects, functions, and states. Prentice-Hall, Inc..

Davis, F. D., & Venkatesh, V. (1996). A critical assessment of potential measurement biases in the technology acceptance model: three experiments. International Journal of Human- Computer Studies, 45(1), 19- 45.

Davis, FD 1989, 'Perceived usefulness, perceived ease of use, and user acceptance of information technology', MIS Quarterly, vol. 13, no. 3, pp. 319-340.

De Sirisuriya, S., Ranathunga, L., Karunanayaka, S., & Abdullah, N. (2014). Calibration checklist to use in an automated pedagogical evaluation process of web based E-Learning.

Denger, C., Berry, D. M., & Kamsties, E. (2003). Higher quality requirements specifications through natural language patterns. Paper presented at the IEEE International Conference on Software: Science, Technology and Engineering, 2003. SwSTE'03. Proceedings.

Dennis, A., Wixom, B. H., & Tegarden, D. (2002). System analysis and design with UML version 2.0: an object-oriented approach with UML(2nd ed.). Hoboken, NJ: John Wiley and Sons, Inc.

Dirckinck-Holmfeld, L. (2002). Designing virtual learning environments based on problem oriented projectpedagogy. In L. Dirckinck-Holmfeld& B. Fibiger (Eds.), *Learning in virtual environments* (pp. 31–54).Frederiksberg: Samfundslitteratur Press. Distance Learning, 13(2). doi: 10.1007/s40692-014-0007-9

Dorado, C., Hernandez, J., Sani, B., Griffin, C., &Barnette, W. (2009). An exploratory analysis of factors influencing students decisions to take online courses. *Issues in Information Systems, 10*(1).

Dos Santos Soares, M., Vrancken, J., & Verbraeck, A. (2011). User requirements modeling and analysis of software-intensive systems. Journal of Systems and Software, 84(2), 328-339.

El-Aziz Abd El-Sadek Afify, E. A., Hegazy, E. F. A., & El-Sayed, M. A. K. (2011, July). A model for customer complaint management system using SOA. In Proceedings of the 15th WSEAS international conference on Computers (pp. 291-296). World Scientific and Engineering Academy and Society (WSEAS).

Elizabeth, M. (2012). An E-Learning Approach to Secondary School Education. *Jurnal of Education and Practice: Kenyatta University School of Education*.

Englehart, J. M. (2009). Teacher–student interaction *International handbook of research on teachers and teaching* (pp. 711-722): Springer.

212

Enloe, C. H. (2010). *Nimo's war, Emma's war: making feminist sense of the Iraq war*: Univ of California Press.

Fadhil, N. A., Osman, W. R. S., T.Nather, I., Al-Saadi, T. A., &Alkhafaji, N. J. (2014). *Mobile Technology in the Iraq Context: Design Mobile Application Prototype for the Election of Directors for Departments in the Ministry of Science and Technology.* Paper presented at the International Conference on Industrial Electronics and Computer Science (ICIECS-2014), New Delhi, india during 24th May, 2014.

Finkelstein, L., Huang, J., Finkelstein, A., & Nuseibeh, B. (1992). Using software specification methods for measurement instrument systems: Part 1: Structured methods. Measurement, 10(2), 79-86.

Firesmith, D. (2003). Specifying Good Requirements. Journal of Object Technology, Vol. 2(no.4), pp. 77-87. doi:10.5381/jot.2003.2.4.c7

Frimpon, M.F. (2012). A Re-Structuring of the Critical Success Factors for E-Learning Deployment. American International Journal of Contemporary Research, Vol. 2 (3), pp.115-123.

Futurelab, N., Naismith, L., Lonsdale, P., Vavoula, G., Sharples, M., & Series, N. F. (2004). Literature Review in Mobile Technologies and Learning.

Garrison, D. R., Anderson, T., & Archer, W. (2003). A theory of critical inquiry in online distance education. Handbook of distance education, 1, 113-127.

General Directorate of Curricula. (2013). Textbooks for Secondary Schools, from http://www.manahj.edu.iq/index.php?name=Pages&op=page&pid=96

George, F.J., Batra D., Valacich J.S & Hoffer J.A (2004). Object Oriented System Analysis and Design. New Jersey: Prentice Hall International, Inc.

Gilbert, J., Morton, S., & Rowley, J. (2007). e-Learning: The student experience. *British Journal of Educational Technology, 38*(4), 560-573.

Glinz, M. (2007, October). On non-functional requirements. In Requirements Engineering Conference, 2007. RE'07. 15th IEEE International (pp. 21-26). IEEE.

213

Gomaa, H. (2001, July). Designing concurrent, distributed, and real-time applications with UML. In Proceedings of the 23rd international conference on software engineering (pp. 737-738). IEEE Computer Society.

Google(2015). ADDIE for eLearning, from https://sites.google.com/site/instructionaldesignandtraining/e-learning/addie-for-elearning.

Goyal, S. (2012). E-Learning: Future of Education. *Journal of Education and Learning (EduLearn), 6*(4), 239-242.

Gregg, D. G., Kulkarni, U. R., &Vinzé, A. S. (2001). Understanding the philosophical underpinnings of software engineering research in information systems. *Information Systems Frontiers, 3*(2), 169-183.

Hadjerrouit, S. (2007). Applying a system development approach to translate educational requirements into e-learning. *Interdisciplinary Journal of E-Learning and Learning Objects, 3*(1), 107-134.

Hair, J. F., Tatham, R. L., Anderson, R. E., & Black, W. (2006). Multivariate data analysis (Vol. 6). Pearson Prentice Hall Upper Saddle River, New Jersey: Pearson Education Inc.

Hameed, M. (2012). Connecting 60 schools in the province of Dhi-Qar e-government project, from http://www.nasiriyah.org/ara/post/16781/. Accesses date 30 Jan 2015.

Hara, N., & Kling, R. (2001). Student distress in web-based distance education. *Educause Quarterly, 24*(3), 68-69.

Harun, R. BIN. (2010). A Generic Requirement Model For E-learning Management System. Information Communication Technology, UUM, Kedah.

Hausmann J.H, Heckel R., Taentzer G. (2002). "Detection of Conflicting Functional Requirements ina Use Case-Driven Approach". ICSE, May 19-25, 2002.

Hoffer, J., George, J., &Valacich, J. (2002). Modern Systems Analysis and Design (3rd ed).New Jersey, USA: Prentice Booking.

Honey, P., & Mumford, A. (1992). The manual of learning styles.

214

Hsieh, T.-C., Lee, M.-C., & Su, C.-Y. (2013). Designing and implementing a personalized remedial learning system for enhancing the programming learning. *Educational Technology & Society, 16*(4), 32-46.

Imadildayeva, K., &Zhaidarbek, A. (2010). *Developing e-learning for Kazakh National University.*UniversitiTeknologi Malaysia, Faculty of Computer Science and Information Systems.

International Organization for Migration Iraq (IOM). (2013). Barriers to secondary school attendance, Retrieved 2 March 2015 from:http://iomiraq.net/reports/barriers-secondary-school-attendance.

Iraqi Research Foundation for Analysis and Development. (2014). *Iraq Education.* Retrieved 1March 2015 from: http://irfad.org/iraq-education/

Islamic Relief. (2014). Improving secondary education in Iraq, Retrieved 2March 2015 from:http://www.islamic-relief.com/NewsRoom/4-894-improving-secondary-education-in-iraq.aspx

ITU, (2002). "specification and description language, Z.100 serie," ed: International Telecommunication Union, 2002.

Jalil, A., Beer, M., & Crowther, P. (2015). Pedagogical Requirements for Mobile Learning: A Review on MOBIlearn Task Model. Journal of Interactive Media in Education, 2015(1).

Jiang, L. (2005). A framework for the requirements engineering process development. University of Calgary.

Johari, B. (2004). Requirement Model for Storing and Retrieving ISO Document: Teaching and Learning Process (Doctoral dissertation, Universiti Utara Malaysia).

Johnston, J., Killion, J., &Oomen, J. (2005). Student satisfaction in the virtual classroom. *The Internet Journal of Allied Health Sciences and Practice, 3*(2), 1-7.

Kanninen, E. (2008). Learning styles and e-learning. *Master of Science Thesis, Tampere University of Technology*.

Karagiannidis, C., Politis, P., &Karasavvidis, I. (2014). Research on e-Learning and ICT in Education. *Springer*.

Kaufman, W. T. (2015). *Traditional vs. Electronic Learning Environment.* Master, The College at Brockport: State University of New York, New York.

Kazanidis, I., Valsamidis, S., Kontogiannis, S., &Karakos, A. (2014). Courseware Evaluation through Content, Usage and Marking Assessment *Research on e-Learning and ICT in Education* (pp. 149-161): Springer.

Kent, R 1999, Marketing Research: Measurement, Method and Application, International Thomson Business Press, London.

Kern, J., & Garrett, C. (2003). Effective sequence diagram generation. Borrand White Paper. (www.borland.com/together/white_papers).

Khan, B. H. (2002). Dimensions of e-learning. Educational Technology, January-February, 59-60.

Khan, B. H. (2005). Learning features in an open, flexible and distributed environment. Association for the Advancement of Computing in Education Journal (AACE), 13(2), 137-153.Training, 34(2), 44-53.

Koh, M. H., & Hill, J. R. (2009). Student perceptions of groupwork in an online course: Benefits and challenges. *International Journal of E-Learning & Distance Education, 23*(2), 69-92.

Kolb, D. A. (2014). *Experiential learning: Experience as the source of learning and development*: FT Press.

Kothari, C.R. (2004). Research Methodology. Igarss 2004. doi: 10.1007/s13398-014-0173-7.2

Kramer, W. J., Jenkins, B., & Katz, R. S. (2007). The role of the information and communications technology sector in expanding economic opportunity. Cambridge, MA: Kennedy School of Government, Harvard University.

Kulak, D., Eamonn, G. (2004). Use cases: requirements in context. Boston: Pearson Education Inc, (2nd ed).

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Kumar, S., Gankotiya, A. K., & Dutta, K. (2011). *A comparative study of moodle with other e-learning systems.* Paper presented at the Electronics Computer Technology (ICECT), 2011 3rd International Conference on.

Kushnir, N., Manzhula, A., &Valko, N. (2013). Bridging the Generation Gap in ICT Education Information and Communication Technologies in Education, Research, and Industrial Applications (pp. 229-251): Springer.

Lam, J, Lau, N, Fung, KY & Cheung, KS 2009, 'A Survey on the Readiness in Adopting e-Learning among Teachers and Students,' 2nd International Conference on Hybrid Learning - ICHL 2009, 143-158.

Leedy, P. D., & Ormrod, J. E. (2013). Practical research planning and design (10th ed.). United States of America: Pearson Education Inc.

Legris, P., Ingham, J., & Collerette, P. (2002). Why do people use IT? A critical review of the TAM. Information and Management, 40(3), 1-14.

Lehr, T. (2012). Formal and Non-Formal Education Action Plan on Civic Values and Life Skills. Berlin, Germany: United Nations Economic and Social Commission for Western Asia (ESCWA).Available, http://www.escwa.un.org/divisions/ecri_editor/Download.asp?table_name=ecri_documents&field_name=id&FileID=206.

Lenhart, A., Madden, M., Macgill, A. R., & Smith, A. (2007). Teens and social media the use of social media gains a greater foothold in teen life as they embrace the conversational nature of interactive online media. Washington, DC: Pew/Internet.

Lessen, E., & Sorensen, C. (2006). Integrating technology in schools, colleges, and departments of education: A primer for deans. *Change, 38*(2), 45-49.

Lili, Z., & Jing, L. (2012). An Evaluation of the Effectiveness of Urban Traffic Guide Signs. In Future Communication, Computing, Control and Management. Springer.

Lim, B, Hong, KS & Tan, KW 2008, 'Acceptance of E-learning Among Distance Learners: A Malaysian Perspective,' *Hello! Where are you in the landscape of educational technology?*, 541-551.

Livingstone, S., Haddo, L., Go¨rzig, A., & O´lafsson, K. (2010). Risks and safety on the internet: The perspective of European children. London: LSE, EU Kids Online.

Lotfi, Z., Nasaruddin, M., Hanum, F., Sahran, S., & Mukhtar, M. (2013). Collaborative E-   learning tool for secondary schools. *Journal of applied sciences, 13*, 22-35.

Maciaszek, L. A. (2001). Requirements analysis and system design: Developing information systems with UML. New York: Addison-Wesley.

MacNeill, H., Telner, D., Sparaggis-Agaliotis, A., & Hanna, E. (2014). All for One and One for All: Understanding Health Professionals' Experience in Individual Versus Collaborative Online Learning. *Journal of Continuing Education in the Health Professions, 34*(2), 102-111.

Mahmud, S. F. (2013). The Higher Education in Iraq Challenges and Recommendations. *Journal of Advanced Social Research Vol, 3*(9), 255-264.

Masrom, M 2007, 'Technology Acceptance Model and E-learning,' 12th International Conference on Education, Sultan Hassanal Bolkiah Institute of Education.

Minguillón, J., Sicilia, M.-A., & Lamb, B. (2011). From Content Management to E-Learning Content Repositories *Content Management for E-Learning* (pp. 27-41): Springer.

Modern Analyst, (2010). Business Analysis Glossary from A to Z. Retrieved 07 July 2010,
http://www.modernanalyst.com/Resources/BusinessAnalysisGlossary/tabid/231/Default.aspx

Mulwa, A. S. and Kyalo, D. N. (2013). The Influence of Principals', Teachers' and Students' Attitude on Readiness to Adopt e-Learning in Secondary Schools in Kitui District, KENYA. European Scientific Journal February 2013 edition Vol.9, (5), pp. 138-202.

Murphy, K. L., & Collins, M. P. (1997). Communication conventions in instructional electronic chats. *First monday, 2*(11).

Mwasha, R., & Pima, J. (2010). Implementing and Using Portals in Higher Education Institutions in Mainland Tanzania. *A Survey. Published by the Institute of Accountancy Arusha*.

Neyland, E. (2011). Integrating online learning in NSW secondary schools: Three schools' perspectives on ICT adoption. Australasian Journal of Educational Technology, Vol. 27(1), pp.152-173.

NunamakerJr, J. F., & Chen, M. (1990). *Systems development in information systems research.* Paper presented at the Proceedings of the Twenty-Third Annual Hawaii International Conference on System Sciences.

NunamakerJr, J. F., Chen, M., &Purdin, T. D. (1991). Systems development in information systems research. *Journal of Management Information System 7*(3), 89-106.

Nuseibeh B. A. and Easterbrook S. M., "Requirements Engineering: A Roadmap", In A. C.W. Finkelstein (ed) "The Future of Software Engineering (Companion volume to the proceedings of the 22nd International Conference on Software Engineering, ICSE' 2000). IEEE Computer Society Press.

Nuseibeh, B., & Easterbrook, S. (2000, May). Requirements engineering: a roadmap. In Proceedings of the Conference on the Future of Software Engineering (pp. 35-46). ACM.

Olson, J., Codde, J., Tarkleson, E., Sinclair, J., Yook, S., &Egidio, R. (2011). An Analysis of e-Learning Impacts & Best Practices in Developing Countries.

OMG., (2003), UNIFIED MODELING LANGUAGE (UML) VERSION 1.5. Available: http://www.omg.org/spec/UML/1.5

Ouma, G. O., Awuor, F. M., &Kyambo, B. (2013). E-Learning Readiness in Public Secondary Schools in Kenya. *European Journal of Open, Distance and e-Learning, 16*(2).

219

Palloff, R. M., & Pratt, K. (2010). *Collaborating online: Learning together in community* (Vol. 32): John Wiley & Sons.

Petrides, L. A. (2002). Web-Based Technologies for Distributed (or Distance) Learning: Creating Learning-Centered Educational Experiences in the Higher Education Classroom. *International journal of instructional media, 29*(1), 69-77.

Pirie, I., Cordiner, S., & Triggs, J. (2011). Digital Spaces for Learning and Assessment in Art and Design. future learning spaces, 43.

Poole, D. M. (2000). Student participation in a discussion-oriented online course: A case study. *Journal of research on computing in education, 33*(2), 162-177.

Preece, J., Rogers, Y., Sharp, H., Benyon, D., Holland, S., & Carey, T.(1994). Human- Computer Interaction. Harlow, UK: Addison- Wesley.

Quatrani, T., & Evangelist, U. M. L. (2003). Introduction to the Unified modeling language. A technical discussion of UML, 6(11), 03.

Raja, U. A. (2009). Empirical studies of requirements validation techniques. In 2009 2nd International Conference on Computer, Control and Communication.

Ramanand, R. (2013). Towards A Proposed Framework for An E-learning System. Graduate Theses and Dissertations, (Feburuary).

Redempta, K. and Elizabeth, M. (2012). An E-Learning Approach to Secondary School Education: E-Readiness Implications in Kenya. Journal of Education and Practice, Vol. 3 (16), pp. 142-148.

Revels, M., &Ciampa, M. (2012). Student Access to Online Interaction Technologies: The Impact on Grade Delta Variance and Student Satisfaction. *Online Journal of Distance Learning Administration, 15*(4), 1-12.

Rideout, V. J., Foehr, U. G., & Roberts, D. F. (2010). GENERATION M2: Media in the lives of 8-to 18-year-olds. Menlo Park, CA: Henry J.: Kaiser Family Foundation.

220

Riding, R. (1996). *Learning styles and technology-based training*: Great Britain, Department for Education and Employment, Education and Training Technologies.

Rosenberg, M. J. (2001). *E-learning: Strategies for delivering knowledge in the digital age* (Vol. 9): McGraw-Hill New York.

Roy, A. (2010). SMEs: How to make a successful transition from conventional training towards e-learning. *International Journal of Advanced Corporate Learning (iJAC), 3*(2), 21-27.

Sadler-Smith, E. (1996). Learning styles: a holistic approach. *Journal of European Industrial Training, 20*(7), 29-36.

Saeedi, K. A. (2014). QRMF: A Multi-Perspective Framework for Quality Requirements Modelling.

Salim, T. M., Zulkifli, A. N., Mohamed, N. F. F., Razak, A. H. A., &Saad, M. N. (2009). *Arabic Language Learning (ALL) for Kids.*Masters thesis, Universiti Utara Malaysia.

Salmon, G. (2000). *E-Moderating: The key to teaching and learning online*. London. Kogan Page.

Salmon, G. (2003). E-moderating: The key to teaching and learning online: Psychology Press.

Saraporn Chumpia, (2011). Requirement Model For Hatyai Technical College Social Network Learning Site. Information Technology, UUM, Kedah

Schrum, L. (2002). Oh, What Wonders You Will See--Distance Education Past, Present, and Future. *Learning & Leading with Technology*.

Sekaran, U. (2013). Research Methods for Business. Saudi Med J (Vol. 33). doi: 10. 1073/ pnas. 0703993104

Selimi, V., &Veliu, I. (2011). Design & Development of Modular Learning Management Systems-Methods & Techniques: Learning From a Success Story.
221

Selwyn, N. (2012). School 2.0: Rethinking the Future of Schools in the Digital Age *Research on e-Learning and ICT in Education* (pp. 3-16): Springer.

Serce, F. C., &Yildirim, S. (2006). A web-based synchronous collaborative review tool: a case study of an on-line graduate course. *Educational Technology & Society, 9*(2), 166-177.

Shams-Ul-Arif, M. R., KHAN, M. Q., & Gahyyur, S. A. K. (2009). Requirements engineering processes, tools/technologies, & methodologies. International Journal of Reviews in Computing.

Shaykhli, Z. (2014). Dhi-Qar officially opens the e-government project, from http://www.nasiriyah.org/ara/post/54548

Shih, H. S., & Chen, S. H. (2013). A conceptual design of a mobile healthcare device-an application of three-stage QFD with ANP and TRIZ. International Journal of Operations Research, 10(2), 80-91.

Sim, S., & Yin, S. (2012). Developing a New Learning System with Social Software by Studying the Learners' Readiness and Acceptance by A thesis submitted for the degree of Doctor by Research.

Siti Mahfuzah, S. (2011). Conceptual Design Model of Computerized Personal-Decision AID (ComPDA) (Doctoral dissertation, Universiti Utara Malaysia).

Sjödahl, B. (2014). *Autonomous Recharging for Swarms of Flying Robots.* Master's Thesis, Luleå University of Technology, Luleå, Sweden.

Song, L., Singleton, E. S., Hill, J. R., &Koh, M. H. (2004). Improving online learning: Student perceptions of useful and challenging characteristics. *The Internet and Higher Education, 7*(1), 59-70.

Stephens, T. (2013). Transforming Learning with Technology.

Su, A, Y.S., Yang, S, J.H., Hwan, WY & Zhang, J 2010, 'A Web 2.0-based collaborative annotation system for enhancing knowledge sharing in collaborative learning environment', Computers and Education, vol. 55, no. 2, pp. 752-766.

222

Swan, K. (2001). Virtual interaction: Design factors affecting student satisfaction and perceived learning in asynchronous online courses. *Distance education, 22*(2), 306-331.

Taha, M. (2014). Investigating the success of E-learning in secondary schools: The case of the Kingdom of Bahrain (Doctoral dissertation, Brunel University).

Taylor, J 2004 A task-centred approach to evaluating a mobile learning environment for pedagogical soundness. In J. Attewell and C. Savill-Smith, eds. 2004. Learning with mobile devices: Research and development. London: Learning and Skills Development Agency, pp. 167–171

Thiqarpc. (2014). Dhi-Qar province opens first e-government project in Iraq, from http://www.thiqarpc.gov.iq/index.php?aa=news&id22=1035. Accesses date 7 Jan 2015.

Thompson, J. (2007). Is Education 1.0 ready for Web 2.0 students? *Innovate Journal of Online Education, 3*(4), 6.

Thompson, L., &Lamshed, R. (2006). E-learning within the building and construction and allied trades.

Titthasiri, W. (2013). *A Comparison of E-Learning and Traditional Learning: Experimental Approach*. Paper presented at the International Conference on Mobile Learning, E-Society and E-Learning, Singapore.

UNESCO. (2010). E-Learning in the Republic of Korea. Retrieved 6 March 2015 from:http://iite.unesco.org/pics/publications/en/files/3214677.pdf

UNESCO. (2011). ICT in Education for Iraq: Stars Orbit Consultants and Management Development.

Unhelkar, B. (2005). Verification and validation for quality of UML 2.0 models (Vol. 42). John Wiley & Sons.

Uţă, I. A. (2006). *Developing E-Learning System*. Paper presented at the International Conference on Computer Systems and Technologies.

Valtolina, S., Barricelli, B. R., Mesiti, M., & Ribaudo, M. (2012). User-Centered Design of E-Learning Tools for Users with Special Needs: The VisualPedia Case Study. IxD&A, 13, 47-55.

Vonderwell, S. (2003). An examination of asynchronous communication experiences and perspectives of students in an online course: A case study. *The Internet and Higher Education, 6*(1), 77-90.

Vonderwell, S., Liang, X., & Alderman, K. (2007). Asynchronous discussions and assessment in online learning. *Journal of Research on Technology in Education, 39*(3), 309-328.

Voogt, J., &Knezek, G. (2008). *International handbook of information technology in primary and secondary education* (Vol. 20): Springer Science & Business Media.

Wall, J., Smit, D. K., Betts, M., & Ahmed, V. (2005). An International Comparison Of E-Learning In Action–An Interactive Graphical on Line Teaching Resources for Residential Construction in Australia and a Blended Programme to Support Irish Entrepreneurs in Ireland.

Wheeler, S. (2012). e-Learning and digital learning *Encyclopedia of the sciences of learning* (pp. 1109-1111): Springer.

Wong, D, A,H,D 2008, E-learning: An Empirical Study on Perceptions of Benefits and Limitations towards E-learning between Fulltime students and Working Adults in Klang Valley, Malaysia, thesis, International Graduate School of Business, Division of Business & Enterprise, University of South Australia.

Xanthidis, D., Wali, S. W., &Nikolaidis, P. (2013). *E-Learning in Saudi Universities, Challenges and Issues.* Paper presented at the Fourth International Conference on e-Learning" Best Practices in Management, Design and Development of e-Courses: Standards of Excellence and Creativity", IEEE.

Yaumena. (2014). An overview of education in Iraq, from http://www.yaumena.org/research/2014/10/28/an-overview-of-education-in-iraq.

Yildirim, Z., Reigeluth, C. M., Kwon, S., Kageto, Y., & Shao, Z. (2014). A comparison of learning management systems in a school district: searching for the ideal personalized integrated educational system (PIES). *Interactive Learning Environments, 22*(6), 721-736.

Zhang, D. (2004). Virtual mentor and the lab system-toward building an interactive, personalized, and intelligent e-learning environment. *Journal of Computer Information Systems, 44*(3), 35-43.

Zhang, D., Zhao, J. L., Zhou, L., &NunamakerJr, J. F. (2004). Can e-learning replace classroom learning? *Communications of the ACM, 47*(5), 75-79.

Zhang, P.(2013). Automated Test Case Generation to Validate Non-functional Software Requirements. Graduate Theses and Dissertations.

Appendixes

Appendix A
Official Letters

بسم الله الرحمن الرحيم

العدد/138

التاريخ/ 2015/6/28

ادارة
اعدادية الجمهورية
للبنين
1957م

الى/ طالب الماجستير السيد رائد محمد حسين

م/ بيانات مدرسية

نود ان نعلمكم ببعض البيانات عن اعداديتنا وحسب طلبكم كجزء من متطلبات الدراسة... مع التقدير.

البيانات:

1- عدد المدرسي الدرسة 31 مدرسا

2-عدد طلاب المدرسة 637 طالبا

عدنان شلاكة علاوي
مدير الأعدادية

بسم الله الرحمن الرحيم

إدارة
ثانوية تل الزعتر
للبنين

العدد/ 63
التاريخ/ 2015/5/21

م/ معلومات

نود اعلامكم ان الموقع الجغرافي لثانوية تل الزعتر تقع ضمن الرقعة الجغرافية التابعة الى ناحية الطار والتابعة الى قضاء سوق الشيوخ في محافظة ذي قار وتحتوي على الأعداد التالية:

عدد المدرسين 25 مدرس

عدد الطلاب 360 طالب

مع فائق التقدير والاحترام

مدير المدرسة
علي طه ياسين

Appendix B

Interview Questions

UIVERSITI UTARA MALAYSIA
SCHOOL OF COMPUTING

APPENDIX B. INTERVIEW

My name is Raed Mohammed Hussein and I am a master student conducting a study of "A Requirement Model of Interactive E-learning System in Secondary School in Dhi-Qar Province, Iraq". The aim of this interview is to find the importance and essential of the tools and features for the interactive e-learning system. Your response is much appreciated. I will ensure that the interview is private and all of the data is kept confidential.

Questions for Teachers

- What do you consider as the main pedagogical challenges in e-learning systems?
- What would be your requirements for the e-learning system in order to offer your course online?
- What kind of support would you need for providing an online course?
- Can you suggest any other issues that need to be taken into consideration when implementing e-learning in secondary school, which was not addressed in this interview?
- If we want to design one interactive system (easily sharing ideas & files) for you and your students as well as their parents and management of school, what is your opinion about the features that should be included in this system?

Please read the following statements below carefully and tick (√) only one of your most applicable answer.

(1-Not important, 2-Slightly important, 3 – Not Sure, 4-Important, 5-Very important)

	How would you rate the presence of the following tools and features to be important to learner?	1	2	3	4	5
1	Email					
2	Announcement, News & Event (showing school announcements and news)					
3	Calendar (showing class calendar and exam time table)					
4	Discussion forum (it is a threaded online text conversation between participants.)					
5	Shared Whiteboard (a board used to write texts or draw pictures and give explanation at the same time to you and your students.)					
6	Application sharing (the process of bringing components of different programs together)					
7	Video Conferencing					
8	Shared bookmarks, hot lists or suggested resources archive (provides motivation for discovering websites and encourages sharing of knowledge)					
9	Syllabus , Curriculum objectives and upload shared repository by teacher					
10	Frequently Asked Questions (FAQ)					
11	Project Space (it is a place for a group of collaborators to focus on a certain project and work on the project)					
12	Online guides and support or advice on demand					
13	Online survey or Evaluation					
14	Curriculum management					
15	Real time chat					
16	Content folder					
17	Search Facility					
18	Assessment and assignment					
19	Personal work space					
20	Quiz					
21	Project tracking					
22	Grades book					
23	Web link					
24	Media library					
25	Expert Services					
26	Activity tracking					
27	Who's online					

| 28 | Self–reflection (Students evaluate their own performance in achieving group goal.) | | | | | |

Questions for the Students

- What do you think of the possibility to discuss the topics with your fellow learners and your teachers via a discussion forum in the online system?

- What kind of support would you need for providing an online course?

- What do you think about the possibility of seeing what other students say about a particular topic?

- What do you think if you can use this system as the tools to take quiz or exam and receive evaluation result from teacher?

- If we want to design one interactive system (easily sharing ideas & files) for you and your teachers as well as your parent and management of school, what is your opinion about the features that should be included in this system?

Please read the following statements below carefully and tick (√) only one of your most applicable answer.

(1-Not important, 2-Slightly important, 3 – Not Sure, 4-Important, 5-Very important)

	How would you rate the presence of the following tools and features to be important to learner?	1	2	3	4	5
1	Email					
2	Announcements, News & Event (showing school announcements and news)					
3	Calendar (showing your class calendar and exam time table)					
4	Discussion forum (it is a threaded online text conversation between participants.)					
5	Shared Whiteboard (a board used to write texts or draw pictures and give explanation at the same time.)					
6	Application sharing (the process of bringing components of different programs together)					
7	Video Conferencing					
8	Shared bookmarks, hot lists or suggested resources archive (provides motivation for discovering websites and encourages sharing of knowledge)					
9	Syllabus , Curriculum objectives and upload shared repository by teacher					

10	Project Space (it is a place for a group of collaborators to focus on a certain project and work on the project)					
11	Online guides and support or advice on demand					
12	Self–reflection (Students evaluate their own performance in achieving group goal.)					
13	Online survey or Evaluation					
14	Real time chat					
15	Content folder					
16	Search Facility					
17	My progress					
18	Assessment and assignment					
19	Personal Workspace					
20	Quiz					
21	My Grades					
22	Web link					
23	Media library					

Questions for the parents

- What do you think of the possibility to use the computer as a tool for learning for your child/ children?

- In which way do you think such system will address your particular needs as parents and why?

- As a parent, what do you think about the possibility of seeing activities for your child/ children in school?

- As a parent, what do you think about the possibility of discussing with teachers through electronic equipment such computer application?

- How do you feel about using computer or any other kinds of technologies for communicating with the school?

- If we want to design one interactive system (easily sharing ideas & files) for you and your child/ children as well as the teachers and management of school, what is your opinion about the features that should be included in this system?

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Please read the following statements below carefully and tick (√) only one of your most applicable answer.

(1-Not important, 2-Slightly important, 3 – Not Sure, 4-Important, 5-Very important)

	How would you rate the presence of the following tools and features to be important to learner?	1	2	3	4	5
1	Email					
2	Announcement, News & Event (showing school announcements and news)					
3	Grades book					
4	Online survey or Evaluation					
5	Real time chat					
6	Orientation/ help					
7	Calendar (showing class calendar and exam time table)					

Questions for School Management

- What do you think about using new technologies in the educational purpose?
- As a manager of school, what are the important requirements which must be available in this system?
- In your opinion, what are the obstacles that this system can overcome?
- If we want to design one interactive system (easily sharing ideas & files) for you and students as well as their parents and teachers, what is your opinion about the features that should be included in this system?

Please read the following statements below carefully and tick (√) only one of your most applicable answer.

(1-Not important, 2-Slightly important, 3 – Not Sure, 4-Important, 5-Very important)

	How would you rate the presence of the following tools and features to be important to learner?	1	2	3	4	5
1	Email					
2	Announcement, News & Event (showing school announcements and news)					
3	Calendar (showing class calendar and exam time table)					

4	Grades book					
5	Orientation/ help					
6	Syllabus, Curriculum objectives and upload shared repository by teacher					
7	Creation of course					
8	Management of course					
9	Real time chat					

Thank you for your time and assistance.

Acceptance Questionnaire

UNIVERSITI UTARA MALAYSIA
SCHOOL OF COMPUTING
QUESTIONNAIRE

A Requirement Model of Interactive E-learning System in Secondary School in Dhi-Qar Province, Iraq

Dear Respondents,

I am a master student from the College of Arts and Sciences (CAS), University Utara Malaysia (UUM) under the supervision of Dr. Wiwied Virgiyanti.

I would like your cooperation to help me in providing information by kindly filling in the following questions. I'm greatly appreciated your cooperation and time to participate in my survey. The data gathered in this survey questionnaire will be analysed and published in academic conferences, publication in journals and master dissertation. Your participation will remain anonymous and your identity will not be recorded nor revealed in any form or association.

Best regards,
Raed Mohammed Hussein
Master student
School of Computing, College of Arts and Sciences (CAS)
University Utara Malaysia (UUM), Sintok 06010, Kedah Darul Alman, Malaysia

Researcher e-mail address: raaadr@yahoo.com   & Phone Number: 00601137096675

C. **Section I: Demographic Information**

1. Your area?

   ☐ Rural   ☐ Urban

2. Are you?

   ☐ Teacher   ☐ Student   ☐ Parent   ☐ Manager

3. If you student what is your grade?

   ☐ Grade 1   ☐ Grade 2   ☐ Grade 3

Section II: User's Feedback and Acceptance on the System

This section is to evaluate how learner comes to accept and use of the system.

Please read the following statements below carefully and tick (√) only one of your most applicable answer.

1 – Strongly Disagree   2 – Disagree   3 – Not Sure   4 – Agree

5 – Strongly Agree

	Perceived Communication	1	2	3	4	5
4	I think create an online collaborative learning environment through social software is a good idea.					
5	I think the E-LS supports collaborative learning, knowledge sharing, exchange ideas, networking and community building.					
6	I think the E-LS helps me to organize and exchange my personal knowledge with others.					
7	I think the E-LS gives me opportunity to communicate with others.					
8	I think the E-LS supports personalized learning resources which are able to connect people with right knowledge and deliver quality resources that are tailored to my learning preferences and goals.					
9	I think the E-LS increases interest, motivation and learning achievement in a collaborative learning environment.					

	Perceived Usefulness	1	2	3	4	5
10	I think using social networking features (i.e. wall post, photo and video sharing) in the E-LS are useful to share knowledge and exchange ideas with others (i.e. course mates, lecturers, peers, etc.).					
11	I think using the E-LS is useful for conversation and interaction through discussions (i.e. ask questions and make comments on a topic) with others.					
12	I think using the E-LS is useful to support networking and community building with others.					
13	Overall, I think using the E-LS is useful to my learning activities and performances.					

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	Perceived Ease of Use	1	2	3	4	5
14	I think it is easy to share knowledge and exchange ideas in the E-LS.					
15	I think it is easy to communicate and interact with others in the E-LS through wall postings, discussions and chats.					
16	I think it is easy to network and create a community with others in the E-LS.					
17	I think the system is easy to access and navigate to find my way (i.e. to find the right buttons) in the E-LS.					
18	I think it is easy to use the E-LS even though there is no guidance from instructor.					
	Perceived Satisfaction	1	2	3	4	5
19	I am satisfied with the sharing knowledge and exchanging ideas features in the E-LS (i.e. wall post, photo and video sharing).					
20	I am satisfied with the communication and interaction with others in the E-LS through discussions, wall posts and chats.					
21	I am satisfied with the networking and community with others in the E-LS.					
22	I am satisfied with the flexible accessibility of the E-LS anytime and anywhere.					

23- Any other suggestions or improvements would you like to recommend on the E-LS?

- Thank you for your collaboration –

Appendix D

Usability Questionnaire

1   Overall, I am satisfied with how easy it is to use the E-LS.

      STRONGLY   **STRONGLY**
      DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

2   It is simple to use the IE-LS.

      STRONGLY   **STRONGLY**
      DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

3   I can effectively complete my work using the E-LS.

      STRONGLY   **STRONGLY**
      DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

4   I am able to complete my work quickly using E-LS.

      STRONGLY   **STRONGLY**
      DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

5   I am able to efficiently complete my work using the E-LS.

      STRONGLY   **STRONGLY**
      DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

6   I feel comfortable using the E-LS.

      STRONGLY   **STRONGLY**
      DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

7   It was easy to learn to use the E-LS.

      STRONGLY   **STRONGLY**
      DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

8   I believe I became productive quickly using the E-LS.

      STRONGLY   **STRONGLY**
      DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

9   The E-LS gives error messages that clearly tell me how to fix problems.

      STRONGLY   **STRONGLY**
      DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

10   Whenever I make a mistake using the E-LS, I recover easily and quickly.

      STRONGLY   **STRONGLY**
      DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

11   The information (such as on-line help, on-screen messages and other documentation) provided with the E-LS is clear.

STRONGLY   **STRONGLY**
DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

12   It is easy to find the information I need.

STRONGLY   **STRONGLY**
DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

13   The information provided with the E-LS is easy to understand.

STRONGLY   **STRONGLY**
DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

14   The information is effective in helping me complete my work.

STRONGLY   **STRONGLY**
DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

15   The organization of information on the E-LS screens is clear.

STRONGLY   **STRONGLY**
DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

16   The interface of the E-LS is pleasant.

STRONGLY   **STRONGLY**
DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

17   I like using the interface of the E-LS.

STRONGLY   **STRONGLY**
DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

18   The E-LS has all the functions and capabilities I expect it to have.

STRONGLY   **STRONGLY**
DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

19   Overall, I am satisfied with E-LS.

STRONGLY   **STRONGLY**
DISAGREE   **1**   **2**   **3**   **4**   **5**   **AGREE**

Appendix E

Experts' Notes

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APPENDIX B. INTERVIEW
Date:
Interview start time:
Interview end time:

My name is Raed Mohammed Hussein and I am a Master student conducting a study of "A Requirement Model of Interactive E-learning in Secondary School in Dhi-Qar Province, Iraq". I will ensure that the interview is private and all of the data is kept confidential.

Questions for Teachers

- What do you consider as the main pedagogical challenges in e-learning systems?
- What would be your requirements for the e-learning system in order to offer your course online?
- What kind of support would you need for providing an online course?
- Can you suggest any other issues that need to be taken into consideration when implementing e-learning in secondary school, which was not addressed in this interview?
- If we want to design one interactive system (easily sharing ideas & files) for you and your students as well as their parents and management of school, what is your opinion about the features that should be included in this software?

(1-Not important, 2-Slightly important, 3-Important, 4-Very important)

	How would you rate the presence of the following tools and features to be important to learner?	1	2	3	4
1	Group Email (you and your students are able to send message or information to a group of students.)				
2	Announcement				
3	Calendar				
4	News & Event				
5	Discussion forum (it is a threaded online text conversation between participants.)				
6	Shared Whiteboard (a board used to write texts or draw pictures and give explanation at the same time to you and your students.)				
7	Application sharing (the process of bringing components of different programs together)				

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Head of Department Multimedia Technology
School of Multimedia Technology and Communication (SMMTC)
UUM College of Arts and Sciences
Universiti Utara Malaysia

UIVERSITI UTARA MALAYSIA
SCHOOL OF COMPUTING

DR. SHAFIZ AFFENDI MOHD YUSOF
Associate Professor
School of Computing
UUM College of Art and Sciences
Universiti Utara Malaysia

APPENDIX B. INTERVIEW
Date:
Interview start time:
Interview end time:

My name is Raed Mohammed Hussein and I am a Master student conducting a study of "A Requirement Model of Interactive E-learning in Secondary School in Dhi-Qar Province, Iraq". I will ensure that the interview is private and all of the data is kept confidential.

Questions for Teachers

- What do you consider as the main pedagogical challenges in e-learning systems?
- What would be your requirements for the e-learning system in order to offer your course online?
- What kind of support would you need for providing an online course?
- Can you suggest any other issues that need to be taken into consideration when implementing e-learning in secondary school, which was not addressed in this interview?
- If we want to design one interactive system (easily sharing ideas & files) for you and your students as well as their parents and management of school, what is your opinion about the features that should be included in this software?

(1-Not important, 2-Slightly important, 3-Important, 4-Very important)

	How would you rate the presence of the following tools and features to be important to learner?	1	2	3	4
1	Group Email (you and your students are able to send message or information to a group of students.)				
2	Announcement				
3	Calendar				
4	News & Event				
5	Discussion forum (it is a threaded online text conversation between participants.)				
6	Shared Whiteboard (a board used to write texts or draw pictures and give explanation at the same time to you and your students.)				
7	Application sharing (the process of bringing components of different programs together)				

need to explain

need to add 5th Column for "neutral" / "not sure"

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UIVERSITI UTARA MALAYSIA
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APPENDIX B. INTERVIEW
Date:
Interview start time:
Interview end time:

My name is Raed Mohammed Hussein and I am a Master student conducting a study of "A Requirement Model of Interactive E-learning in Secondary School in Dhi-Qar Province, Iraq". I will ensure that the interview is private and all of the data is kept confidential.

Since you are asking your people, will you use your language?

Questions for Teachers

- What do you consider as the main pedagogical challenges in e-learning systems?
- What would be your requirements for the e-learning system in order to offer your course online?
- What kind of support would you need for providing an online course?
- Can you suggest any other issues that need to be taken into consideration when implementing e-learning in secondary school, which was not addressed in this interview?
- If we want to design one interactive system (easily sharing ideas & files) for you and your students as well as their parents and management of school, what is your opinion about the features that should be included in this software?

(1-Not important, 2-Slightly important, 3-Important, 4-Very important)

You need to give instruction to the the teachers.

	How would you rate the presence of the following tools and features to be important to learner?	1	2	3	4
1	Group Email (you and your students are able to send message or information to a group of students.)				
2	Announcement				
3	Calendar				
4	News & Event				
5	Discussion forum (it is a threaded online text conversation between participants.)				
6	Shared Whiteboard (a board used to write texts or draw pictures and give explanation at the same time to you and your students.)				
7	Application sharing (the process of bringing components of different programs together)				

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UNIVERSITI UTARA MALAYSIA
SCHOOL OF COMPUTING
QUESTIONNAIRE

A Requirement Model of Interactive E-learning in Secondary School in Dhi-Qar Province, Iraq

Dear Respondents,

I am a master student from the College Of Arts and Sciences (CAS), University Utara Malaysia (UUM) under the supervision of Dr. Wiwied Virgiyanti.

I would like your cooperation to help me in providing information by kindly filling in the following questions. I'm greatly appreciated your cooperation and time to participate in my survey. The data gathered in this survey questionnaire will be analysed and published in academic conferences, publication in journals and Masters Dissertation. Your participation will remain anonymous and your identity will not be recorded nor revealed in any form or association.

Best regards,
Raed Mohammed Hussein
Master student
School of Computing, College of Arts and Sciences (CAS)
University Utara Malaysia (UUM), Sintok 06010, Kedah Darul Alman, Malaysia
Date: _____.
Researcher e-mail address: raaadr@yahoo.com   & Phone Number: 00601137096675

Please that is applicable and fill or type in all the answers.

Section I: Personal Information

1. Age

☐ 15 – 19   ☐ 20 – 24   ☐ 25 – 29   ☐ 30 and above

2. Are you?

☐ Teacher   ☐ Student   ☐ Parent   ☐ Manager   *A Parent can be a teacher, student, manager.*

3. If you are student what is your grade?

☐ Grade 10   ☐ Grade 11   ☐ Grade 12

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Head of Department Multimedia Technology
School of Multimedia Technology and Communication (SMMTC)
UUM College of Arts and Sciences
University Utara Malaysia

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SCHOOL OF COMPUTING
QUESTIONNAIRE

A Requirement Model of Interactive E-learning in Secondary School in Dhi-Qar Province, Iraq

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Best regards,
Raed Mohammed Hussein
Master student
School of Computing, College of Arts and Sciences (CAS)
University Utara Malaysia (UUM), Sintok 06010, Kedah Darul Alman, Malaysia
Date: _____.
Researcher e-mail address: raaadr@yahoo.com   & Phone Number: 00601137096675

Please that is applicable and fill or type in all the answers. *? I don't understand this instruction.*

Section I: Personal Information

1. Age

   ☐ 15 – 19   ☐ 20 – 24   ☐ 25 – 29   ☐ 30 and above

2. Are you?

   ☐ Teacher   ☐ Student   ☐ Parent   ☐ Manager

3. If you student what is your grade?

   ☐ Grade 1   ☐ Grade 2   ☐ Grade 3

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Questionnaire No: ☐☐☐☐

UNIVERSITI UTARA MALAYSIA
SCHOOL OF COMPUTING
QUESTIONNAIRE

A Requirement Model of Interactive E-learning in Secondary School in Dhi-Qar Province, Iraq

Dear Respondents,

I am a master student from the College Of Arts and Sciences (CAS), University Utara Malaysia (UUM) under the supervision of Dr. Wiwied Virgiyanti.

I would like your cooperation to help me in providing information by kindly filling in the following questions. I'm greatly appreciated your cooperation and time to participate in my survey. The data gathered in this survey questionnaire will be analysed and published in academic conferences, publication in journals and Masters Dissertation. Your participation will remain anonymous and your identity will not be recorded nor revealed in any form or association.

Checked on 15/7/2015

DR. AZHAM BIN HUSSAIN
Senior Lecturer
School of Computing
UUM College of Art and Sciences
Universiti Utara Malaysia

Best regards,
Raed Mohammed Hussein
Master student
School of Computing, College of Arts and Sciences (CAS)
University Utara Malaysia (UUM), Sintok 06010, Kedah Darul Alman, Malaysia
Date: .
Researcher e-mail address: raaadr@yahoo.com   & Phone Number: 00601137096675

Please that is applicable and fill or type in all the answers.

Section I: Personal Information

1. Age

   ☐ 15 – 19   ☐ 20 – 24   ☐ 25 – 29   ☐ 30 and above

2. Are you?

   ☐ Teacher   ☐ Student   ☐ Parent   ☐ Manager

3. If you student what is your grade?

   ☐ Grade 1   ☐ Grade 2   ☐ Grade 3

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Name the system.

Usability questionnaire adapted from (Lewis, 1995).

1   Overall, *The system is easy to use* I am satisfied with how easy it is to use this system.

| | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

2   It is simple to use this system.

| | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

3   I can effectively complete my work using this system.

| | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

4   I am able to complete my work quickly using this system.

| | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

5   I am able to efficiently complete my work using this system.

| | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

6   I feel comfortable using this system.

| | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

7   It was easy to learn to use this system.

| | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

8   I believe I became productive quickly using this system.

| | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

9   The system gives error messages that clearly tell me how to fix problems.

| | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

10   Whenever I make a mistake using the system, I recover easily and quickly.

| | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

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Usability questionnaire adapted from (Lewis, 1995).

1. Overall, I am satisfied with how easy it is to use this system.

   | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

2. It is simple to use this system.

   | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

3. I can effectively complete my work using this system.

   | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

4. I am able to complete my work quickly using this system.

   | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

5. I am able to efficiently complete my work using this system.

   | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

6. I feel comfortable using this system.

   | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

7. It was easy to learn to use this system.

   | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

8. I believe I became productive quickly using this system.

   | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

9. The system gives error messages that clearly tell me how to fix problems.

   | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

10. Whenever I make a mistake using the system, I recover easily and quickly.

    | STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

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Usability questionnaire adapted from (Lewis, 1995). *quite old*

1   Overall, I am satisfied with how easy it is to use this system.

| STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

2   It is simple to use this system.

| STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

3   I can effectively complete my work using this system.

| STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

4   I am able to complete my work quickly using this system.

| STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

5   I am able to efficiently complete my work using this system.

| STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

6   I feel comfortable using this system.

| STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

7   It was easy to learn to use this system.

| STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

8   I believe I became productive quickly using this system.

| STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

9   The system gives error messages that clearly tell me how to fix problems.

| STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

10 Whenever I make a mistake using the system, I recover easily and quickly.

| STRONGLY DISAGREE | 1 | 2 | 3 | 4 | 5 | STRONGLY AGREE | N/A |

check on 15/7/2015

DR. AZHAM BIN HUSSAIN
Senior Lecturer
School of Computing
UUM College of Art and Sciences
Universiti Utara Malaysia

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EXPERT REVIEW INSTRUMENT FOR THE PROPOSED FUNCTIONAL REQUIREMENT OF E-LEARNING SYSTEM IN SECONDARY SCHOOL

The purpose of this questionnaire is to review the proposed functional requirements of e-learning system in secondary school as suggested by this study. Your esteemed review will determine the appropriateness and practicality of these proposed functional requirements.

The section A is for your profile information. Sections B is for review of the proposed requirements. Information provided will be treated with utmost confidentiality for the purpose of this research only, and with anonymous reportage in academic publications.

Section A: Expert Profile

Name	JACARIA BIN AHMAD
Institution	SMK. JITRA
Position	I.T. Coordinator
Field experience	ICT
Experience (in Years)	12
Email address	zahiba01@gmail.com
Phone Number	019-5631351

1

Section B: The section presents the list of proposed functional requirement modules of e-learning systems for secondary school. Your opinion is kindly required. Please, tick (√) as you find appropriate: 'Yes', 'No', or 'I don't know'.

The following functional requirements and their use cases are applicable in designing e-learning systems			Yes	No	I don't know
Module	**Functional Requirement**	**Applicable Use Cases**			
Communication & Community participation	Real time chat room	Send and receive message to members of the same course or different course	✓		
	Course community discussion forum	Post comment on topics discussed under course headings	✓		
	Video conferencing	Make video conferencing between users in the course		✓	
	Calendar (share Important Dates For Events)	Share important dates for events	✓		
	Sending and receiving e-mail in the course	Sending and receiving e-mail in the course	✓		
	Announcements	Make announcement as it regards the learning programmes and events	✓		
	Share white board	Write texts or draw pictures and give explanation at the same time	✓		
	Who's online	See who's active at a moment.	✓		
	Application sharing	Share application		✓	
Manage Course	Create course	Create course to be available	✓		
	Update course	Edit the course	✓		
Manage Curriculum	Create curriculum	Create class to be available	✓		
	Upload material	Upload material and note	✓		
	Download material	Download material and note	✓		
	Set list of eligible learners	Access courses based on authentication	✓		
	Set maximum participant of a class	Set the maximum students that can enrol per course		✓	
Evaluate	Activity tracking	View the learners' progress	✓		
	Self-reflection	Students evaluate their own performance		✓	

2

Learners	Project progress	Show project progress		✓	
	Online survey	Ability to make survey of evaluation for specific subject	✓		
	Grade book	Share information about grades	✓		
	Assignment and assessment	Make assignment and receive the answer	✓		
	Quiz	Mark multiple choices and structured questions	✓		
Support Learning	Project space	It is a place for a group of collaborators to focus on a certain project and work on the project		✓	
	Personal work space	It is a space for every user	✓		
	Expert services	For giving knowledge and source to learner		✓	
	Online guides/ help	To support or advice the learner	✓		
Share Repository	Search facility	Search in the course	✓		
	Shared bookmarks	Share bookmarks between student and teacher		✓	
	Content folder /Data collection	Share folder	✓		
	Syllabus /Lessons plans	Upload syllabus or curriculum objectives by teacher	✓		
	Media library	Share media files	✓		
	Web link	The teacher share web link with student	✓		
	Frequently Asked Questions	View FAQ section	✓		

Any other suggestions or improvements would you like to recommend on the functional requirements.

can add many user include add the new user, update user information and delete user.

3

EXPERT REVIEW INSTRUMENT FOR THE PROPOSED FUNCTIONAL REQUIREMENT OF E-LEARNING SYSTEM IN SECONDARY SCHOOL

The purpose of this questionnaire is to review the proposed functional requirements of e-learning system in secondary school as suggested by this study. Your esteemed review will determine the appropriateness and practicality of these proposed functional requirements.

The section A is for your profile information. Sections B is for review of the proposed requirements. Information provided will be treated with utmost confidentiality for the purpose of this research only, and with anonymous reportage in academic publications.

Section A: Expert Profile

Name	NOR'AIN SULAIMAN
Institution	SMK JITRA KEDAH
Position	TEACHER
Field experience	VISUAL ARTS ICT
Experience (in Years)	18 YEARS
Email address	annas24@gmail.com
Phone Number	0125234606

1

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Section B: The section presents the list of proposed functional requirement modules of e-learning systems for secondary school. Your opinion is kindly required. Please, tick (√) as you find appropriate: 'Yes', 'No', or 'I don't know'.

The following functional requirements and their use cases are applicable in designing e-learning systems			Yes	No	I don't know
Module	**Functional Requirement**	**Applicable Use Cases**		√	
Communication & Community participation	Real time chat room	Send and receive message to members of the same course or different course	√		
	Course community discussion forum	Post comment on topics discussed under course headings	√		
	Video conferencing	Make video conferencing between users in the course	√		
	Calendar (share Important Dates For Events)	Share important dates for events	√		
	Sending and receiving e-mail in the course	Sending and receiving e-mail in the course	√		
	Announcements	Make announcement as it regards the learning programmes and events	√		
	Share white board	Write texts or draw pictures and give explanation at the same time	√		
	Who's online	See who's active at a moment.			√
	Application sharing	Share application	√		
Manage Course	Create course	Create course to be available	√		
	Update course	Edit the course	√		
Manage Curriculum	Create curriculum	Create class to be available	√		
	Upload material	Upload material and note	√		
	Download material	Download material and note	√		
	Set list of eligible learners	Access courses based on authentication			√
	Set maximum participant of a class	Set the maximum students that can enrol per course			√
Evaluate	Activity tracking	View the learners' progress	√		
	Self-reflection	Students evaluate their own performance	√		

2

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Learners	Project progress	Show project progress	✓		
	Online survey	Ability to make survey of evaluation for specific subject	✓		
	Grade book	Share information about grades	✓		
	Assignment and assessment	Make assignment and receive the answer	✓		
	Quiz	Mark multiple choices and structured questions	✓		
Support Learning	Project space	It is a place for a group of collaborators to focus on a certain project and work on the project	✓		
	Personal work space	It is a space for every user	✓		
	Expert services	For giving knowledge and source to learner		✓	
	Online guides/ help	To support or advice the learner	✓		
Share Repository	Search facility	Search in the course	✓		
	Shared bookmarks	Share bookmarks between student and teacher		✓	
	Content folder /Data collection	Share folder	✓		
	Syllabus /Lessons plans	Upload syllabus or curriculum objectives by teacher	✓		
	Media library	Share media files	✓		
	Web link	The teacher share web link with student	✓		
	Frequently Asked Questions	View FAQ section	✓		

Any other suggestions or improvements would you like to recommend on the functional requirements.

SATISFACTORY - NO ADDITIONAL Suggestions

3

**EXPERT REVIEW INSTRUMENT FOR THE PROPOSED FUNCTIONAL
REQUIREMENT OF E-LEARNING SYSTEM IN SECONDARY SCHOOL**

The purpose of this questionnaire is to review the proposed functional requirements of e-learning system in secondary school as suggested by this study. Your esteemed review will determine the appropriateness and practicality of these proposed functional requirements.

The section A is for your profile information. Sections B is for review of the proposed requirements. Information provided will be treated with utmost confidentiality for the purpose of this research only, and with anonymous reportage in academic publications.

Section A: Expert Profile

Name	Wael H. Ali
Institution	Alnajah Private School
Position	Teacher
Field experience	Information Technology
Experience (in Years)	10 years
Email address	2017wael@gmail.com
Phone Number	009647803209181

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Section B: The section presents the list of proposed functional requirement modules of e-learning systems for secondary school. Your opinion is kindly required. Please, tick (√) as you find appropriate: 'Yes', 'No', or 'I don't know'.

The following functional requirements and their use cases are applicable in designing e-learning systems			Yes	No	I don't know
Module	**Functional Requirement**	**Applicable Use Cases**			
Communication & Community participation	Real time chat room	Send and receive message to members of the same course or different course	✓		
	Course community discussion forum	Post comment on topics discussed under course headings	✓		
	Video conferencing	Make video conferencing between users in the course		✓	
	Calendar (share Important Dates For Events)	Share important dates for events	✓		
	Sending and receiving e-mail in the course	Sending and receiving e-mail in the course	✓		
	Announcements	Make announcement as it regards the learning programmes and events	✓		
	Share white board	Write texts or draw pictures and give explanation at the same time	✓		
	Who's online	See who's active at a moment.		✓	
	Application sharing	Share application		✓	
Manage Course	Create course	Create course to be available	✓		
	Update course	Edit the course	✓		
Manage Curriculum	Create curriculum	Create class to be available	✓		
	Upload material	Upload material and note		✓	
	Download material	Download material and note	✓		
	Set list of eligible learners	Access courses based on authentication	✓		
	Set maximum participant of a class	Set the maximum students that can enrol per course		✓	
Evaluate	Activity tracking	View the learners' progress	✓		
	Self-reflection	Students evaluate their own performance		✓	

2

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Learners	Project progress	Show project progress		✓	
	Online survey	Ability to make survey of evaluation for specific subject	✓		
	Grade book	Share information about grades	✓		
	Assignment and assessment	Make assignment and receive the answer	✓		
	Quiz	Mark multiple choices and structured questions	✓		
Support Learning	Project space	It is a place for a group of collaborators to focus on a certain project and work on the project		✓	
	Personal work space	It is a space for every user	✓		
	Expert services	For giving knowledge and source to learner		✓	
	Online guides/ help	To support or advice the learner	✓		
Share Repository	Search facility	Search in the course	✓		
	Shared bookmarks	Share bookmarks between student and teacher	✓		
	Content folder /Data collection	Share folder	✓		
	Syllabus /Lessons plans	Upload syllabus or curriculum objectives by teacher	✓		
	Media library	Share media files	✓		
	Web link	The teacher share web link with student	✓		
	Frequently Asked Questions	View FAQ section	✓		

Any other suggestions or improvements would you like to recommend on the functional requirements.

No suggestions.

3

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EXPERT VERIFICATION INSTRUMENT FOR THE PROPOSED FUNCTIONAL REQUIREMENT MODEL OF E-LEARNING SYSTEM IN SECONDARY SCHOOL

The purpose of this questionnaire is to verify the proposed functional requirements model of e-learning system as suggested by this study. Your esteemed review will determine the Completeness, unambiguous and Consistency of this proposed functional requirements model.

The section A is for your profile information. Section B is for verifications of the proposed functional requirements model. Information provided will be treated with utmost confidentiality for the purpose of this research only, and with anonymous reportage in academic publications.

A. Demographic Information

Name	ROHAIDA BT ROMLI
Occupation	SENIOR LECTURER
Institution	Universiti Utara MalaysiA
Research Interest	Software Engineering, Software Verification & Testing.
Experience (in Years)	10 years.

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B. Review of the Functional Requirements Model

Please read the following statements below and tick (√) only one of your most applicable answer.

1 – Strongly Disagree   2 – Disagree   3 – Not Sure   4 – Agree   5 – Strongly Agree

Characteristic	Description	1	2	3	4	5	Other Comment
Completeness	All functional requirements have been modelled using the appropriate diagram.					√	
	Each functional requirement presented in model is not need further amplification or clarification				√		
	The functional requirement model is sufficient to represent the real system				√		
Unambiguous	Each functional requirement presented in the model provide sufficient information to avoid ambiguity					√	
	Each functional requirement stated in the model has only one interpretation				√		
	Each functional requirement expressed using term which can be clearly understood				√		
Consistency	All the functional requirements presented in the model are not conflict with each other				√		
	All the functional requirements use the correct UML notation					√	
	Naming convention (e.g. use case) has been applied consistently				√		

EXPERT VERIFICATION INSTRUMENT FOR THE PROPOSED FUNCTIONAL REQUIREMENT MODEL OF E-LEARNING SYSTEM IN SECONDARY SCHOOL

The purpose of this questionnaire is to verify the proposed functional requirements model of e-learning system as suggested by this study. Your esteemed review will determine the Completeness, unambiguous and Consistency of this proposed functional requirements model.

The section A is for your profile information. Section B is for verifications of the proposed functional requirements model. Information provided will be treated with utmost confidentiality for the purpose of this research only, and with anonymous reportage in academic publications.

A. Demographic Information

Name	
Occupation	DR. AZHAM BIN HUSSAIN Pensyarah Kanan Pusat Pengajian Pengkomputeran
Institution	UUM College of Art and Sciences Universiti Utara Malaysia
Research Interest	HCI, Mobile HCI, Evaluation and Software Engineering
Experience (in Years)	10 years

B. Review of the Functional Requirements Model

Please read the following statements below and tick (√) only one of your most applicable answer.

1 – Strongly Disagree   2 – Disagree   3 – Not Sure   4 – Agree   5 – Strongly Agree

Characteristic	Description	1	2	3	4	5	Other Comment
Completeness	All functional requirements have been modelled using the appropriate diagram.					✓	
	Each functional requirement presented in model is not need further amplification or clarification					✓	
	The functional requirement model is sufficient to represent the real system				✓		
Unambiguous	Each functional requirement presented in the model provide sufficient information to avoid ambiguity					✓	
	Each functional requirement stated in the model has only one interpretation					✓	
	Each functional requirement expressed using term which can be clearly understood				✓		
Consistency	All the functional requirements presented in the model are not conflict with each other					✓	
	All the functional requirements use the correct UML notation					✓	
	Naming convention (e.g. use case) has been applied consistently					✓	

EXPERT VERIFICATION INSTRUMENT FOR THE PROPOSED FUNCTIONAL REQUIREMENT MODEL OF E-LEARNING SYSTEM IN SECONDARY SCHOOL

The purpose of this questionnaire is to verify the proposed functional requirements model of e-learning system as suggested by this study. Your esteemed review will determine the Completeness, unambiguous and Consistency of this proposed functional requirements model.

The section A is for your profile information. Section B is for verifications of the proposed functional requirements model. Information provided will be treated with utmost confidentiality for the purpose of this research only, and with anonymous reportage in academic publications.

A. Demographic Information

Name	DR. MUHAMMAD IKHWAN JAMBAK
Occupation	Associate Professor School of Computing
Institution	UUM College of Art and Sciences Universiti Utara Malaysia
Research Interest	Software engineering, Information Management
Experience (in Years)	Since 1997 in Information Modeling

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B. Review of the Functional Requirements Model

Please read the following statements below and tick (√) only one of your most applicable answer.

1 – Strongly Disagree   2 – Disagree   3 – Not Sure   4 – Agree   5 – Strongly Agree

Characteristic	Description	1	2	3	4	5	Other Comment
Completeness	All functional requirements have been modelled using the appropriate diagram.				√		
	Each functional requirement presented in model is not need further amplification or clarification				√		
	The functional requirement model is sufficient to represent the real system				√		
Unambiguous	Each functional requirement presented in the model provide sufficient information to avoid ambiguity				√		
	Each functional requirement stated in the model has only one interpretation			√			
	Each functional requirement expressed using term which can be clearly understood					√	
Consistency	All the functional requirements presented in the model are not conflict with each other					√	
	All the functional requirements use the correct UML notation			√			
	Naming convention (e.g. use case) has been applied consistently				√		

EXPERT VERIFICATION INSTRUMENT FOR THE PROPOSED FUNCTIONAL REQUIREMENT MODEL OF E-LEARNING SYSTEM IN SECONDARY SCHOOL

The purpose of this questionnaire is to verify the proposed functional requirements model of e-learning system as suggested by this study. Your esteemed review will determine the Completeness, unambiguous and Consistency of this proposed functional requirements model.

The section A is for your profile information. Section B is for verifications of the proposed functional requirements model. Information provided will be treated with utmost confidentiality for the purpose of this research only, and with anonymous reportage in academic publications.

A. Demographic Information

Name	
Occupation	
Institution	
Research Interest	
Experience (in Years)	

B. Review of the Functional Requirements Model

Please read the following statements below and tick (√) only one of your most applicable answer.

1 – Strongly Disagree 2 – Disagree 3 – Not Sure 4 – Agree 5 – Strongly Agree

Characteristic	Description	1	2	3	4	5	Other Comment
Completeness	All functional requirements have been modelled using the appropriate diagram.						
	Each functional requirement presented in model is not need further amplification or clarification						
	The functional requirement model is sufficient to represent the real system						
Unambiguous	Each functional requirement presented in the model provide sufficient information to avoid ambiguity						
	Each functional requirement stated in the model has only one interpretation						
	Each functional requirement expressed using term which can be clearly understood						
Consistency	All the functional requirements presented in the model are not conflict with each other						
	All the functional requirements use the correct UML notation						
	Naming convention (e.g. use case) has been applied consistently						

Appendix G

Experts' Profile

Experts from software engineering field

No	Name	Occupation	Institution	Research interest	years of Experience
1	Dr. Rohaida Bt Romli	Lecturer	UUM	Software Engineering, software verification& testing	10
2	Dr. Azham Hussain	Lecturer	UUM	HCI, Mobile HCI, Evaluation and Software Engineering	10
3	AP Dr. Muhammed Ikhwan	Lecturer	UUM	Software Engineering, information management	18

Experts from secondary school

Name	Institution	Position	Field experience	Experience (in years)	Email	Phone
Zakaria Bin Ahmed	SMK Jitra	I.T Coordinator	ICT	12	Zakba01@gmail.com	0195631351
Nor Ain Sulaiman	SMK Jitra	Teacher	Visual ART, ICT	18	Ainnas24@gmail.com	0125234606
Wael H. Ali	Alnajah	Teacher	Information Technology	10	2017wael@gmail.com	0096478032 09181

Appendix H
Experts' Review Instrument

EXPERT REVIEW INSTRUMENT FOR THE PROPOSED FUNCTIONAL REQUIREMENT OF E-LEARNING SYSTEM IN SECONDARY SCHOOL

The purpose of this questionnaire is to review the proposed functional requirements of e-learning system in secondary school as suggested by this study. Your esteemed review will determine the appropriateness and practicality of these proposed functional requirements.

The section A is for your profile information. Sections B is for review of the proposed requirements. Information provided will be treated with utmost confidentiality for the purpose of this research only, and with anonymous reportage in academic publications.

Section A: Expert Profile

Name	
Institution	
Position	
Field experience	
Experience (in Years)	
Email address	
Phone Number	

Section B: The section presents the list of proposed functional requirement modules of e-learning systems for secondary school. Your opinion is kindly required. Please, tick (√) as you find appropriate: 'Yes', 'No', or 'I don't know'.

The following functional requirements and their use cases are applicable in designing e-learning systems			Yes	No	I don't know
Module	**Functional Requirement**	**Applicable Use Cases**			
Communication & Community participation	Real time chat room	Send and receive message to members of the same course or different course			
	Course community discussion forum	Post comment on topics discussed under course headings			
	Video conferencing	Make video conferencing between users in the course			
	Calendar (share Important Dates For Events)	Share important dates for events			
	Sending and receiving e-mail in the course	Sending and receiving e-mail in the course			
	Announcements	Make announcement as it regards the learning programmes and events			
	Share white board	Write texts or draw pictures and give explanation at the same time			
	Who's online	See who's active at a moment.			
	Application sharing	Share application			
Manage Course	Create course	Create course to be available			
	Update course	Edit the course			
Manage Curriculum	Create curriculum	Create class to be available			
	Upload material	Upload material and note			
	Download material	Download material and note			
	Set list of eligible learners	Access courses based on authentication			
	Set maximum participant of a class	Set the maximum students that can enrol per course			
Evaluate	Activity tracking	View the learners' progress			
	Self-reflection	Students evaluate their own performance			

Learners	Project progress	Show project progress			
	Online survey	Ability to make survey of evaluation for specific subject			
	Grade book	Share information about grades			
	Assignment and assessment	Make assignment and receive the answer			
	Quiz	Mark multiple choices and structured questions			
Support Learning	Project space	It is a place for a group of collaborators to focus on a certain project and work on the project			
	Personal work space	It is a space for every user			
	Expert services	For giving knowledge and source to learner			
	Online guides/ help	To support or advice the learner			
Share Repository	Search facility	Search in the course			
	Shared bookmarks	Share bookmarks between student and teacher			
	Content folder /Data collection	Share folder			
	Syllabus /Lessons plans	Upload syllabus or curriculum objectives by teacher			
	Media library	Share media files			
	Web link	The teacher share web link with student			
	Frequently Asked Questions	View FAQ section			

Any other suggestions or improvements would you like to recommend on the functional requirements.