C-Man: Course Management Assistant

Azwan Abd Aziz[1]
Nooraini Yusoff[2], Fadzilah Siraj[3]

Faculty of Information Technology
06010, Sintok, Universiti Utara Malaysia
azwan_abdaziz@yahoo.com[1], nooraini@uum.edu.my[2], fad173@uum.edu.my[3]

Abstract: Course management systems (CMS) are widely utilized nowadays and their purpose is to provide a teaching and learning environment that includes tools for retrieval of educational content, synchronous and asynchronous communication, administrative functions, and assessment. This project identifies the functionalities of a CMS based on four aspects: course grading, course support material, course notification, and system usability. A prototype called C-Man was built based on the identified functionalities and further tested by potential users to evaluate the prototype usability. The evaluation used Computer System Usability Questionnaire (CSUQ) and was performed according to four subscales of usability namely the system usefulness, the information quality, the interface quality and the overall satisfaction. Overall results showed that majority of the participants satisfied with the C-Man usability. Nevertheless, for the future enhancements, recommendations from participants will be taken into considerations.

1.0 INTRODUCTION

Over the past few years, universities and colleges have made substantial progress in using the World Wide Web for teaching and learning and for distance-learning applications. Many institutions have repurposed course offerings for distance learning, where students and instructors no longer have to meet in the same place at the same time.

Web-based learning environments, often called Course Management Systems (CMS), are widely used nowadays in universities and companies around the world. These tools take advantage of computer mediated communication to create virtual classrooms where learners and instructors share a common learning space. An increasing number of institutions use course management system (CMS) to complement traditional classroom-based instruction. With CMS, the instructors can produce and distribute content material, prepare course materials, engage in discussions with the students, and manage online grade book. The students have unlimited access to the learning material from any location and can submit assignments at a convenient for them time.

While distance learning and the Web provide more convenient virtual access to learners around the world, some shortcomings limit the benefits, mainly from the perspectives of communication, collaboration, pedagogy, and course administration. The course instructor in a distance-learning situation, for instance, can no longer enjoy the powerful face-to-face communication channels available in a traditional classroom setting. The communication and collaboration channels are limited to capabilities of the tools available within the CMS.

Despite the fact that CMS have reached a good level of maturity and reliability, they still fail to provide effective support to the instructors to perform basic student monitoring activities. Indeed, educational research reports a number of problems with using CMS in distance learning, such as lack of ease of use features, complicated and time consuming functionalities and difficulties with finding course support material (Galusha, 2000; Rivera & Rice, 2002; Valentine, 2002). Although new versions include easy-to-use Web authoring tools, most offer passive services. As a result, some instructors spend more time teaching a distance-learning course than teaching the same course in a classroom setting. This problem results mostly from the time-consuming operational nature of online courses.

1.1 Problem Statement

Advances in technology have provided educators with tools to increase productivity, better transmit knowledge to students, and provide education to students around the world via distance learning programs and the Internet. Course management systems (CMS) have been utilized by many colleges and universities for several years. Their purpose is to provide a teaching and learning environment that includes tools for retrieval of educational content, synchronous and asynchronous communication, administrative functions, and assessment (Malloy, Jensen & Reddick, 2001). Besides, plethora of other CMS products has been produced to meet present and future needs of teaching and learning.

Nevertheless, the existing CMS seem to have several weaknesses that been summarized as below:

- Course grading
  A CMS should be more flexible in terms of grading facility (Burhans *et al.*, 2002). After being graded, there should be no need to list all the student names in order to re-grade just some of them. There should be a mechanism that able to filter the list according to certain criterions. It also important for CMS to has alternative results representation such as in graphical forms.

- Course support material
  Present CMS typically do not permit the inclusion of links to other web sites, thereby necessitating the need for students for access multiple resources in order to obtain course support material (Burhans *et al.*, 2002).

- Course notification
  Current CMS uses email, chatroom, and announcement as alert tools. These methods require third party application that is less efficient to notify students about important events (Crisp, 2002). Faster approach need to be used to encourage immediate response from student. For example, the overview page can be used to shows the notification about the status of subscription request, upcoming assignments, announcements, and replacement class.

- System usability
  Specific features are standard in CMS, some of which are grade books, authentication, course material, and file sharing. However Halloran (2004) study shows these features receive low supports from users due to complicated interface that caused the functions become difficult to use. Ease of use, clear navigation, content quality, and efficiency are the top requirements for course management software and on-line learning resources (Rodriguez & Parks, 2004).

1.2 Objective

This study focuses on the functionalities of C-Man, a Web-based course management assistant. Following are the objectives:

1. To identify the functionalities of C-Man based on four aspects: course grading, course support material, course notification and system usability.
2. To develop a prototype of C-Man according to identified functionalities.
3. To evaluate the prototype using usability testing.

1.3 Project Scope

C-Man has been developed based on three functionalities: course grading, course support material, and course notification (Burhans *et al.*, 2002; Crisp, 2002). Usability testing was used to evaluate the prototype as proposed by Halloran (2004). The testing involves fifteen participants from FTM lecturers and students where each one of them tests the prototype as system admin or lecturer or student.

2.0 LITERATURE REVIEW

2.1 Web Based Teaching and Learning

Over time, higher education has seen a number of innovations, some revolutionary, others having minimal to no impact (Katz, 2003). Over the last decade, the development of computer software and hardware directed toward education and the teaching and learning process has tremendous impact on course management (Glahn & Glen, 2002; Katz, 2003). During this period, higher education has been witness to fundamental changes from courses delivered in the traditional face-to-face method to those delivered via video cassette and television, to a proliferation of courses and course content delivered via computer technologies.

In recent years, the use of Internet resources (i.e. web pages) in course and curriculum development has made a significant impact on teaching and learning. The use of the Internet has evolved from the display of static, dull, and lifeless information to a rich multimedia environment that is both engaging, dynamic, and user friendly (Powel and Gill, 2003).

During this period, the Internet has become an important component in the teaching and learning process. As a result, the use of the Internet in higher education settings has become a more accepted and widely used tool in academia (Angelo, 2004; Glahn & Glen, 2002; Katz, 2003). With the advent of web editing tools and other programs, the need to learn Hyper Text Markup Language (HTML) and other programming languages has diminished. Most recently, the development and refinement of university and commercially developed course management systems (CMS) like Blackboard, WebCT, and Prometheus, have resulted in the proliferation of web use in higher education (Angelo, 2004; Morgan, 2003). These technologies have made it possible to easily and efficiently distribute course information and materials to students via the Internet and have allowed for greater online communication and interaction (Stith, 2000). While these tools were initially developed for use in distance education pedagogies, their use in on-campus classroom settings to compliment traditional courses is now considered a viable and often preferred option. As a result, many academic units (i.e. departments) are struggling to keep pace with the demand for CMS supported course sites for traditional, face-to-face courses.

CMS have shown to significantly increase student involvement in multiple aspects of courses (Stith, 2000). The ability of lecturers to control access to a variety of course materials such as syllabus, lecture notes, outlines, and notifications allows students access to such material from virtually at any location. For the lecturer, a multitude of options exist for developing, implementing, revising, and delivering course content. At the department level, these tools can have a profound effect on faculty teaching and student learning, departmental communication, and faculty workload.

2.2 Course Management System

Course management systems (CMS) are widely utilized nowadays by numerous colleges and universities. Their purpose is to provide a teaching and learning environment that includes tools for retrieval of educational content, synchronous and asynchronous communication, administrative functions, and assessment (Malloy, Jensen & Reddick, 2001). Course management system also offers anytime and immediate access to information which being a powerful force that tremendously affected education field.

CMS was designed to simplify, streamline, and automate many aspects of the workflow associated with running a large course, such as course creation, importing students, management of student course groups, online notes and submission of assignments, grading, course support material, and reminder services (Botev *et al.,*2005).

Course Management System (CMS) is a tool that allows an instructor to post information on the web without knowledge of HTML. In its complete form, a CMS provides an instructor a set of tools and a framework that allows easy creation of online course content, and teaching and management of that course, including various interactions with students (Bayrak *et al.,* 2004).

2.3 Related Work on Course Management System (CMS)

BlackBoard (http://www.blackboard.com/). It was founded in 1997 by BlackBoard Company. BlackBoard supports assignment submission through drop boxes. It also offers email and real time chat services to facilitate instructor-instructor, student-student, and instructor-student interactions.

In terms of authorization, BlackBoard gives privilege to administrator to assign different levels of access to the system or course based on the predefined roles like instructors, students and administrators. On the other hand, instructors can selectively release materials based on specific start and end dates. Instructors also can view grades in the grade book by single or all students.

Educator (http://www.ucompass.com/). This CMS was developed by Compass Publishing in 1998. Educator allows instructors to upload their files to the personal folder of a student. It also has other services such as email and chatroom. In addition, instructors can set up specific course content that is released on a specific date as well as control the course accessibility at login. For the grading purpose, instructor is able to gives grades to student and can manually edit the recorded grades.

WebCT (http://www.WebCT.com/). WebCT comes with assignment submission using drop boxes facility. It also has Java based chat tool plus internal email services. This CMS is produced by Web CT Company in 1999, authorizes instructors to personalize student access upon course materials based on student membership. Instructors also can create a course grading scales. WebCT offers premium services for quicker response time, direct access, and 24/7 supports. The company also provides customized training for available users.

FirstClass (http://www.centrinity_inc.com/). Centrinity Inc. has produced this CMS that supports email and real time chat. It was released in 1999 with course access authorization facilities. Therefore, instructors can customize specific access permissions for each student. It also allows students to create their own personal homepage and folders.

Desire2Learn (http://www.Desire2Learn_Inc.com/). Desire2Learn has launched their product of CMS in 2002. This CMS called Desire2Learn released with various services like assignment submission through drop boxes, real time chat, email, and course content searching. It also enables student grades modification. Moreover, instructor can use statistical analysis to show the level of student performance.

Learnwise (http://www.learnwise.com/). It allows student to share their folders with other students and instructors. Whereas instructor can gives grades to student and view the grades by assignments or exams. Learnwise also provides email and real time chat for communication facilities. In addition, Learnwise permits search services for course content and FAQs. It was launched by Granada Learning in 2003.

2.4 Prototype Evaluation

The evaluation of prototype usability is the process of determining how easily and usable the product is. It involves analyzing the products or systems effectively, efficiently, and securely for use; easy to learn and remember and has a good utility (Preece, Roger & Sharp, 2000). In other word, evaluation is the way to obtain user feedback and improve the product or system (Glosiene & Manzuch, 2004).

According to the International Standard Organization (ISO) 9126 as cited in Avouris (n.d.), one of the factors in measuring software quality is usability. Usability depends on a number of factors including understandability, learnability, operability, attractiveness, and compliance to standards and guidelines. In ISO 9241-11 draft standard, usability is defined as "the extent to which a product can be used with effectiveness, efficiency, and satisfaction in a specified context of use" (ISO 9241-11 as cited in Avouris, n.d.). Marcus as cited in Shahizan and Li (2003) stated that usability can be defined in term of "how easy or efficient a product is for a user to recognize, learn, remember, use, and enjoy".

Avouris (n.d.) concluded three techniques to measure usability which are inspection, testing, and inquiry methods. The main methods of inspection cover heuristic evaluation, cognitive walkthrough, pluralistic

walkthrough, standards inspection, and guidelines checklist. Usability testing techniques are thinking aloud protocol, co-discovery, performance measurement, and in-field studies. While, inquiry methods consist of questionnaires and interviews. Moreover, Avouris (n.d.) claimed that inquiry method (questionnaires and interviews) can be used to measure various usability attributes especially which relates to measurement of user's satisfaction.

The questionnaire is a technique of collecting data using a specific form or document to get feedback from respondents (Kendall & Kendall, 2002). According to Kirakowski (n.d.) questionnaire is "a method for the elicitation, recording, and collecting of information". As claimed by Hix and Hartson (1993), a questionnaire will allow us to determine each user's initial opinion of the system. Furthermore, questionnaires are less expensive to administer take less time to complete, and specific information can be gathered from many people at one time (Hoffer, George & Valacich, 2002). The technique of questionnaire is very suitable when sources of information from respondents are located at different sites and areas (Mohamad Noorman, Safawi & Kamarulariffin, 2001).

Many questionnaires have been proposed (Kirakowski, n.d.) in order to serve various usability evaluation objectives. The Software Usability Measurement Inventory (SUMI) is a well known technique for measuring user satisfaction and assessing user perception on software quality. SUMI consists of fifty items questionnaire and available in several languages. Another example is the Computer System Usability Questionnaire (CSUQ) which was introduced by Lewis in 1995. It has been developed and evaluated by IBM Corporation (Perlman, n.d.). The CSUQ consists of nineteen items. It is divided into four subscales namely the system usefulness, the information quality, the interface quality, and the overall satisfaction. The items were constructed as seven-point Likert rating scales. Users are asked to rate agreement with the statement ranging from very strongly disagree to very strongly agree.

3.0 RESEARCH METHODOLOGY

There are numerous methodologies available today that can be used as aid tools to develop various types of systems. As mentioned by Hoffer *et al.* (2002), methodology is used to ensure a consistent approach is applied to all phases of a project. Methodology also facilitates project accomplishment by structuring the related processes according to the phase defined.

This study adapted General Methodology of Design Research as proposed by Vaishnavi and Kuechler (2005) that include five main phases (as Fig. 1). The phases involved are problem identification, development, analysis, and the last phase which is conclusion and suggestion.

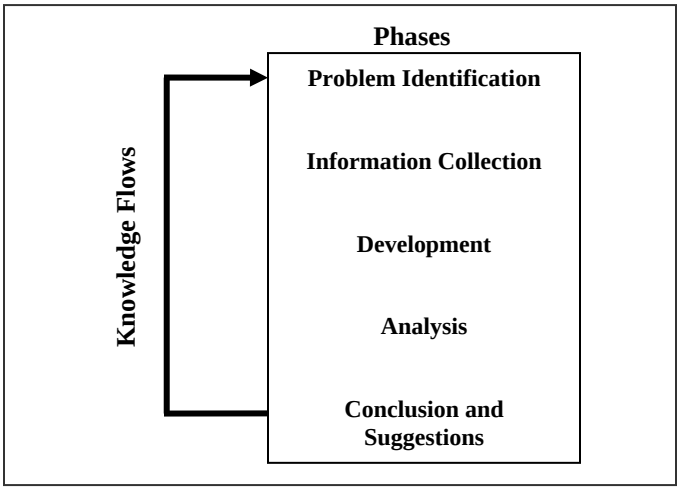

Figure 1: Adapted General Methodology of Design Research (Vaishnavi and Kuechler, 2005)

3.1 Problem Identification

The first phase is to identify the domain of the study, problem statement, and then to define the achievable study objective. For this study, the appropriate domain is course management system. Hence, for the first three months of the study schedule, literature review is carried out. During the literature review phase, ideas, information, issues and problems related to the e-learning area are gathered from books, proceedings, journals, white papers, reports and news.

3.2 Gathering Information

Activities performed during this phase are to gain information about course management system. The process started by getting information about existing course management systems, features and functions provided and identifying the problems upon course grading, course support material, and course notification aspects. In collecting the necessary information, six course management systems were visited.

Those systems are Blackboard (http://www.blackboard.com/), Desire2Learn (http://www.desire2learn.com/), Educator (http://www.ucompass.com/), WebCT (http://www.webct.com/), FirstClass (http://www.Centrinity_Inc.com/), and Learnwise (http://www.learnwise.com/).

On the other hand, interview (using unstructured and open-ended questions) also being conducted with two types of respondents, which are lecturers and students from Faculty of Information Technology, UUM. Interview is one of information gathering techniques in which information can be obtained through direct conversation (Hoffer *et al.*, 2002). Other than that, information, problems, and issues related to the study are gathered from books and websites. From the information, user's requirements have been determined. Three types of users potentially required for this system which are system admin, lecturer or instructor, and student. The output of this phase is the list of identified functionalities that based on course grading, course support material and course notification aspects. Use case notation (UML approach) has been used to illustrate the relationship of potential users (system admin, lecturer, and student) with the identified functionalities.

3.3 Development

This phase involves the development of the system prototype. It used prototyping approach as its methodology. The prototyping process comprises four main steps which are adapted from Laudon (2000) (as Fig. 2).

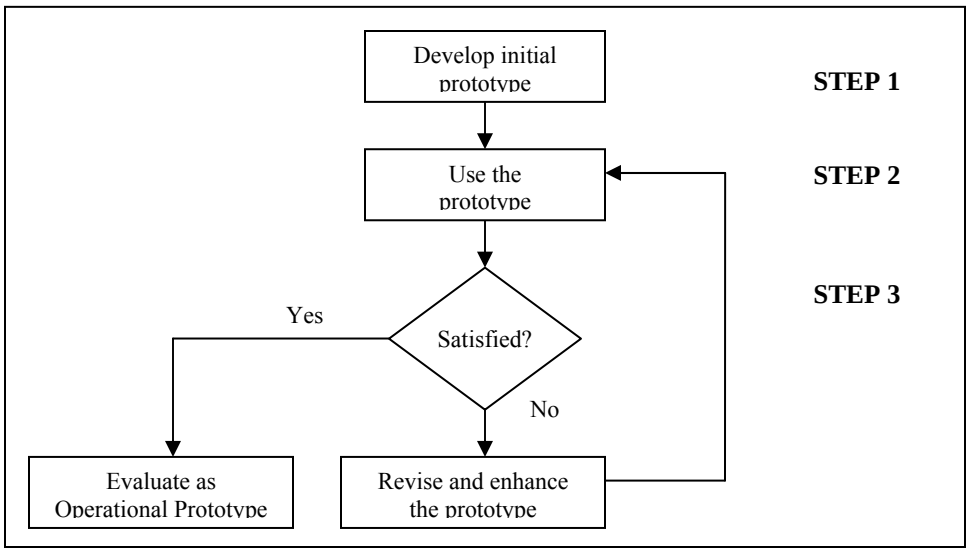

Figure 2: The Prototyping Processes

Step 1: Develop an initial prototype
Based on the functionalities list formed in the prior phase, a prototype called **C-Man** was built. The following software tools were utilized:

i. Microsoft Internet Explore 6.0, Opera 8.0 – It was used for web browser to launch the prototype.

ii. Macromedia Dreamweaver MX – It was used to create, design and edit the interface of the prototype.

iii. PHP – It was used to create a dynamic prototype, is an open source server-side scripting language. It also works well with certain programming languages that have been use for the prototype like CSS, HTML and Java Script.

iv. MySQL – It is an open source product, was used as the database because it is low cost, very fast, robust, provides high performance, multi threaded, multi user, provides high security and easy to use.

v. Apache – It was used as web server, it has high performance, open source, excellent compatibility with PHP and MySQL.

vi. Adobe Photoshop 7.0 - This graphic editor used to create images, banners and graphics used in the prototype.

Step 2: Use the prototype
In this step, users are encouraged to work with and experience the prototype. This experiment is crucial to identify errors and the efficiency of the functionalities provided. Nine end-users have been selected randomly to use the prototype. Minimal instruction was given to them before they start using the prototype.

Step 4: Evaluate as Operational Prototype
During this step, the prototype has been evaluated for its usability aspects. Questionnaire is chosen as a method to measure users' satisfaction and it is based on the Computer System Usability Questionnaire (CSUQ).

According to Bevan (1998), reliable results can be obtained with a sample of only eight participants. However, Kirakowski, (n.d.) stated that the minimum responses needed for an analysis data using SUMI is about ten to twelve users. For the evaluation purposed, fifteen respondents have been selected. Five respondents are allocated for each type of user which includes system admin, lecturer and student.

3.3 Analysis

All data gathered from questionnaire were analyzed. Data analysis is carried out in the form of descriptive statistic. As mentioned by Mohd Majid (2000), descriptive statistic is used to summarize and present the data in a much clearer and easier to understand. All items in CSUQ are measured using the Likert Scale format ranging from 1 to 7. To facilitate data analysis, the Likert Scale will be categorized as in Table 3.2 (Best & Kahn, 2000). The analysis of usability evaluation results will be discussed in the next section (Findings).

Table 1: Likert Scale Classification

	Very strongly disagree	Strongly disagree	Disagree	Not sure	Agree	Strongly agree	Very strongly agree
Score	1	2	3	4	5	6	7
Category	Disagree			Not Sure	Agree		

3.4 Conclusion and Suggestion

The final phase of the chosen methodology is the conclusion and suggestion. Based on the findings and results from the data analysis, a conclusion on overall study is made and suggestions from users are proposed for the enhancement of future work.

4.0 FINDINGS

This section contains the usability testing results and prototype of C-Man.

4.1 Usability Testing Results

According to usability testing performed by fifteen participants, the evaluation results are summarized as in Table 2, 3, 4 and 5. The testing is based on four aspects of usability that includes system usefulness, information quality, interface quality and the overall satisfaction.

The participants have been grouped into three types of user which are system admin, lecturer and student.

Table 2: System Usefulness

Item	Description	Percentage Agreed		
		Admin	Lecturer	Student
1	Overall, I am satisfied with how easy it is use to use this system.	100	100	100
2	It was simple to use this system.	100	80	100
3	I can effectively complete my work using this system	90	80	90
4	I am able to complete my work quickly using this system	80	100	100
5	I am able to efficiently complete my work using this system	100	80	100
6	I feel comfortable using this system.	100	100	100
7	It was easy to learn to use this system.	80	100	100
8	I believe I became productive quickly using this system.	90	80	90
	Average	**92.5**	**90.0**	**97.5**
	Average of users agreed	**93.3**		

Table 2 indicates the user acceptance of system usefulness with 92.5% by system admin, 90% by lecturer and 97.5% by student. Hence the average of the user acceptance is 93.3%. The results shows that the prototype is useful to be used to facilitate the user tasks that relate with managing course material, student's marks grading and instructor-student interaction.

Table 3: Information or Content Quality

Item	Description	Percentage Agreed		
		Admin	Lecturer	Student
9	The system gives error messages that clearly tell me how to fix problems.	80	40	80
10	Whenever I make a mistake using the system, I recover easily and quickly.	40	40	60
11	The information (such as online help, on-screen messages, and other documentation) provided with this system is clear.	40	40	100
12	It is easy to find the information I needed.	100	60	80
13	The information provided for the system is easy to understand.	100	100	100

14	The information is effective in helping me complete the tasks and scenarios.	80	60	100
15	The organization of information on the system screens is clear.	100	80	100
	Average	**77.1**	**60.0**	**88.6**
	Average of users agreed	**75.2**		

Item 10 in Table 2 shows the lowest percentage of user's satisfaction by system admin, lecturer, and student with 40%, 40% and 60% respectively. They quite disagree that they can recover easily and quickly when they make mistake. This perhaps due to the fact that there are some situations where C-Man does not provides an accurate error message. Nevertheless 75.2% participants agreed that this prototype has the quality of information or content.

Table 4: Interface Quality

Item	Description	Percentage Agreed		
		Admin	**Lecturer**	**Student**
16	The interface of this system is pleasant.	90	100	90
17	I like using the interface of this system.	100	100	9086.7
18	This system has all the functions and capabilities I expect it to have.	90	80	80
	Average	**93.3**	**93.3**	**93.3**
	Average of users agreed	**91.1**		

The percentage of user's satisfaction upon interface quality is 91.1%. This indicates most of the respondents agreed that the interface of C-Man is pleasant and attractive.

Table 5: Overall Satisfaction

Item	Description	Percentage Agreed		
		Admin	**Lecturer**	**Student**
19	Overall, I am satisfied with this system.	100	80	90
	Average of users agreed	**90.0**		

In this evaluation, the prototype of C-Man obtained 90% of overall user's satisfaction which indicates the prototype has satisfied users in terms of system usability.

Table 6: Respondents Feedbacks and Recommendation

Feedbacks
• Most of the provided functionalities facilitate their tasks. • Times taken to accomplish most of the tasks are reasonable. • Prototype has attractive and friendly interface. • Easy to search course support materials. • Notification method used in the prototype is effective and allow user to give instant response.
Recommendations
• Ability to import external files (E.g. MS Excel document) to create grade book. • Ability to recycle courses from semester to semester. • Course management tools that use the drag and drop instead of upload and download. • Reduce number of clicks to accomplish some tasks. • Error message should be more clear and helpful.

Table 6 shows the summarized feedbacks and recommendations from the participants.

Based on the overall comments the following conclusions can be drawn:

- All respondents agreed that the functionality provided by the prototype performed accordingly to their expectation.
- The provided functionalities managed to expedite grading and re-grading process.
- The provided functionalities also increased the level of interaction among lecturer and student.
- The provided functionalities speed up the course support material searching.
- User can be notified effectively and able to give immediate response through provided functionalities.
- Respondents validated all the provided functionalities.

4.2 Prototype of C-Man

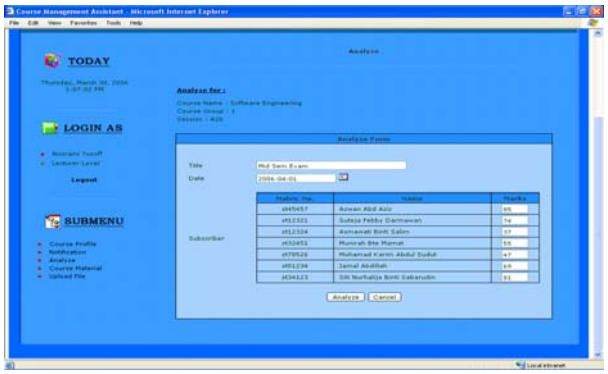

Figure 4: Grade Form Page

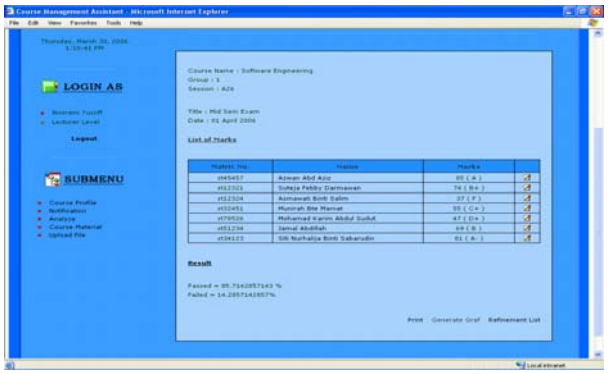

Figure 5: Grade Report Page

Figure 6: Notification List Page

Figure 7: Course Support Material Page

5.0 SIGNIFICANCE

C-Man, the web based prototype provides main features and functionalities in managing course for online teaching and learning. Throughout these functionalities, C-Man able to facilitate course grading and re-grading, provide single access to multiple resources of course support materials, and disperse news and events effectively with immediate responses. By evaluating the prototype, user determinations upon system usability can be satisfied.

6.0 CONCLUSION

On the whole, this study has achieved its predetermined objectives. As a result, a set of functionalities that able to facilitate course grading, expedite access to resources of course support material, and spread news and events with instant replies have been prototyped. The usability evaluation indicates that the prototype pleased users in terms of system usefulness, information and content quality, pleasant and attractive interface, and overall of satisfaction.

Although the study has shown that 90% of users satisfied with the prototype, the recommendations from participants will be taken into considerations for future enhancements.

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