Asian Journal *of* Distance Education

http://www.AsianJDE.org

ISSN 1347-9008 Asian J D E 2006 vol 4, no 1, pp 56 - 66

Eliciting Specification for a Web-Based Distance-Learning System from Lecturers and Students in Malaysia

Siti Salwah SALIM & Raja Noor Ainon Zabariah RAJA ZAINAL ABIDIN
University of Malaya, Malaysia
salwa@um.edu.my

ABSTRACT :

We have reviewed the existing web-based distance-learning systems and have performed a research survey among the undergraduate distance-learning students and lecturers of the Open University Malaysia (OUM). Here we report the findings that emerged from both investigations. The main focus was to elicit specifications for a web-based distance-learning system from the main users of a distance-learning program (i.e. the actual lecturers and students). The features compiled from the existing systems were used as a checklist for them to specify their needs and preferences of the features, at the same time giving them the opportunity to specify any other features that they required for a web-based distance-learning system. This revealed a list of required functions together with their preference ratings and a list of non-functional requirements, specified by the lecturers and students. The analysis of the investigations also discovered those features which were important to the students and lecturers but were not well supported by the existing systems. Research efforts towards implementing these less-supported features are suggested.

1. INTRODUCTION :

Currently there are many web-based distance-learning systems available to accommodate online learning needs. Web-based distance-learning systems provide an environment for students to enrol and study with an educational institution, which permits an 'anywhere, anytime' approach to learning, as well as provide a highly structured method of facilitating on-line courses. They are either commercial systems produced by software development companies or research-based systems produced by research centers. BlackBoard (Blackboard Inc., 2005) is an example of a commercial system that provides technological solutions for distance learning. On the other hand, KEWL (University of the Western Cape, 2004 ; Keats, 2003) is a research-based system built at the University of the Western Cape to support a distance-learning environment.

Each system has its own set of specification of the features available for the users of a distance-learning program. Table 1 shows the results of our reviews which give an insight into the features supported by four commercial systems - BlackBoard (Blackboard Inc., 2005 ; Steenhaut et al., 2002), WebCT (WebCT Inc., 2005 ; Leyell, 2002), eCollege (eCollege Inc., 2005 ; Sanda, 2003), and ANGEL (CyberLearning Inc., 2004 ; Clapp, 2003), together with three research-based systems - KEWL (University of the Western Cape, 2005 ; Keats, 2003), Atutor (ARTC, 2004 ; Gay, 2002), and Eledge (University of Utah, 2005). In Table 1, the presence of a feature in the system is indicated by an 'O', while the absence is indicated by an 'X'.

Table 1 also indicates which features are well supported by 'OO', which are less

supported by 'O', and which are those that are not supported by 'X'. Features that are supported by five or more systems (>70%) are categorized as well supported, while less-supported features are those that are only supported by four or fewer systems (≤70%). Features not supported by any of the systems are simply categorized as not supported.

From our review, most of the systems support some aspects of synchronous tutoring through some combination of whiteboard and audio / video conferencing features.

However, an ideal synchronous tutoring feature should have an integrated environment that is equipped with all the necessary facilities in order to facilitate and

Table 1 : Overview of the Support of Features

Feature	Distance-Learning System							
	WebCT 4.1	KEWL 1.2	ATutor 1,3	eCollege AU+	BlackBoard 6.0	Eledge 3.1	ANGEL 6.0	Overall Support
Course Profile	O	O	O	O	O	O	O	OO
Course Template	O	X	O	O	O	X	O	OO
Synchronous Tutoring	X	X	X	X	X	X	X	X
Asynchronous Tutoring	O	O	O	O	O	O	O	OO
Discussion Forum	O	O	O	O	O	O	O	OO
Email	O	O	O	O	O	O	O	OO
Chat Room	O	O	O	O	O	O	O	OO
Audio and Video Conferencing	X	O	X	O	O	X	O	O
Whiteboard	O	O	X	O	O	X	O	O
Online Assignment	O	O	O	O	O	O	O	OO
Online Submission	O	O	X	O	O	O	O	OO
Self-assessment	O	O	O	O	O	O	O	O
Student Group Work	O	O	X	O	O	X	O	OO
Student Progress Tracking	O	X	X	O	O	X	O	O
Searching Within Course	O	O	X	X	O	X	O	OO
Student Community Building	X	O	X	O	X	X	O	O
Student Portfolios	O	O	X	X	O	O	O	O
Orientation / Help	O	O	O	O	O	O	O	O

It can be seen from Table 1 that of the eighteen features, fourteen are well supported, three features are less supported, and the remaining one feature 'synchronous tutoring' is not supported by any system.

Synchronous tutoring allows students from remote locations - such as homes or offices - to have an interactive real-time tutorial session with their tutor / lecturer. coordinate the interactions between the students and the lecturer. These include (a) the facilities for the lecturers to prepare tutorial questions and hand-outs for students to view / download; to schedule the tutorial slots for students to sign-in; to make announcements and send reminders to the students prior to the tutorial hours, (b) the communication / interaction facilities for

the students to ask questions, clarify certain issues, participate in the discussion, show their answers, etc., and (c) the facilities for the students to submit their tutorial questions and obtain feedback from their lecturer. The review shows that none of the existing systems fulfill the ideal features of synchronous tutoring.

Supporting the right features for lecturers and students to carry out their activities in a distance-learning environment is inevitably important. In this study, we have elicited the specification for a web-based distance-learning system from the lecturers and students using the features collected from the existing system as the checklist for them to indicate their needs and preferences, at the same giving them the opportunity to inform of any other features they require for a web-based distance-learning system. Brief description of some of these features is given in Table 2. Figure 1 summarizes the elicitation approach employed for this research.

Table 2 : Brief Description of Some of the Supported Features

Feature	Description
Course Profile	Allow students to access/upload course objectives, syllabus, references, schedule, announcements, resources, calendars, course notes, etc.
Course Template	Allows lecturers to design and create their learning material based on templates provided by the system
Synchronous Tutoring	Allow students from remote locations to have an interactive real-time tutorial session with their tutor/lecturer. The synchronous tutoring is equipped with all the necessary facilities to facilitate and coordinate the communication activities between the students and the lecturer; as well as the administrative activities of the real-time tutorial session.
Asynchronous Tutoring	Allow students to view the tutorial contents prepared by the instructors at their own convenient time. Interaction between the students and the lecturer is carried out over time through the communication tools such as discussion board/email.
Self-assessment	Allow students to practice test / quizzes online
Student Group Work	Provide a working space for the students to carry out their group activities assigned by the instructors
Student Progress Tracking	Allow students to view their assignments grades and the feedback given by the instructors on the assignments and their progress
Student Community Building	Allow students to create study groups, clubs, or collaborative teams
Orientation / Help	Help students to learn how to use the system by providing user manuals, self-paced tutorials, etc.

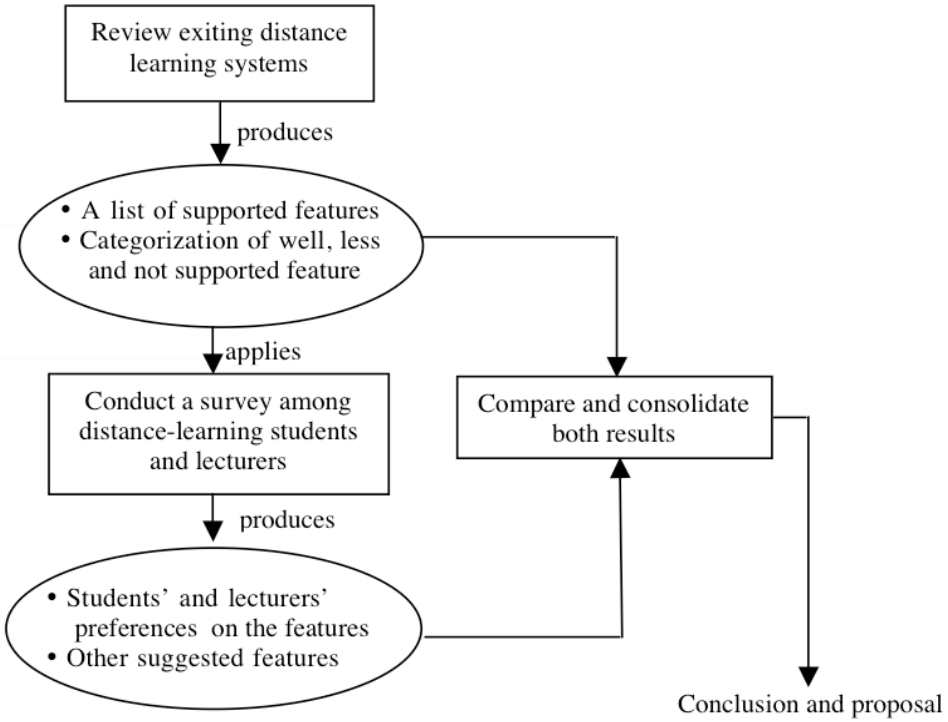

Figure 1 : The elicitation approach in this study

2. METHODS :

2.1 The Survey Instrument :

The questionnaire was divided into three parts. Part 1 gathered details of participants' background. Part 2 investigated the features of distance-learning systems. Part 3 gave space to participants to include other features which were not listed in Part 2, and to give feedback on any other requirements related to a web-based distance-learning system. The features included in the questionnaire were drawn from the reviews carried out on seven major existing web-based distance-learning systems as described in the preceding section. This section further explains the reviews. The reviews of the existing systems were based on three main sources – the information collected from the documentation and white papers; the information gathered from executing the systems, especially the research-based systems where full execution are permitted; and the information reported from the EduTools web-site. The EduTools web-site collects information on various e-learning products.

Features supported by each system were listed and compared with each other. We found that there were many variations of the terms used for the features in the systems. For example, the discussion forum was also being termed as threaded discussion or discussion board. In such a situation, we chose one term which was more common among the systems. This led to the identification of 18 different features in supporting lecturers' and students' needs in a distance-learning environment. The features were grouped under four main categories, namely course management, communication, assessment, and others. The features concerning course profile and delivery were listed under the 'course management' category. The features that assist in communication and interaction were listed under the 'communication' category. The online features of assessment, performance and group work were listed under the 'assessment' category. Other features to help students and lecturers in a distance-learning environment were listed under the category of 'others'.

Besides the reviews, we also undertook a

discussion with program officers of OUM to gather any other useful features from their experience to support lecturers and students. As a result of the discussion, we added one feature, the program coordinator, which falls under the category of others. This feature provides the students with the program information, forum, FAQ and the online academic advising service. Table 3 shows the available features for the students and lecturers according to the categories identified. All were available to both students and lecturers except for the feature of 'course template' that was available only to the lecturers.

Table 3 : The Features in Categories

Category	Feature
Course Management	Course Profile
	Course Template
	Synchronous Tutoring
	Asynchronous Tutoring
Communication	Discussion Forum
	Email
	Chat Room
	Audio and Video Conferencing
	Whiteboard
Assessment	Online Assignment
	Online Submission
	Self-assessment
	Group Work
	Student Progress Tracking
Others	Searching Within Course
	Student Community Building
	Student Portfolios
	Orientation/Help
	Program Coordinator

The questionnaire used a rating scale of 1 to 4, where 1 represents most preferred, 2 represents preferred, 3 represents moderately preferred, and 4 represents least preferred. The participants were asked to rank the features according to degree of preference.

2.2 The Participants :

The survey was sent out by mail to 372 lecturers and 1955 undergraduate students at the Open University Malaysia (OUM) to gather their needs and preferences on features of distance-learning systems. The lecturers and students were from 10 learning centers of OUM and were experienced at using at least one type of web-based distance-learning system, provided by OUM.

A total of 1502 students and 224 lecturers sent back forms which could be successfully processed. The survey forms from the other 453 students and 148 lecturers were not processed due to their incompleteness. Participation in this survey was carried out on a voluntary basis. Among the students that fully answered the questionnaire, there was a slightly higher proportion of female students to male students. In contrast, among the lecturers that fully completed the survey form, there was a higher proportion of male lecturers to female lecturers.

Background data collected in the survey from the students included 'gender', 'program enrolled', 'age group', and 'semester of study'. The background data from the lecturers included 'gender', 'programs taught', and 'age group'.

Most of the students were enrolled in the IT, Mathematics, Management, Business, TESL, and Science programs, in decreasing incidence.

The majority of the students were in the age group of 25–35 years old, followed by the age group of 36–45, and next by less-than-25 years old. Most of them were in the third and fifth semester of study. As for the lecturers, most of them were teaching the TESL, IT, Math, Science and Business programs. The majority of the lecturers were in the age groups of 25–35 and 36–45 years old.

3. RESULTS :

Tables 4 – 8 present the ratings for the four categories of web-based distance-learning features. Students and lecturers ratings are given in the same table for each group to ease the comparisons. The first row highlights the students' ratings followed by the lecturers' ratings in the second row. The mode and mean values of each feature are also calculated.

3.1 Course Management Category :

The students' ratings on the features in the course management category are given in Table 4, and show that the course profile is the most preferred feature. Both modes of tutoring, synchronous and asynchronous were rated equally preferred. When comparing the mean values of these modes, students rather prefer synchronous type of tutoring. The lecturers' results show that course profile and both modes of tutoring are the most preferred. The mean values for both modes are the same, thus, the lecturers regard asynchronous and synchronous mode of tutoring as of equal importance. As for the course template, it is preferred by lecturers.

3.2 Communication Category :

The ratings on the features in the communication category are given in Table 5, and show that the discussion forum is the most preferred feature for students and lecturers. This is followed by the whiteboard and email. Chat room is less preferred as compared to whiteboard and email. Audio/video conferencing is the least preferred among the communication tools.

3.3 Assessment Category :

The ratings on the features in the assessment category are given in Table 6a, and show that students preferred all the features, with self-assessment as the most preferred, followed by online assignment, student progress tracking, online submission, and student group work, in decreasing order. On the other hand, lecturers regard self-assessment and online assignment as most preferred. Student progress tracking, student group work and online submission are rated as preferred.

For the online assignment, lecturers were also asked to identify the types of question that they prefer to mark online. As shown in Table 6b, the three most preferred type of question is true/false, followed by short subjective, and then by MCQ. Fill in the blanks is rated as preferred, but the lecturers least preferred the essay type of question to be marked online

3.4 Others Category :

The ratings on the features in the others category are given in Table 7, and show that students prefer all the features. Interestingly

Table 4 : The % Ratings in the Course Management Category

		Feature			
		Course Profile	Course Template	Asynchronous Tutoring	Synchronous Tutoring
Rating	1	45.81		24.77	32.16
		62.50	25.90	38.80	32.10
	2	37.08		42.08	37.15
		22.80	43.30	29.90	32.10
	3	14.91		26.76	24.03
		9.40	23.20	13.80	20.10
	4	2.20		6.39	6.66
		5.40	7.60	17.40	15.60
	mean	1.74		2.15	2.05
		1.58	2.13	2.10	2.10
	mode	1		2	2
		1	2	1	1

Table 5 : The % Ratings in the Communication Category

		Feature				
		Discussion Forum	Email	Chat Room	Audio/Video Conferencing	Whiteboard
Rating	1	33.95	30.56	17.11	16.25	33.56
		45.10	38.40	26.80	17.90	37.50
	2	40.01	39.88	40.88	31.62	35.89
		31.30	34.80	42.40	34.80	39.30
	3	21.97	23.37	30.29	32.16	25.17
		16.50	17.00	21.00	31.70	17.00
	4	4.06	6.19	11.72	19.97	5.39
		7.10	9.80	9.80	15.60	6.30
	mean	1.96	2.05	2.37	2.56	2.02
		1.86	1.98	2.14	2.45	1.92
	mode	2	2	2	3	2
		1	1	2	2	2

Table 6a : The % Ratings in the Communication Category

		Feature				
		Discussion Forum	Email	Chat Room	Audio/Video Conferencing	Whiteboard
Rating	1	33.95	30.56	17.11	16.25	33.56
		45.10	38.40	26.80	17.90	37.50
	2	40.01	39.88	40.88	31.62	35.89
		31.30	34.80	42.40	34.80	39.30
	3	21.97	23.37	30.29	32.16	25.17
		16.50	17.00	21.00	31.70	17.00
	4	4.06	6.19	11.72	19.97	5.39
		7.10	9.80	9.80	15.60	6.30
	mean	1.96	2.05	2.37	2.56	2.02
		1.86	1.98	2.14	2.45	1.92
	mode	2	2	2	3	2
		1	1	2	2	2

Table 6b : The % Ratings by Lecturers on Types of Question to be Marked Online

		Type of Question to be Marked Online				
		Essay	Fill in the blanks	MCQ	Short Subjective	True / False
Rating	1	18.80	31.70	41.10	37.90	47.80
	2	27.20	36.20	33.50	37.90	29.90
	3	25.90	21.00	15.60	18.80	15.20
	4	28.10	11.20	9.80	5.40	7.10
	mean	2.63	2.12	1.94	1.92	1.82
	mode	4	2	1	1	1

Table 7 : The % Ratings in the Others Category

		Feature				
		Searching within the Course	Student Community Building	Student Portfolios	Orientation / Help	Program Coordinator
Rating	1	32.56	23.20	37.22	32.56	36.15
		40.60	33.50	42.90	40.60	47.30
	2	41.01	45.70	42.01	41.01	44.61
		39.30	39.30	39.30	39.30	37.50
	3	20.97	24.00	16.91	20.97	16.31
		15.20	20.50	13.80	15.20	11.20
	4	5.46	7.20	3.86	5.46	2.93
		4.90	6.70	4.00	4.90	4.00
	mean	1.99	2.15	1.87	1.99	1.86
		1.84	2.00	1.79	1.84	1.72
	mode	2	2	2	2	2
		1	2	1	1	1

the lecturers regard all of these features as most preferred except student community building which they regard as preferred. The program coordinator feature that we included in the survey is the most preferred feature among the category of others. This is currently not supported by the existing system.

3.5 Feedback from the Students and Lecturers :

Besides getting their preferences on the checklist of features given in the survey, the students and lecturers also gave their feedback by suggesting their perceptions of any addition needs concerning other new features for web-based distance-learning systems. These suggested features are summarized in Table 8(a).

These five new features suggested can be added into the four categories given above to improve the survey instrument for future use. The two newly suggested features of providing texts online as e-books, and of having bilingual functionality (in this region, this meant in Malay language as well as in English) can be added to the category of others. The newly suggested feature of having a collaborative workspace to support online study group can be added to the assessment category. The other newly suggested feature of providing an editor for mathematical equations and symbols to help lecturers who are teaching mathematics courses can be added to the course management category, and finally the fifth newly suggested feature of having the capability of sending marking of a same question to multiple students asking for commentary on the same question can be added to the list to lecturers of types of question to be marked online.

Table 8a : New Features suggested by the Students and Lecturers

New Feature	Suggested by	
	Students	Lecturers
E-books	O	
Collaborative workspace to support online study groups	O	
Editor for mathematical equations and symbols		O
Online marking for matching questions		O
Bilingual functionality (Malay and English)	O	O

Table 8b : Non-functional Requirements suggested by the Students and Lecturers

System Property	Requirement	Suggested by	
		Students	Lecturers
Ease of Use	Be user-friendly	O	O
	Provide online help to students and lecturers with little knowledge of computers	O	O
	Have simple instructions and navigation	O	O
Reliability	Be reliable	O	O
	Be easy to access at any time and anywhere	O	O
Speed	Have minimal layout and graphics to prevent slow connection and download time	O	O

The students and lecturers also suggested other needs for system requirements that are not directly concerned with the specific features delivered by the system but are important for the usability of a system – the non-functional requirements of the web-based distance-learning system. These six non-functional requirements newly suggested by both the students and lecturers are given above in Table 8b, together with their categorization here as the system properties of ease of use, reliability, and also speed.

4. DISCUSSION AND CONCLUSION :

This study began with a review of existing web-based distance-learning system to give an insight into the features supported by these systems for the students and lecturers. This produced a compiled list of supported features that served as a checklist for lecturers and students to specify their needs and preferences of the features for a web-based distance-learning system. The students and lecturers were also given the opportunity to specify any other additional needs required by them in a web-based distance-learning system. Consequently, the survey undertaken among the distance-learning students and lecturers has discovered several important points as follows.

(1) The list of features provided by the existing systems are the ones needed by the lecturers and students. This is indicated by the relatively high ratings given to almost all features, with the exception of the video conferencing feature which was only moderately preferred by the students. Similarly, the program coordinator feature that was included in the list of features received high ratings from both the students and the lecturers.

(2) Most of these features have been well supported by the existing systems, with the exception of synchronous tutoring and program coordinator. These less-supported features need to be supported as they have been rated as important features. The ratings given by the students and lecturers represent the importance of the features to be supported. They can serve as a guideline to developers on the features that need to be emphasized when developing an initial version of a distance-learning system. They can also act as a guideline for designers to produce a user-interface where important features should be salient to the users.

(3) Research efforts are needed towards implementing the less-supported and not-supported features. A real-time tutoring room is needed which is equipped with all the necessary facilities to enable and to coordinate the interactions between the learners and the lecturer. Similarly, a tool is required that can provide a working space for the program coordinators to disseminate useful information and to communicate effectively with the students.

(4) In addition, there are also some new features and non-functional requirements specified by the students and lecturers. Similarly, research efforts towards implementing these features are needed. These features were an online marking system for the various types of questions, an

Table 9 : Summary of the Ratings to Each Feature and Levels of Support Provided

Features by Category	Ratings of Preference								Supported			Research
	1 high		2		3		4 low					
	S	T	S	T	S	T	S	T				
Course Management												
Course Profile	O	O							OO			
Course Template				O					OO			
Asynchronous Tutoring		O	O						OO			
Synchronous Tutoring		O	O								X	O
Editor for Maths Symbols												O
Communication												
Discussion Forum		O	O						OO			
Email		O	O						OO			
Chat Room			O	O					OO			
Audio/Video Conferencing				O	O					O		
Whiteboard			O	O					OO			
Assessment												
Online Assignment		O	O						OO			
Online Submission			O	O					OO			
Question Type marked online												
i Essay								O				O
ii Fill in the blanks				O								
iii MCQ		O										
iv Short questions		O										
v True / False		O										
vi Matching questions												
Self-assessment		O	O						OO			
Student Group Work			O	O					OO			
Student Progress Tracking			O	O						O		
Collaborative Workspace												O
Others												
Searching within the Course		O	O						OO			
Student Community Building			O	O						O		
Student Portfolios		O	O						OO			
Orientation / Help		O	O						OO			
Program Coordinator		O	O								X	O
E-books												
Bilingual Functionality												

editor that will help lecturers teaching mathematics courses to easily incorporate symbols and equations into their notes / lectures / tutorials, and a collaborative working space to support online study group.

The findings from this survey study are summarized in Table 9. Here in Table 9, the student is abbreviated as 'S', and lecturer as 'T' (tutor or teacher). The well-supported, less-supported, and not-supported features are also summarized and indicated as 'OO', 'O', and 'X' respectively. The need for research efforts towards implementing specific features is indicated by 'O' in the final column. The features newly suggested in open responses by the students and lecturers are as yet without preference ratings, and so research effort is indicated for these new items.

ACKNOWLEDGEMENTS :

We are grateful to the Open University Malaysia for the support and cooperation given in carrying out the survey. We also thank the students and lecturers who kindly completed the survey. This project was funded by an IRPA research grant.

REFERENCES :

ATRC (2004). *ATutor - Learning Content Management System*. Adaptive Technology Resource Center. Retrieved January 1, 2004, from http://www.atutor.ca/

Blackboard Inc. (2005). *Blackboard Website*. Retrieved January 1, 2005, from http://www.blackboard.com/

Clapp, C. (2003). CyberLearning labs - ANGEL: Version 5.5 Highlights. *EDUCAUSE Midwest Regional conference – Strategic IT leadership in challenging times*. Chicago, IL. March 24-26, 2003.

CyberLearning Inc. (2004). *CyberLearningLabs*. Retrieved January 6, 2004, from http://cyberlearninglabs.com/products/communicationCollaboration.asp

eCollege Inc. (2005). *eCollege Website*. Retrieved February 14, 2005, from http://www.ecollege.com/indexflash.learn

Gay, G. (2002). Atutor : Adaptive learning online. *IEEE Computer Society Learning Technology Task Force (LTTF), 4* (1).

Keats, D. (2003). Knowledge environment for web-based learning (KEWL) : An open source learning management system suited for the developing world. *Technology Source*. Retrieved January 1, 2004, from http://ts.mivu.org/

Leyell, T.S. (2002). The effectiveness of technology-enhanced learning. *Proceedings of the 4th Annual WebCT User Conference,* (pp. 1-5). Boston, MA.

Sanda, J. (2003). eCollege accessibility : The on-campus benefits of accessible elearning. *CSUN 18th Annual International Conference - Technology and Persons with Disabilities*. Los Angeles, CA.

Steenhaut, K., Ebraert, P., & Fink-Jensen, J. (2002). Introducing elements of knowledge management for e-learning. *IADIS International Conference*. Lisbon, Portugal.

Univeristy of the Western Cape (2005). *KEWL – Knowledge environment for web-based learning web-site*. Retrieved January 26, 2005, from http://kewl.uwc.ac.za/

University of Utah (2005). *Eledge open learning management system*. Retrieved February 1, 2005, from http://eledge.sourceforge.net

WebCT Inc. (2005). *WebCT Website*. Retrieved January 2, 2005, from http://www.webct.com/

Dr Siti Salwah SALIM is Associate Professor of the Department of Software Engineering, at the Faculty of Computer Science and Information Technology, University of Malaya, Kuala Lumpur, Malaysia. Email : salwa@um.edu.my