

THE EFFECTIVENESS OF USING LEARNING MANAGEMENT SYSTEMS AND COLLABORATIVE TOOLS IN WEB-BASED TEACHING OF PROGRAMMING LANGUAGES

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ABSTRACT

This paper is about a pilot study which has been carried out at the Near East University during the 2004/5 Fall Semester using the Moodle LMS together with GREWPtool collaborative editor. The system has been tested with 36 students taking the *Java* and the *Pascal* programming courses. The results of the pilot study showed that a Learning Management System can be made more efficient if it is enhanced by a collaborative learning tool. Our results have also shown that programming languages such as Pascal and Java can be thought successfully in a web-based environment using an LMS system together with a collaborative tool.

Keywords: Learning management systems(LMS), programming languages, Java, Pascal, web-based learning, collaborative learning, collaborative learning tool.

I. INTRODUCTION

The term *distant education* was accepted by the International Council for Correspondence Education [1] in 1972. In recent years a shift has occurred in higher education. The traditional paradigm of a university as an institution that provides teaching is shifting to a new paradigm of the university as an institution that produces learning (Barr and Tagg, 1995). This shift from teaching to learning requires a movement away from the traditional class-room teaching approach where the instructors talk and students listen. In the new paradigm students are encouraged to take an active role in their own learning. Thus, the role of the university is no longer to transfer knowledge, but instead to create the required environment such that the students can discover and learn for themselves. When we look at the distance education student we get the picture of an adult learner with self-direction and personal responsibility [2].

Although the distant education is growing rapidly it has some common problems associated with it, such as the lack of economic resources, lack of human expertise, and the lack of recognition of educational

equivalence. But nevertheless there are strong reports that distant education is as effective as delivering courses in the traditional manner in a classroom. Rosetti and Surnyt [3] found that the students who used video conferencing outperformed the traditional face-to-face group. Similarly, Haynes and Dillon [4] compared the traditional learning and two-way video conferencing and found no significant differences in learning gains. Some studies have shown that participants in distant education programs are more motivated, self-directed and achieve more than participants in traditional classrooms achieve [5].

II. THE EFFECTIVENESS OF WEB-BASED LEARNING

Web-based learning (also known as “E-Learning”) is currently one of the major applications of the Internet. Generally distance education has been delivered using the technology such as video conferencing, videotape, satellite broadcast, TV broadcast, Internet, and so on.

A review of the two recent mainline e-Learning projects in the European Union, namely the e-Learning Action Plan, and the e-Learning Program have been fully supported [6] by the European Commission, who provided the necessary infrastructure and equipment, teacher training, encouragement, cooperation, delivery of useful services, and promotion of digital literacy.

Many researchers have compared the performance of online students with students participating in traditional classrooms [7]. Uzunboylu [8] has found that the English language grammar achievement of the experimental groups’ subjects, who conducted English grammar exercises on the Web, was higher than the control groups’ subjects who conducted them using traditional methods. Schultz [9], who investigated online education at Virginia Community College, found that students liked the convenience of online education but disliked the lack of personal interaction.

III. LEARNING MANAGEMENT SYSTEMS IN WEB-BASED EDUCATION

A learning management system (LMS) provides the platform for the web-based learning environment by enabling the management, delivery, and tracking of learning. LMS are often viewed as being the starting point of any web-based learning program. A good LMS should be 100 percent web-deployable, requiring no additional client applications. It is also important that the LMS should support various sources from different manufacturers and it should be based on open industry standards for web deployments.

Some of the best known commercially available LMS systems are *Blackboard*, *WebCT*, and *Desire2Learn*. There are also many open-source and free LMS systems, such as *Moodle*, *Segue*, *Interact*, *CourseWork*, *Autor*, *KEWL* and several others. Open source usually means that users have access to the source code of the software. Anyone can download and use the open source code, and more importantly users can write new features, fix bugs, improve performance, or learn how a particular problem has been solved by others.

Moodle is one of the popular learning management systems. It is coded in *php* and supports features such as chat, assignment management etc. *Segue* is based on a publishing model which regards faculty not as course managers but as authors and editors and students as contributors. *Segue* allows for a site to become a personal workspace, where site owners can develop ideas in a private web-based environment accessible anywhere. *Interact* has been developed by the Christchurch College of Education and it claims to have the same features as commercial products. *CourseWork* has been developed at the Stanford University. Using this system instructor can setup course web sites that display dynamic syllabus, announcements, discussion forms, assignments and quizzes, and a grade book. *KEWL* is an open source system developed by the University of the Western Cape in South Africa.

Collaborative learning is one of the important topics in web-based education. There has been a great deal of research on collaborative technologies for the computer science classroom. There are several benefits to giving students assignments that they can work on collaboratively. Roschelle [10] report that the students can undertake more complicated problems and gain a better understanding of the material when the work is done collaboratively. Although in general the benefits of collaborative work has been recognized there are still many open questions about it. Some typical questions are, is it better to pair a novice with an expert or pair two novices, or perhaps pair two experts? Are individuals better at learning a programming language than pairs?

IV. THE AIM AND METHOD

The aim of this research has been to create an environment for teaching programming languages using a virtual learning environment. In order to reach this aim we have sought answers to the following questions:

- What are the opinions of students about the *Near East University Virtual Learning Environment* (NEU-VLE) system?
- Are there any differences between the opinions of students about the NEU-VLE system who take the Pascal and Java courses?
- What are the opinions of instructors about the NEU-VLE system?

This pilot study has been carried out at the Near East University, Department of Computer Information Systems, during the 2004/5 Fall Semester using the Moodle together with GREWPtool. The web-based education system named, NEU-VLE, has enabled students to follow the lessons in their own places of study, using their own computers. It was sufficient just to use the Internet Explorer to access the NEU-VLE system.

Subjects

NEU-VLE was tested in two courses. The GCPA (General Cumulative Point Average) grades of the students have been calculated and sorted in a descending list. Then, 18 students in odd numbers of the list were grouped CIS 221 is entitled Programming Language I (Pascal) and is a heavy content course in the Professional sequence for majors in programming languages. The students are typically sophomore ages 18-19.

18 students in even numbers of the list were grouped CIS 456 is entitled Object Programming Language (Java). The main purpose of the course is to introduce the students to the fundamentals of Object Oriented (OO) Programming. CIS 456 is a university main course that is taken by senior students. The students are typically sophomore ages 20-22.

Materials and Procedure

The material is the NEU-VLE system organized by the authors. A highly interactive and collaborative teaching environment has been created by supporting Moodle LMS (www.moodle.org) system with the collaborative learning tool system GREWPtool (<http://groupscheme.sourceforge.net/grewpedit>), named as NEU-VLE (Near East University Virtual Learning Environment). Both of these are Open-Source software

products. Various utilities of NEU-VLE system such as interactive course tool, self-test, assignments, resources which can be downloaded, chat, quiz, and internal mail have been offered to the students independently whenever they wanted. Students met their instructors twice a week using synchronous collaborative tool, where each session lasted for an hour. Collaborative tool has been used to deliver the lessons to the students, and to develop sample programs interactively in cooperation with the students. In addition, students had the chance of communication and exchanging information with each other synchronously, whenever they wanted, using the collaborative tool.

V. USING THE NEU-VLE

Students using the online NEU-VLE system access the system from their places of study at their choice of time and a typical session is as follows:

- Student enters the system by linking to the web site: <http://cis.neu.edu.tr>
- Student registers on the NEU-VLE system using the username and the password assigned to them.
- Course notes are prepared in a weekly format and can be accessed by the students interactively at any time and from any place. The lecture notes are prepared interactively in SCROM (Sharable Content Object Reference Model) standards.
- After studying the course material students attempt to solve the self-test quizzes. Instructors can create timed assessments that help the students take multiple times. The system automatically scores multiple choices, true/false and short answer type questions and can display instructor created feedback, explanations and links to relevant course material. Although we have only used text, questions can contain images, video, and other multimedia files. The instructor can randomize the questions in a test so that alternative questions can be presented to the students.
- One of the innovative elements of the NEU-VLE system is that the students and the instructor can meet at pre-specified times using the collaborative tool (twice a week, with each session lasting an hour). This feature has provided a highly interactive learning environment where the students could ask questions to the instructor in an interactive manner while all the students could participate

in this interactive session. With the addition of the collaborative learning environment the students felt more like in a traditional classroom.

- Before the mid-term and the final examinations, although not implemented in our study, students can access the various online quizzes, video and media files, sample exam questions etc so that they can prepare themselves for the real examinations.

Lecture notes have been prepared on a weekly basis and a typical Moodle screen layout is shown in Fig. 1. Lecture notes are largely in text format with audio enhancements at appropriate places. Students normally follow the lecture notes in the order shown on their screens which has been prepared carefully by the instructor. Sections of the lecture notes can be repeated as many times as required until the student is comfortable with the contents. It is recommended that the students attempt to solve the quizzes at the end of each section and a high grade is a requirement. A section from the PASCAL lecture notes is shown in Fig 2.

VI. RESULTS

Students taking the online courses were asked to carry out a survey at the end of their studies in order to determine the opinion to use of NEU-VLE, and also to receive feedback from them. The Online Learning Opinion Scale instrument was adapted for use in North Cyprus based upon an instrument developed by James L. Fitch (2004). Ten carefully prepared questions were given to them to answer in the class. Each question was phrased to determine whether or not there was a positive response to different aspects of using NEU-VLE. This questionnaire is formed in 5-point Likert scale type questions, consisting of 10 items, with 5 being a response of *Strongly Agree* and 1 representing *Strongly Disagree*. Each question was phrased so that *Strongly Agree* represented a positive reaction to the project.

The mean opinion scores and standard deviations for students responses to the 10 statements on the 5-point Likert type opinion survey administered after completion of the web-based program are shown in Table 1. The table shows a summary of the survey results. At a glance the results suggest that both online classes had a positive opinion to NEU-VLE, with the course for general studies having more significant positive response.

It is interesting to notice that the first question “*I enjoyed using the NEU-VLE*” has the highest score (M=3.94) for Pascal. One of the reasons for this is that students enjoy using the computer as a tool while

NEAR EAST UNIVERSITY - VIRTUAL LEARNING ENVIRONMENT

You are logged in as Admin User (Logout)
English (en)

DEPARTMENT OF COMPUTER INFORMATION SYSTEMS

- NEU-VLE-MAIL
- USER MANUAL FOR LEARNERS
- USER MANUAL FOR TEACHERS
- C.I.S TIMETABLE SCHEDULE(2005-2006 FALL)
- C.I.S MIDTERM SCHEDULE(2005-2006 FALL)
- COM.ENG. MIDTERM SCHEDULE (2005-2006 FALL)
- FINAL EXAM Schedule for C.I.S Department

ACADEMIC CALENDAR 2005/2006 FALL TERM
by Admin User - Tuesday, 11 October 2005, 12:50 PM

2005-2006 FALL TERM / 2005-2006 GÜZ DÖNEMİ	
Sept 14-16, 2005	Course Registration / Ders Alma
Sept 19, 2005	Classes Commence / Derslerin Başlaması
Oct 07, 2005	Last Day for Add/Drop / Ders Alma/Bırakma için Son Gün
Nov 21-25, 2005	Midterm Exams / Ara Sınavlar
Dec 02, 2005	Last Day for Withdrawal / Dersten Çekilmenin Son Günü
Jan 6, 2006	End of Classes / Derslerin Son Günü
Jan10-13, 2006	Religious Holiday / Dini Bayram
Jan 16-25, 2006	Final Exams / Final Sınavlar
Jan 31, 2006	Last Day for Submission of Letter Grades / Not Teslimi için Son Gün
Feb 03, 2006	FALL Term Graduation Ceremony / Güz Dönemi Mezuniyet Töreni
Feb 06, 2006	End of Term / Dönem Sonu

Read the rest of this topic (125 words)...

Discuss this topic (0 replies so far)

Fig. 1 A typical Moodle screen layout

Chap 4 (1b) - CASE Statement

Lecturer: Miss Nadire CAVUS

The Flowchart For DO...CASE...ELSE...END Statement

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graph TD
    Start([VARIABLE := INITIAL VALUE]) --> DO_CASE{DO CASE}
    DO_CASE -- Y --> S1[STATEMENT]
    DO_CASE -- N --> S2{SELECTION_N}
    S2 -- Y --> S3[STATEMENT]
    S2 -- ELSE --> S4{ELSE}
    S4 --> S5[STATEMENT]
    S4 --> S6[STATEMENT]
    S1 --> End([END])
    S3 --> End
    S5 --> End
    S6 --> End
    
```

SLIDE 7 OF 20 PAUSED 00:25 / 00:34

Fig. 2 A section from PASCAL lecture notes

Table 1 Student opinion survey scores

Survey Items	Pascal		Java	
	M	SD	M	SD
1. I enjoyed using NEU-VLE in the class.	3.94	1.39	4.61	0.61
2. I feel that most of the other students in class liked the NEU-VLE.	2.39	1.09	3.94	0.64
3. Using NEU-VLE added interest to the class.	2.50	1.20	4.28	0.83
4. The use of NEU-VLE helped me to learn the material better.	2.89	1.60	4.28	0.83
5. I prepared more for class knowing NEU-VLE would be used to test my knowledge of the subject.	3.00	1.33	4.22	0.73
6. I told my friends about using NEU-VLE in the classroom.	3.33	1.88	4.50	0.99
7. NEU-VLE helped focus the class as a whole on the subject.	2.67	1.33	3.83	0.86
8. NEU-VLE was a means of involving all of the class members at the same time.	3.00	1.68	4.56	0.70
9. I believe NEU-VLE should continue to be used in this class.	2.72	1.36	4.61	0.50
10. I would like for other classes I have to use the NEU-VLE.	2.61	1.65	4.28	0.75
Total items score	29.06	12.06	43.11	4.59

Scoring: 5 = Strongly Agree, 1 = Strongly Disagree

learning as it brings great flexibility into their learning practice, and they learn while doing something practical. They can follow the lecture notes in their own places and time and attempt the quizzes whenever they are ready.

The most important items for the Java class are item 1 “*I enjoyed using NEU-VLE in the class*” (M=4.61) and item 9 “*I believe NEU-VLE should continue to be used in this class*” (M=4.61). The first item shows that the students have been happy using the

NEU-VLE system. Item 9 indicates that the students are happy if the NEU-VLE system is continued to be used inside the class. This is an indication of the success of the NEU-VLE system and also an indication that the NEU-VLE system has been successful and sufficient in the teaching of a programming language.

Instructors' Opinion

Although the pilot study has lasted for a term only and instructors have just began to explore the pedagogical opportunities of the LMS tools, they can make the following observations on the advantages and disadvantages of these tools in web-based learning courses:

The advantages of the NEU-VLE system are:

- Students can have access to the system from any geographical location in the world. 3 students from the Pascal course and 5 students from the Java course had to travel abroad for sports activities. But this has not prevented them from attending the classes, since they used the NEU-VLE system over the internet to follow the course.
- Communication with students can be on an individual basis as well as on a group basis. The students felt comfortable and confident while using the GREWPool and as a result, they could ask questions about the course without being shy.
- Lessons can be studied at the comfort of your home or alongside friends in an internet cafe. This also encourages group involvement.
- Group learning increases the learning process and allows students to benefit from each other's experiences. Students are encouraged to join in and also to participate in every collaborative session.
- Students can assess their own progress by carrying out quizzes any time they are ready. This has helped them to assess their knowledge, to learn about their weak points, and consequently to gain higher marks in the examinations.
- Instructors have better understanding of progress of the students as they can analyze the VCR in play-back mode. For example, instead of only looking at the final results, the instructor can find out how a student reached that final result.

The disadvantages of the NEU-VLE system are:

- There is no visible body reaction and the instructor is not clear if students have understood the topics. It is recommended by the authors that the LMS systems should incorporate live video interface as a means of increasing the instructor-student and the student-student interaction.
- Students must have a computer and internet connections at their places of study. This may be beyond the budgets of some students. One solution here could be for the institution to lend the necessary equipment to such students during the term time.

It was observed that an LMS on its own was not sufficient to provide the “real class” environment where students and the instructor can interactively exchange messages. But when an LMS was used together with a collaborative tool it had been possible to achieve the required “real class” feeling.

VII. CONCLUSION

The results of the pilot study showed that a Learning Management System can be made more efficient if it is enhanced by a collaborative learning tool. In this paper we have used the Moodle together with the GREWPtool for the teaching of Pascal and Java languages. It appears that in common with other LMS systems, although Moodle on its own is sufficient and successful to deliver the lecture notes, it lacks the *instructor-student* and *student-student* interaction which exists in a “real” class-room environment. It is our recommendation that current and future LMS systems should incorporate a collaborative tool so that the benefits of learning in a class-like group environment can be achieved.

Students taking the Java course have been more satisfied using NEU-VLE system than those taking the Pascal course. One of the reasons for this is that GREWPtool offers compile and run utilities for Java programming. The instructors’ opinion is that these tools have increased the motivation of students, and this point is the fundamental reasons why students taking the Java course were more in favour of the NEU-VLE system.

As a result of this pilot study we can say by confidence that an LMS system with an integrated

collaborative tool can be used satisfactorily for the teaching of programming languages in a web-based environment.

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