THE EFFECTS OF USING LEARNING MANAGEMENT SYSTEMS ON COLLABORATIVE LEARNING FOR TEACHING PROGRAMMING LANGUAGES

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BY
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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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ABSTRACT

THE EFFECTS OF USING LEARNING MANAGEMENT SYSTEMS ON COLLABORATIVE LEARNING FOR TEACHING PROGRAMMING LANGUAGES

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The development of collaborative studies in learning has led to a renewed interest in the field of web-based education. This study describes the development of a highly interactive and collaborative virtual teaching environment by supporting the Moodle Learning Management System (LMS) together with two types of collaborative learning tools (GREWPTool), at Near East University: Standard Collaborative Learning Tool (SCLT) and Advanced Collaborative Learning Tool (ACLT) to create a virtual learning environment to teach programming languages. The main aim of this study was to find out the effectiveness of an ACLT during the teaching of programming languages in a web-based environment. The developed system was tested with a total of 58 students whose aims were to learn the programming language Java. This study was an experimental study, and it was based on the *Near East University - Virtual Learning Environment* (NEU-VLE) which has been developed as a part of this research study. The NEU-VLE system has been developed to enable students to learn programming languages, and to follow the lessons over the internet, in their own places of study, using their own computers in their own time.

The following tools have been used during the data collection: “Online Learning Opinion Scale”, “Scale of Student Opinions about the NEU-VLE System”, “Scale of Student Opinions about Collaborative Learning Tools”, “Learning Strategies Scale”, “Java Programming Language Success Test (Pre-Test and Post-Test)”.

The collected data were analyzed using independent sample t-test, and one-way analysis of covariance (ANCOVA). The important results of this study are that students using the ACLT have shown the highest statistically significant success rates, and the results of the experimental study have shown that an LMS can be made more efficient if it is enhanced by an ACLT. In addition, students' opinions were the highest when using an ACLT in teaching programming languages in a web-based environment.

The results of this study add empirical data to the relevant field, and are expected to help educational technologist, online administrators, instructional and technical support staff, and software tool developers.

Keywords: Web-Based Learning, Learning Management System (LMS), Collaborative Learning, Moodle, Collaborative Learning Tools, Programming Languages, Java, Student Success.

ÖZ

PROGRAMLAMA DİLLERİ ÖĞRETİMİ İÇİN İŞBİRLİKLİ ÖĞRENMEDE DERS YÖNETİM SİSTEMLERİNİN KULLANIMININ ETKİNLİĞİ

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Ağustos 2006, 173 sayfa

Eğitimde işbirlikli çalışmaların geliştirilmesi Web-tabanlı eğitimi yeniden ilgi kaynağı haline getirmiştir. Bu çalışma, Yakın Doğu Üniversitesinde Öğretim Yönetim Sistemiyle beraber iki çeşit işbirlikli araç ile desteklenen etkileşimli ve işbirlikli sanal öğretme ortamı geliştirmeyi anlatıyor. Programlama dillerinin öğretimi için tasarlanan sanal öğretim ortamında standart (SCLT) ve gelişmiş (ACLT) olmak üzere farklı yapıda işbirlikli öğrenim araçlar kullanılmıştır. Bu çalışmanın esas amacı, Web-tabanlı eğitimde programlama dili öğretiminde gelişmiş işbirlikli araç kullanımının etkililiğini ortaya koymaktır. Geliştirilmiş olan sistem, amaçları Java programlama dilini öğrenmek olan 58 öğrenci üzerinde denenmiştir. Bu çalışma, araştırmanın bir bölümü olarak geliştirilen Sanal Öğrenme Ortamında (YDU-SÖO) deneysel bir çalışma olarak gerçekleştirilmiştir. YDU-SÖO Sistemi programlama dillerinin öğrenimi için geliştirilmiş ve öğrenciler derslerini internet üzerinden kendi çalışma alanlarından kişisel bilgisayarlarını kullanarak istedikleri zamanda takip etmişlerdir.

Araştırmada veri toplama aracı olarak "Online Öğrenim Görüşleri Ölçeği", "İşbirlikli Öğrenme Araçları ile İlgili Öğrenci Görüşleri Ölçeği", "YDU-SÖO Sistemi ile İlgili Öğrenci Görüşleri Ölçeği", "Öğrenim Stratejileri Ölçeği", ve "Java Programlama Dili Başarı Testi (Ön-Test ve Son-Test)" kullanılmıştır.

Toplanan veriler t-testi ve ANCOVA ile analiz edilip yorumlanmışlardır. Araştırmanın en önemli sonucu ACLT kullanan öğrencilerin istatistiksel anlamda başarı oranlarının en yüksek düzeyde elde edilmesidir. Bu deneysel çalışma ayrıca ders

yönetim sistemlerinin ACLT ile birlikte kullanılmasının öğrenimi daha etkili hale getirdiğini ortaya koymaktadır. Bunların yanında web-tabanlı eğitimde programlama dilleri öğretilirken ACLT kullanan öğrencilerin görüşlerinin de en yüksek seviyede olduğu tespit edilmiştir. Bu çalışmanın neticeleri, ilgili alana deneysel bulgular katmakta ve bu bulguların eğitim teknolojisi ile ilgilenenlere, web yöneticilerine, teknik destek elemanlarına ve yazılım geliştirenlere faydalı olması beklenmektedir.

Anahtar kelimeler: Web-Tabanlı Öğretim, Ders Yönetim Sistemleri, İşbirlikli Öğrenme, Moodle, İşbirlikli Öğrenme Araçları, Programlama Dilleri, Java, Öğrenci Başarısı.

To My Parents

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ABBREVIATIONS

ACLT: Advanced Collaborative Learning Tool

AU: Anadolu University

AUI: Audio User Interface

C.I.S: Computer Information Systems

CAI: Computer Assisted Instruction

CAI: Computer-Assisted Instruction

CAT: Computer Aided Teaching

CBT: Computer Based Training

CD-ROM: Compact Disc Read-Only Memory

Class ACT: Class Annotation and Collaboration Tool

DCU: Dublin City University

DL: Distance Learning

DOS: Disk Operating System

DPE: Distributed Programming Environment

EDUCO: Real-time Online Collaboration Tool

ELP: The Environment for Learning to Program

ERIC: The Education Resources Information Center

FSF: Free Software Foundation

FTP: File Transfer Protocol

GCPA: General Cumulative Point Average

GHT: Group Homework Tool

GREWPTool: Groupware Research in Education and the Workforce Project

GRL: Geophysical Research Letters

IEEE: The Institute of Electrical and Electronics Engineers, Inc

IMS: Instructional Management System

LMS: Learning Management System

M: Mean

Mb: Megabyte

METARGEM: Technical Education, Research and Development Center (Mesleki ve Teknik Eğitim Araştırma ve Geliştirme Merkezi)

METU: Middle East Technical University

MOODLE: Modular Object-Oriented Dynamic Learning Environment

MySQL: A popular freely available database package (My Structured Query Language)

NEU: Near East University

NEU-VLE: Near East University Virtual Learning Environment

OS: Operating System

OSI: Open Source Initiative

OS X: Successor of the Original MAC Operating System

OU: Open University

p: Significance p-value (2-tailed).

PHP: Hypertext Pre-Processor

RAM: Read Access Memory

SCLT: Standard Collaborative Learning Tool

SCORM: Sharable Content Object Reference Model

SD: Standard Deviation

SOAP: Simple Object Access Protocol

T.R.N.C: Turkish Republic of Northern Cyprus

TBL: Technology Based Education

UK: United Kingdom

VLE: Virtual Learning Environment

WBL: Web Based Learning

WWW: World Wide Web

XML: Extensible Markup Language

APPENDICES

APPENDIX A

THE OPEN SOURCE DEFINITION

http://www.opensource.org/docs/definition.php , Retrieved May 11, 2005

Introduction

Open source doesn't just mean access to the source code. The distribution terms of open-source software must comply with the following criteria:

1. Free Redistribution: The license shall not restrict any party from selling or giving away the software as a component of an aggregate software distribution containing programs from several different sources. The license shall not require a royalty or other fee for such sale.

- ***Rationale:*** By constraining the license to require free redistribution, we eliminate the temptation to throw away many long-term gains in order to make a few short-term sales dollars. If we didn't do this, there would be lots of pressure for cooperators to defect.

2. Source Code: The program must include source code, and must allow distribution in source code as well as compiled form. Where some form of a product is not distributed with source code, there must be a well-publicized means of obtaining the source code for no more than a reasonable reproduction cost—preferably, downloading via the Internet without charge. The source code must be the preferred form in which a programmer would modify the program. Deliberately obfuscated source code is not allowed. Intermediate forms such as the output of a preprocessor or translator are not allowed.

• ***Rationale:*** We require access to un-obfuscated source code because you can't evolve programs without modifying them. Since our purpose is to make evolution easy, we require that modification be made easy.

3. Derived Works: The license must allow modifications and derived works, and must allow them to be distributed under the same terms as the license of the original software.

• ***Rationale:*** The mere ability to read source isn't enough to support independent peer review and rapid evolutionary selection. For rapid evolution to happen, people need to be able to experiment with and redistribute modifications.

4. Integrity of the Author's Source Code: The license may restrict source-code from being distributed in modified form only if the license allows the distribution of 'patch files" with the source code for the purpose of modifying the program at build time. The license must explicitly permit distribution of software built from modified source code. The license may require derived works to carry a different name or version number from the original software.

• ***Rationale:*** Encouraging lots of improvement is a good thing, but users have a right to know who is responsible for the software they are using. Authors and maintainers have reciprocal right to know what they're being asked to support and protect their reputations.

• Accordingly, an open-source license must guarantee that source be readily available, but may require that it be distributed as pristine base sources plus patches.

In this way, "unofficial" changes can be made available but readily distinguished from the base source.

5. No Discrimination Against Persons or Groups: The license must not discriminate against any person or group of persons.

• ***Rationale:*** In order to get the maximum benefit from the process, the maximum diversity of persons and groups should be equally eligible to

contribute to open sources. Therefore we forbid any open-source license from locking anybody out of the process.

• Some countries, including the United States, have export restrictions for certain types of software. An OSD-conformant license may warn licensees of applicable restrictions and remind them that they are obliged to obey the law; however, it may not incorporate such restrictions itself.

6. No Discrimination Against Fields of Endeavor: The license must not restrict anyone from making use of the program in a specific field of endeavor. For example, it may not restrict the program from being used in a business, or from being used for genetic research.

• ***Rationale:*** The major intention of this clause is to prohibit license traps that prevent open source from being used commercially. We want commercial users to join our community, not feel excluded from it.

7. Distribution of License: The rights attached to the program must apply to all to whom the program is redistributed without the need for execution of an additional license by those parties.

• ***Rationale:*** This clause is intended to forbid closing up software by indirect means such as requiring a non-disclosure agreement.

8. License Must Not Be Specific to a Product: The rights attached to the program must not depend on the program's being part of a particular software distribution. If the program is extracted from that distribution and used or distributed within the terms of the program's license, all parties to whom the program is redistributed should have the same rights as those that are granted in conjunction with the original software distribution.

• ***Rationale:*** This clause forecloses yet another class of license traps.

9. License Must Not Restrict Other Software: The license must not place restrictions on other software that is distributed along with the licensed software. For example, the

license must not insist that all other programs distributed on the same medium must be open-source software.

• ***Rationale:*** Distributors of open-source software have the right to make their own choices about their own software.

• Yes, the GPL is conformant with this requirement. Software linked with GPLed libraries only inherits the GPL if it forms a single work, not any software with which they are merely distributed.

10. License Must Be Technology-Neutral: No provision of the license may be predicated on any individual technology or style of interface.

• ***Rationale:*** This provision is aimed specifically at licenses which require an explicit gesture of assent in order to establish a contract between licensor and licensee. Provisions mandating so-called "click-wrap" may conflict with important methods of software distribution such as FTP download CD-ROM anthologies, and web mirroring; such provisions may also hinder code re-use. Conformant licenses must allow for the possibility that (a) redistribution of the software will take place over non-Web channels that do not support click-wrapping of the download, and that (b) the covered code (or re-used portions of covered code) may run in a non-GUI environment that cannot support popup dialogues.

APPENDIX B

http://www.openones.net/opensource/education.html Retrieved May 11, 2005

OPEN SOURCE VIRTUAL LEARNING SYSTEMS

OpenOnes.net

Your one stop for everything that is open source and free

Education

Moodle

Sub Category	**Course management system**
Hosting Organization	**sourceforge.net**
Home Page	**moodle.org/**
Operating System	**OS Independent**
Source Language	**PHP**
License	**GNU General Public License.**
Description	**Moodle is a course management system (CMS) - a software package designed to help educators create quality online courses. Such e-learning systems are sometimes also called Learning Management Systems (LMS) or Virtual Learning**

	Environments (VLE). One of the main advantages of Moodle over other systems is a strong grounding in social constructionist pedagogy.

Claroline	
Sub Category	**e-Learning platform**
Hosting Organization	**www.claroline.net**
Home Page	**www.claroline.net**
Operating System	**Windows, Linux**
Source Language	**PHP, SQL**
License	**GNU General Public License.**
Description	**Claroline is a collaborative learning environment allowing instructor or education institutions to create and administer courses through the web. The system provides group management, forums, document repositories, calendar, chat, assignment areas, links, user profile administration on a single and highly integrated package.**

Pauker	
Sub Category	**Flash card programe**
Hosting Organization	**http://pauker.sourceforge.net**
Home Page	**SourceForge.net**
Operating System	**OS Independent**
Source Language	**Java**
License	**GNU General Public License.**
Description	**Pauker uses a combination of ultra-short-term, short-term, and long-term memory. You can use it to learn all the things efficiently you never want to forget, like vocabulary, capitals, important dates, etc**

The Manhattan Virtual Classroom	
Sub Category	**Course management system**
Hosting Organization	**SourceForge.net**
Home Page	**http://manhattan.sourceforge.net**
Operating System	**Linux**
Source Language	**C**

License	**GNU General Public License.**
Description	**The Manhattan Virtual Classroom is a password protected, web-based course management system that includes a variety of discussion groups, live chat, areas for the instructor to post the syllabus and other handouts and notices, a module for organizing online assignments, a grades module, a surveys module, and a unique, web-based email system open only to students in the class.**

WIKINDX	
Sub Category	**Course management system**
Hosting Organization	**SourceForge.net**
Home Page	**http://wikindx.sourceforge.net/**
Operating System	**Unix**
Source Language	**PHP**
License	**GNU General Public License.**
Description	**WIKINDX is a free bibliographic and quotations/notes management system designed either for single use (on a variety of operating systems) or multi-user collaborative use across the internet.**

Knowde	
Sub Category	**Knowledge management tool**
Hosting Organization	**http://www.lieber-media.de/knowde**
Home Page	**www.lieber-media.de/knowde**
Operating System	**Windows 95/98/ME, Windows NT/2000/XP, Linux**
Source Language	**C,C++**
License	**GNU General Public License.**
Description	**Knowde is a knowledge management tool that lets you create a hierarchical tree structure of knowledge nodes ("knowdes"). Despite its name, it's not a KDE tool, but uses the GTK+ library and aims at supporting both Win32 and Unix-derivate systems**

WIMS	
Sub Category	**Educational Web Application Server**
Hosting Organization	**http://wims.unice.fr**
Home Page	**http://wims.unice.fr**

Operating System	**MacOS X, Linux, Unix**
Source Language	**C**
License	**GNU General Public License.**
Description	**WIMS stands for WWW Interactive Mathematics Server. It is a web application that can host mathematical exercise and puzzles.**

OpenGrade	
Sub Category	**Keep track of school grades**
Hosting Organization	**http://www.lightandmatter.com/ogr/ogr.html**
Home Page	**http://www.lightandmatter.com/ogr/ogr.html**
Operating System	**Windows,Unix**
Source Language	**Perl**
License	**GNU General Public License.**
Description	**OpenGrade is software for instructor to keep track of grades.**

Scout Portal Toolkit	
Sub Category	**Portal Toolkit**
Hosting Organization	**http://scout.wisc.edu/Projects/SPT**
Home Page	**http://scout.wisc.edu/Projects/SPT**
Operating System	**OS Independent**
Source Language	**PHP, SQL**
License	**GNU General Public License.**
Description	**The Scout Portal Toolkit (SPT) allows groups or organizations that have a collection of knowledge or resources they want to share via the World Wide Web to put that collection online without making a big investment in technical resources or expertise.**

Checky	
Sub Category	**A document validation and analysis tool.**
Hosting	**SourceForge.net**

Organization	
Home Page	**http://checky.sourceforge.net/extension.html**
Operating System	**OS Independent**
Source Language	**JavaScript, Other Scripting Engines**
License	**GNU General Public License, GNU Lesser General Public License, Mozilla Public License**
Description	**Checky is an easy to use interface to many online validation and analysis services. Validate, analyze and view documents containing HTML, XHTML, CSS, RDF, RSS, XML, P3P, hyperlinks and metadata.**

StarDict	
Sub Category	**Computerized Dictionary**
Hosting Organization	**SourceForge.net**
Home Page	**http://stardict.sourceforge.net**
Operating System	**Linux**
Source Language	**C++**
License	**GNU General Public License**
Description	**StarDict is a Cross-Platform and international dictionary written in Gtk2. It has powerful features such as "Glob-style pattern matching", "Scan selection word", "Fuzzy query", etc.**

Chemistry Development Kit	
Sub Category	**Computerized**
Hosting Organization	**http://cdk.sourceforge.net**
Home Page	**http://cdk.sourceforge.net**
Operating System	**OS Independent**
Source Language	**Java**
License	**GNU Library or Lesser General Public License (LGPL),**
Description	**The CDK classes are Java utitility classes for ChemoInformatics and Computational chemistry, written in Java. They are developed constantly developed parallel to other projects that make use of them. They are a complete re-write of the CompChem classes that were the basis of JChemPaint, a Java Editor for 2D chemical structures, and of JMDraw, a Java package for the graphical layout of 2D chemical structures.**

LON-CAPA	
Sub Category	**Course management system**
Hosting Organization	**http://www.lon-capa.org**
Home Page	**http://www.lon-capa.org/**
Operating System	**Unix**
Source Language	**C, JavaScript, Perl**
License	**GNU General Public License**
Description	**LON-CAPA is a full-featured, web-based course management system similar to commercial systems**

Open Remote Collaboration Tool	
Sub Category	**Collaboration tool**
Hosting Organization	**SourceForge.net**
Home Page	**www.openrct.org/**
Operating System	**Unix**
Source Language	**C++, Java, PHP, PL/SQL**
License	**GNU General Public License**
Description	**The Open Remote Collaboration Tool (OpenRCT) is a multidisciplinary effort to enhance collaboration - between students working together, between students and instructional staff, and between researchers who are not co-located in time and space. OpenRCT is an Open Source platform-independent, multimedia tool that supports synchronous and/or asynchronous communication. It can be used for group discussions, collaborative assignments, collaborative research, and distance communication.**

School Tools for Online Resource Management	
Sub Category	**Resource Management tools**
Hosting Organization	**www.tonywhitmore.co.uk/storm/**
Home Page	**www.tonywhitmore.co.uk/storm/**
Operating System	**OS Independent**
Source Language	**PHP**
License	**GNU General Public License**
Description	**"School Tools for Online Resource Management" is a systems for managing ICT facilities and resources. The target audience is a school. Basically, the project is a suite of PHP pages that use the PEAR::DB PHP module to communicate with a database backend.**

ILIAS	
Sub Category	**Web-based training**
Hosting Organization	**www.ilias.uni-koeln.de/ios/index-e.html**
Home Page	**www.ilias.uni-koeln.de/ios/index-e.html**
Operating System	**Linux,Sun/Solaris**
Source Language	**PHP**
License	**GNU General Public License**
Description	**The web-based learning management system ILIAS is available as open source software under the GNU General Public License (GPL). Universities, educational institutions and every interested person may use the system free of charge and contribute to its further development. The software development worldwide is coordinated by our team at the Faculty of Economics, Business Administration and Social Sciences at the University of Cologne**

APPENDIX C

http://www.opensource.org/licenses/gpl-license.php Retrieved May 11, 2005

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Version 2, June 1991

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signature of Ty Coon, 1 April 1989
Ty Coon, President of Vice

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APPENDIX D

http://www.openones.net/opensource/inet.html

INTERNET TOOLS

OpenOnes.net

Your one stop for everything that is open source and free

Internet Tools

Firefox	
Sub Category	**web browser**
Hosting Organization	**www.mozilla.org**
Home Page	**http://www.mozilla.org/products/firefox/**
Operating System	**Linux,Windows 95, Windows 98,Windows 98SE,Windows ME, Windows NT 4.0, Windows 2000, Windows XP,Mac OS X 10.1.x,Mac OS X 10.2.x and later**
Source Language	**C++**
License	**Mozilla Public License 1.0 (MPL)**
Description	**Firefox is the latest web browser from mozilla. It is the most customizable browser on the planet. Customize your toolbars to add additional buttons, install new Extensions that add new features, add new Themes to browse with style, and use the**

	adaptive search system to allow you to search an infinite number of engines. Firefox is as big or small as you want.

Mozilla Suite	
Sub Category	**Internet Application suite**
Hosting Organization	**www.mozilla.org**
Home Page	**www.mozilla.org/products/mozilla1.x**
Operating System	**Linux,Windows 95, Windows 98,Windows 98SE,Windows ME, Windows NT 4.0, Windows 2000, Windows XP,Mac OS X 10.1.x,Mac OS X 10.2.x and later**
Source Language	**C++**
License	**Mozilla Public License 1.0 (MPL)**
Description	**Web-browser, advanced e-mail and newsgroup client, IRC chat client, and HTML editing made simple -- all your Internet needs in one application.**

Barracuda Presentation Framework	
Sub Category	**Framework / API**
Hosting Organization	**www.objectweb.org**
Home Page	**www.barracudamvc.org**
Operating System	**OS Independent**
Source Language	**Java**
License	**GNU Lesser General Public License (LGPL)**
Description	**Barracuda is an Open-Source Presentation Framework (LGPL) designed to make it easier to build web apps by providing a simple yet powerful Server-Side Component Model that makes it easy to manipulate DOM structures using proven MVC patterns like you'd find in Swing. With this newest release, you can now use Jivan in addition to XMLC to load and render your DOM templates.**

Enhydra Application Framework	
Sub Category	**Framework / API**

Hosting Organization	**www.objectweb.org**
Home Page	**http://eaf.objectweb.org**
Operating System	**OS Independent**
Source Language	**Java**
License	**GNU Lesser General Public License (LGPL)**
Description	**Enhydra Application Framework implements the Enhydra "super-servlet", provides dynamic URL-JSESSIONID rewriting, PO caching, session-, database-, logging-, configuration- and XMLC APIs using adapters for different application servers.**

Apache Lenya	
Sub Category	**Content Management System**
Hosting Organization	**The Apache Software Foundation**
Home Page	**http://lenya.apache.org**
Operating System	**OS Independent**
Source Language	**Java**
License	**Apache Software License**
Description	**Apache Lenya is an Open-Source Content Management System written in Java and based on open standards such as XML and XSLT. Lenya is built on top of Apache Cocoon and other components from the Apache Software Stack. Its XML-centric architecture allows for content delivery targeted to the capabilities of various devices, and avoids data lock-in. Apache Lenya is built around Off the Shelf components from the Apache Software Foundation. Apache Lenya comes with the features you can expect of a modern Content Management System, such as Revision Control, Scheduling, a built-in Search Engine, separate Staging Areas, and Workflow.**

Apache Cocoon

Sub Category	**Web Development Framework**
Hosting Organization	**The Apache Software Foundation**
Home Page	**http://cocoon.apache.org/**
Operating System	**Unix, Windows**
Source Language	**Java**
License	**Apache Software License**
Description	**Apache Cocoon is a web development framework built around the concepts of separation of concerns and component-based web development. Cocoon implements these concepts around the notion of 'component pipelines', each component on the pipeline specializing on a particular operation. This makes it possible to use a Lego(tm)-like approach in building web solutions, hooking together components into pipelines without any required programming. Cocoon is "web glue for your web application development needs". It is glue that keeps concerns separate and allows parallel evolution of all aspects of a web application, improving development pace and reducing the chance of conflicts.**

Apache HTTP Server	
Sub Category	**Web Server**
Hosting Organization	**The Apache Software Foundation**
Home Page	**http://httpd.apache.org/**
Operating System	**Unix, Windows**
Source Language	**C++**
License	**Apache Software License**
Description	**The Apache HTTP Server Project is an effort to develop and maintain an open-source HTTP server for modern operating systems including UNIX and Windows NT. The goal of this project is to provide a secure, efficient and extensible server that provides HTTP services in sync with the current HTTP standards.**

Jetspeed-2	
Sub Category	**Portlet Server**
Hosting Organization	**The Apache Software Foundation**
Home Page	**http://portals.apache.org/jetspeed-2/**
Operating System	**OS Independent**
Source Language	**Java**
License	**Apache License Version 2.0**
Description	**Jetspeed is an Open Source implementation of an Enterprise Information Portal, using Java and XML. A portal makes network resources (applications, databases and so forth) available to end-users. The user can access the portal via a web browser, WAP-phone, pager or any other device. Jetspeed acts as the central hub where information from multiple sources are made available in an easy to use manner.**

Tomcat	
Sub Category	**Web Server/Servlet container**
Hosting Organization	**The Apache Software Foundation**
Home Page	**http://jakarta.apache.org/tomcat/index.html**
Operating System	**OS Independent**
Source Language	**Java**
License	**Apache Software License**
Description	**Tomcat is the servlet container that is used in the official Reference Implementation for the Java Servlet and JavaServer Pages technologies.**

Ploto	
Sub Category	**Portlet Server**
Hosting Organization	**The Apache Software Foundation**
Home Page	**portals.apache.org/pluto**
Operating System	**OS Independent**
Source Language	**Java**
License	**Apache License Version 2.0**
Description	**Pluto is the Reference Implementation of the Java Portlet Specfication. The current version of this specification is JSR 168**

APPENDIX E

SAMPLE PAGES ARE GIVEN FROM THE MAIN PORTIONS OF EXISTING LESSONS IN NEU-VLE

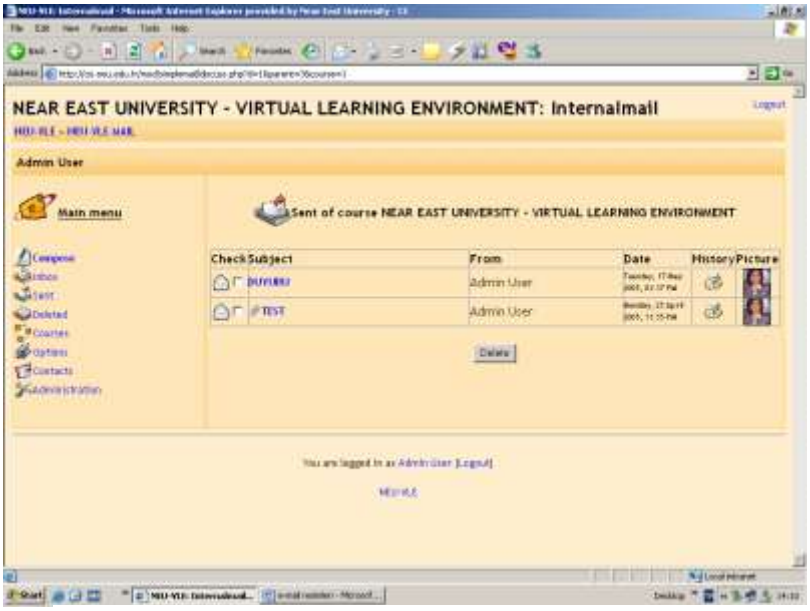
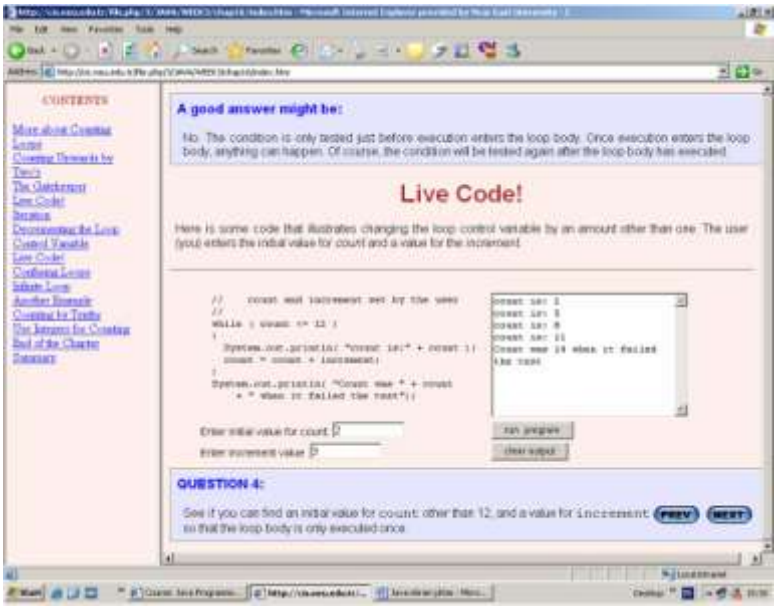


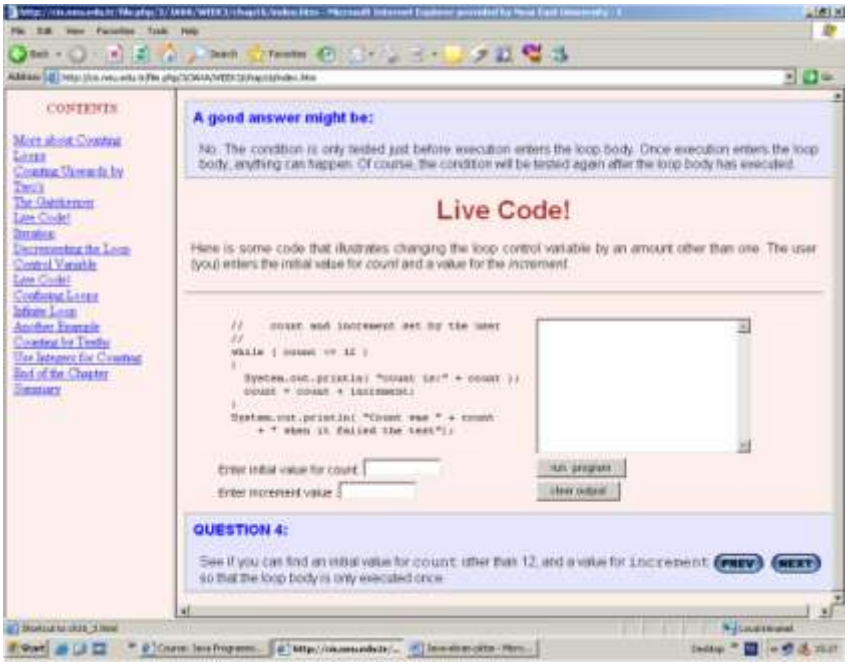
Image of intermail system of NEU-VLE education system

View of Example



View of the Output of Example

View of the Output of Example



View of Example

APPENDIX F

STUDENT OPINIONS ABOUT USING WEB-BASED AND COLLABORATIVE LEARNING TOOLS

1. Do you think that the NEU-VLE Education System has satisfied all of your needs in Java lesson?

2. What are your opinions about the material used in the Java lesson in the NEU-VLE Education System?

3. Was the communication (to your instructor and your class mates) offered in NEU-VLE Education System enough?

4. Do you think the communication tools in NEU-VLE Education System are enough while learning a programming language?
5. Do you think the self-tests at the end of each section in NEU-VLE Education System were necessary? Have they benefited from them?
6. What are your opinions about the assignments in the NEU-VLE Education System?
7. What are your opinions about the quizzes in the NEU-VLE Education System?
8. What do you think in general about the NEU-VLE Education System?
9. Do you want the NEU-VLE Education System to be used in your other courses?
10. Is there anything else you want to say about the NEU-VLE Education System?
11. Do you think it was necessary to use the GREWPTool with the NEU-VLE system? Or, do you think chat, forum, and e-mail used in the NEU-VLE system were sufficient?
12. Among the collaborative tools that you used, which one do you prefer?
13. Are there any additional properties that you would like to see in the collaborative tools that you used?
14. Do you think the collaborative learning tools you used were sufficient?
15. How did you feel during the sessions while using the Collaborative learning tool?
16. Has the Collaborative learning tool you used satisfied all the needs of your students?
17. Is there anything else you would like to say about the Collaborative tool that you used?

APPENDIX G

INSTRUCTOR'S OPINIONS ON COLLABORATIVE LEARNING TOOLS

1. In your opinion, was it necessary to use the GREWPTool together with the NEU-VLE Education System? Or, were the chat, forum, and e-mail used in the NEU-VLE Education System enough?

2. Which one of the collaborative tools that you used you prefer?

3. Are there any additional properties that you would like to see in the collaborative tools that you used?

3. Do you think the collaborative learning tools that you used were sufficient?
4. How did you feel during the sessions when collaborative learning tool was used?
5. Have you met all the needs of students in the sessions when collaborative learning tools were used?
6. Is there anything else that you want to say about the collaborative tools you used?

APPENDIX H

WRITTEN STATEMENTS FROM THE INSTRUCTOR ON COLLABORATIVE LEARNING TOOLS

Lecturer in Java: Tansel Devin

5th July 2005

Findings on the Use of Advanced Collaborative Tools.

The advantages of the Advanced Collaborative Learning Tool are:

d) Provided an easy medium with which students can copy programs into their local environments. Thus, they could benefit from these programs whilst studying the course notes.

e) Students could easily compile and run the programs they wrote with the collaborative editor of the Advanced Collaborative Tool.

f) Students could easily see the outputs of their programs from within the Advanced Collaborative Tool.

g) They could instantly compile and run code that has been developed collaboratively by the participation of several students. Therefore, they did not waste time copying the programs to their own computers: this helped them to be more motivated.

h) I could establish a one to one relationship with the student which helped the student to relax and be motivated.

i) I observed that the student could get help during the collaborative study from ~~the~~ myself

Contd...

i) contd... or from their friends in the class and this helped them understand the topic better.

j) The students could see the screen outputs of their class mates as well as those produced by myself. This provided them with the opportunity to comapare their output with others, and this way, they could test themselves.

The Disadvantages of the Advanced Collaborative Tool:

a) There were performance and technical problems related to the network.

b) As the medium of communication was written, I could not see the body reaction of students and can therefore not be fully certain as to whether the subject matter was understood.

5th July 2005

Lecturer in Java:
Tansel Devin

Findings on the use of the Standard Collaborative Tool.

The advantages:

a) The communication with the students was both at an individual as well as group basis. The students felt confident about using the Standard Collaborative Tool and thereby they could ask questions without being shy.

b) Group learning was found to increase the learning process and allowed students to benefit from each other's experiences. Students were encouraged to join in and participate throughout the collaborative session.

c) The facility to save the whole chat session has the potential to provide feedback on future improvements in content and style of teaching.

d) It was easy for students to copy programs to their local environments and this provided them with additional material on top of their course notes.

e) I could establish a one to one link with the students helping them to relax and be motivated.

The disadvantages of the Standard System:

a) The students could not see the screen outputs of their programs.

b) The students could not instantly compile and save the programs as produced collaboratively with their class. They had to copy the programs to their local PC and compile and run; this wasted a lot of time and was a demotivating factor.

c) There were performance problems related to the network.

d) The medium of learning did not cater for body language.

APPENDIX I

PRE-TEST and POST-TEST QUESTIONS

Answer all nine multiple choice questions (each question carries 5 marks).

1. What term is used for hiding the details of an object from the other parts of a program:

a. Obfustication.
b. Data Mining.
c. Compilation.
d. Encapsulation.

2. What value is assigned to coefficient?

```
double coefficient;
char   code = 'X' ;

switch ( code )
{
  case 'A':
          coefficient = 0.0;

  case 'B':
          coefficient = 0.1;

  case 'C':
          coefficient = 0.2;

  default:
          coefficient = 0.3;
}
```

a. null
b. 0.0
c. 0.3
d. None of the above

3. What must the test be so that the following fragment prints out the integers 10, 11, 12, 13, 14 and 15?

```
for ( int j = 10;  _________ ; j++ )
{
       System.out.print( j + " " );
}
System.out.println( );
```

a. j < 15
b. j <= 16
c. j < 16
d. j == 15

4. What is the output of the following code fragment ?

```
int[] cake = new int[5];

cake[0] = 6;
cake[1] = 3;
cake[2] = 4;

System.out.println( cake[ 2 + 1 ] );
```

a. 0
b. 4 3
c. 3 6
d. 7

5. Say that there are three classes: *Vehicle*, *Car*, and Helicopter. What are the likely relationships between these classes?

a. Vehicle is the superclass, Car and Helicopter are subclasses of Vehicle.
b. Car is the superclass, Helicopter and Vehicle are subclasses of Car.
c. Car, Helicopter and Vehicle are sibling classes.
d. Vehicle is a superclass, Helicopter is a subclass of Vehicle, and Car is a subclass of Helicopter.

6. Which of the following statements is **False** about static variables:

a. A static variable can be accessed by a static or non-static method.

b. A static variable can be accessed without creating an object.
c. A static variable cannot be changed.
d. A static variable does not exist inside objects.

7. Which of the following statements is **True** about inheritance:

a. A class can inherit from more than one class.
b. Variables and methods declared as private are also inherited.
c. A non-abstract class that inherits an abstract method must override the method.
d. A class declared as final can have its methods overridden.

8. Say that class *Reptile* has two child classes (sub-classes) *Dinosaur* and *Lizard*. Class *Dinosaur* has a child class *T_Rex*. Examine the following:

```
Reptile  rep;
Lizard  liz = new Lizard();
Dinosaur  dino = new Dinosaur();
T_Rex  rex = new T_Rex();
```

Which <u>one</u> of the following will cause a compiler error?

a. rep = liz;
b. rep = dino;
c. rex = null;
d. rex = liz;

9. Given that Manager is a sub-class of Employee, examine the following code:

```
Employee emp = new Manager();

boolean check = emp instanceof Employee;
```

What value is placed in *check*?

a. true
b. false
c. null
d. 0

Answer both questions 10 and 11 for a total of 19 marks.

10. Match the five Java terms: **immutable**, **static**, **abstract**, **final** and **private** to each of the five descriptions below, using **all** the terms. Write the closest match next to each description. (**10 marks**)

Description		**Java term**
i.	A special class called Security_check whose methods should not be overridden.	
ii.	An important variable that should never be accessed directly from outside the class.	
iii.	A Bird class having subclasses of specific birds such as Robin, Eagle, Sparrow, etc.	
iv.	The contents of a String object cannot be modified.	
v.	Variable that keeps a count of the number of objects created for a class.	

11. Examine the following program. What will be the **output** after compiling and running main ? (**9 marks**)

```
class TestArr {

   public static void main (String [] args) {

      int[] egArray = new int [8];

      egArray[0] = 2;
      egArray[1] = 4;
      egArray[2] = 6;
      egArray[3] = 8;
      egArray[4] = 10;

      for ( int index= 0 ; index < egArray.length ;
                                    index = index + 2 )
```

```
                System.out.print( egArray[ index ] + " "
);

    }

}
```

Answer 3 out of 4 of questions 12 to 15. If more than 3 questions are answered then only the best 3 will be considered (12 marks for each question).

12. Given the following class, called **Dolphin**,

```
public class Dolphin {
    double length;
    double weight;
}
```

a) Write a **constructor** to **initialize** all 2 variables. **(3 marks)**

b) Show how we can modify this class to provide ***encapsulation***; in particular, you are to write code that sets and gets (retrieves) the values of the 2 instance variables.
(9 marks)

13. Consider the following abstract class called **Book**:

```
abstract public class Book {
     String publisher;
     String author;
     double price;

     public Book (String author) {
          this.author = author;
     }

     public abstract void set_publisher (String pub);
     public abstract void set_price (double price);

}
```

a) You are to write a non-abstract class called **ChildrensBook** to inherit from Book. The **ChildrensBook** class is to provide the **necessary constructors and overriding**.
(9 marks)

b) An additional attribute of ***minimum_age*** is required to indicate the minimum age of children to read the book. Suggest

i. A suitable data type for this attribute? and **(1 mark)**

ii. where it could be held? **(2 marks)**

14. Create a class called **Sport** having the following instance variables: ***String name***, ***int number_of_players***, ***boolean water_sport***. Declare two overloaded methods called **set_attributes ()** for this class such that:

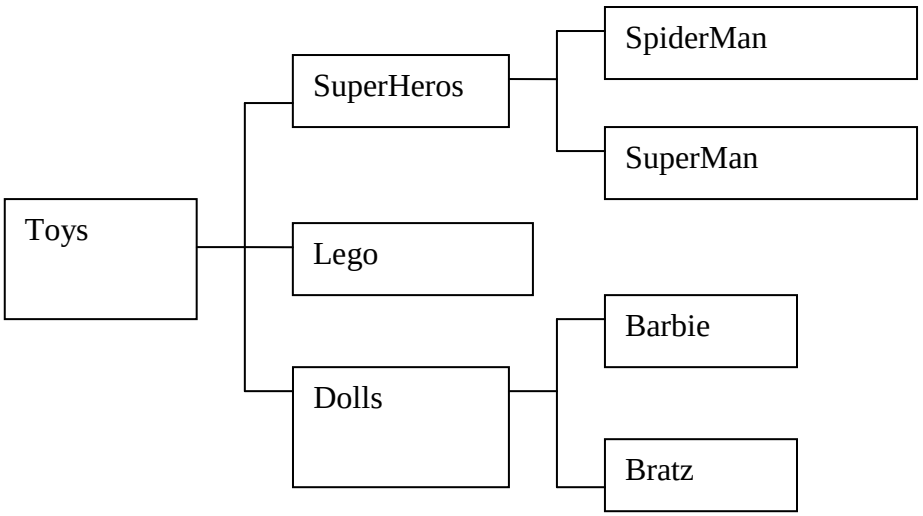
(i) one method is to take one parameter for the name and the number of players,

(ii) one method is to take three parameters for setting all three instance variables.

(8 marks)

Programmatically show how we can modify the class to enable the above settings during instantiation? *Note: there is no need to rewrite the whole class again: just write the part of the code that is required.*

(4 marks)



15. Consider the above class hierarchy designed for a toy store. Answer the following questions:

(i) Indicate the most probable abstract class and suggest one variable for this class.

(2 marks)

(ii) Indicate the data type of an array to hold objects of different types of toys.

(2 marks)

(iii) A primitive variable ***boolean talks*** is to be declared to indicate whether a doll can talk. Suggest a suitable class for this variable.

(2 marks)

(iv) Provide an initial prototype program for the above diagram, including your answers for all the questions (i) to (iii) above.

(6 marks)

☺ *GOOD LUCK !!!*

APPENDIX J

STUDENTS USING RESOURCES OUTSIDE THE NEU-VLE EDUCATION SYSTEM

1. Have you used any resources outside the NEU-VLE system?
2. Have you used any books other than the lesson resources provided in the NEU-VLE Education System?
3. Have you become a member of any forum in the internet and used any such forums other than the forum provided by the NEU-VLE Education System?
4. Have you become a member of any chat groups in the internet and used any such groups other than the chat provided by the NEU-VLE Education System?
5. Have you taken any private tuition?

APPENDIX K

LEARNING STRATEGIES SCALE

	Survey Items	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1)	When I make things for my studies, I remember what I have learned better.					
2)	Written assignments are easy for me to do.					
3)	I learn better if someone reads a book tome than if I read silently to myself.					
4)	I learn best when I study alone.					
5)	Having assignment directions written on the board makes them easier to understand.					

6)	It's harder for me to do a written assignment than an oral one.					
7)	When I do math problems in my head, I say the numbers to myself.					
8)	If I need help in the subject, I will ask a classmate for help.					
9)	I understand a math problem that is written down better than one I hear.					
10)	I don't mind doing written assignments.					
11)	Written assignments are easy for me to do.					
12)	I remember more of what I learn if I learn it when I am alone.					
13)	I would rather read a story than to it read.					
14)	I feel like I talk smarter than I write.					
15)	If someone tells me three numbers to add I can usually get the right answer without writing them down.					
16)	I like to work in a group because I learn from the others in my group.					
17)	Written math problems are easier for me to do oral ones.					
18)	Written a spelling word several times helps me remember it better.					
19)	I find it easier to remember what I have heard than what I have read.					
20)	It is more fun to learn with classmates at first, but it is hard to study with them.					
21)	I like written directions better than spoken ones.					

22)	If homework were oral, I would do it all.					
23)	When I hear a hone number, I can remember it without writing it down.					
24)	It more works done when I work with someone.					
25)	Seeing a number makes more sense to me than hearing a number.					
26)	I like to do things like simple repairs or crafts with my hand.					
27)	The things I write on paper sound better than I say them.					
28)	I study best when no one is around to talk or listen to.					
29)	I would rather read things in a book than have the instructor tell me about them.					
30)	Speaking is a better way than writing if you want someone to understand what you really mean.					
31)	When I have a written math problem to do, I say it to myself to understand it better.					
32)	I can learn more about a subject if I am with a small group of students.					
33)	Seeing the price of something written down is easier for me to understand than having someone tell me the price.					
34)	I like to make things with my hands.					
35)	I like tests that call for sentence completion or written answers.					
36)	I understand more than from a class discussion than from reading about a					

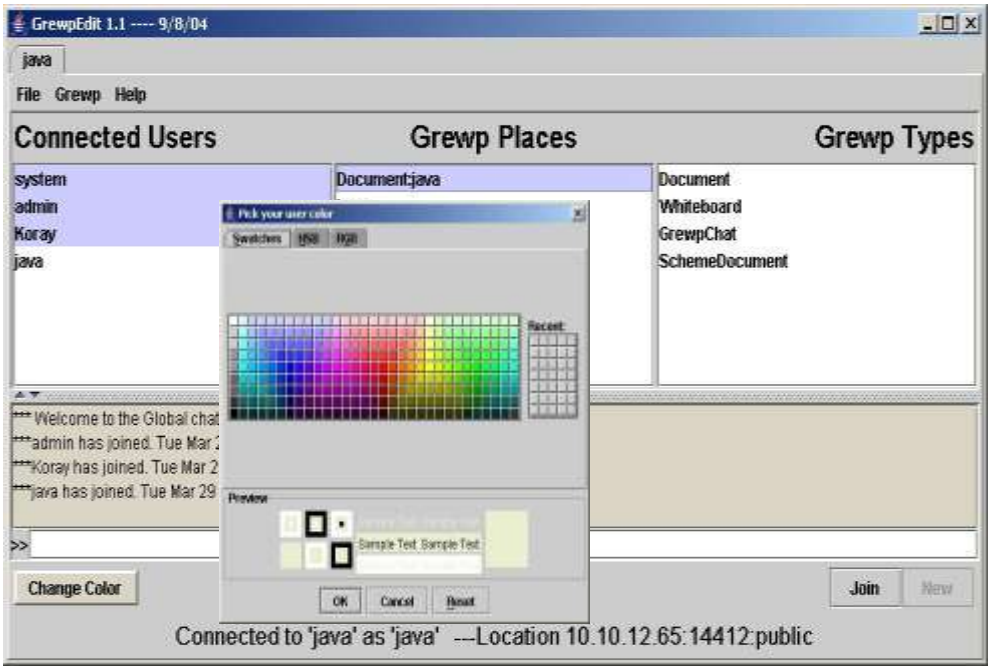
	subject.					
37)	I remember the spelling of a word better, if I see it written down than if someone spells it out loud.					
38)	Spelling and grammar rules make it hard for me to say what want to in writing.					

***Cronbach's alpha coefficient was 0.97.**

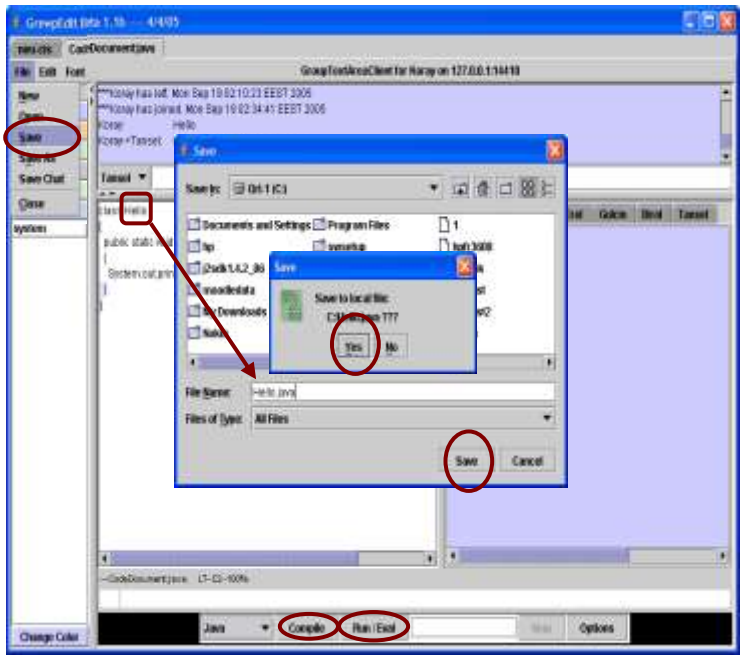
APPENDIX L

SAMPLE PICTURES ARE GIVEN FROM THE MAIN PORTIONS OF EXISTING SYNCHRONOUS SESSION WITH COLLABORATIVE LEARNING TOOL

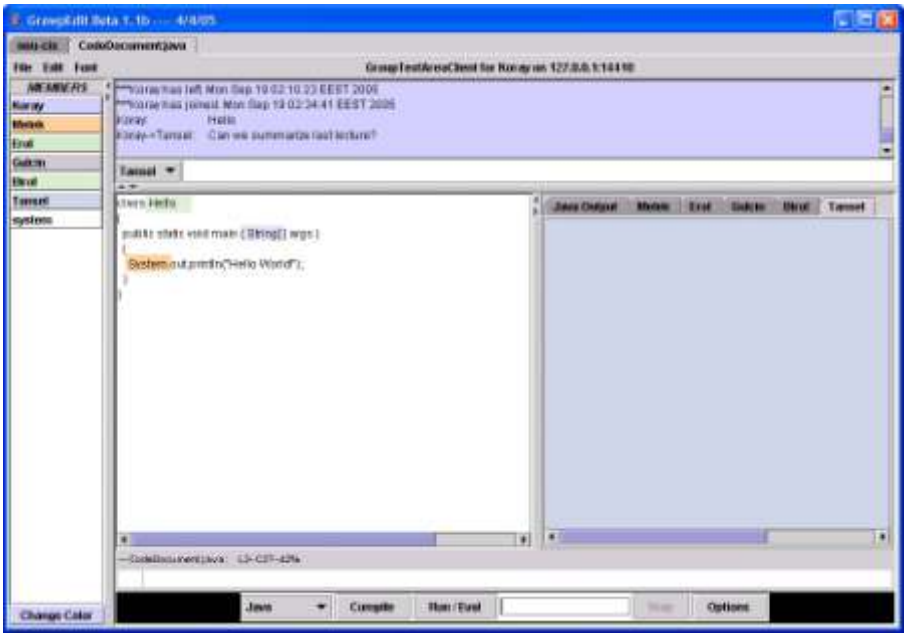
View of Log-In Windows of Collaborative Tool



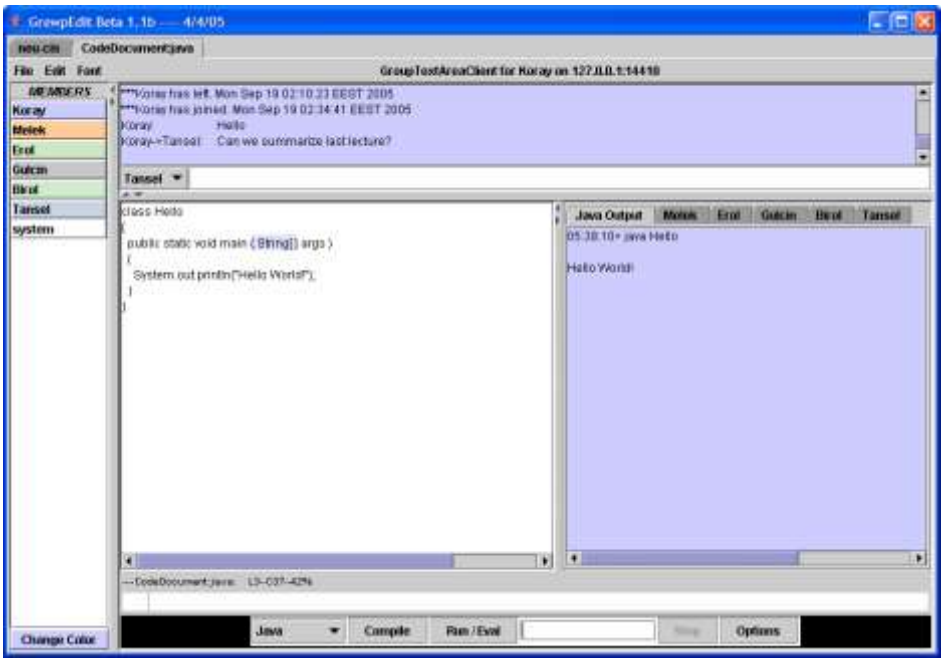
View of Color Palette of Collaborative Tool



View of save of The Source Code



View of common code editor



View of the Output of program

View of Private Message Windows

VITAE

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B.Sc.	NEU, Computer Information Systems	1995
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WORK EXPERIENCE

Year	Place	Enrollment
1997-present	Near East University	Lecturer
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- *B.Sc., Computer Information Systems with High Honors,* CGPA: 3.79 (out of 4.00) Near East University, Lefkoşa, Cyprus, 1995.

- *Ranked first among Computer Information Systems Department, Faculty and University Graduates,* 1995.
- *M.Sc., Business Administrative Sciences, CGPA of business courses and seminar: 3.29 (out of 4.00)*, Near East University, Lefkoşa, Cyprus, 1997.

INDEXED PUBLICATIONS

- Çavuş, N., Uzunboylu, H. & Ibrahim, D. (2007). Assessing the success of students using a learning management system and together with a collaborative tool in web-based teaching of programming languages. *Journal of Educational Computing Research, **36(3)**).*
- Çavuş, N., Uzunboylu, H. & Ibrahim, D. (2005). Near East University learning management system based distant education, ***ERIC DATABASE*** *ERIC: ED491480*.

INTERNATIONAL CONFERENCES AND SYMPOSIUMS

- Çavuş, N., Uzunboylu, H. & Ibrahim, D. (2006). Using the Moodle learning management system and GREWPTool collaborative tool for teaching a programming language. *Creating the Future 4th FAE International Symposium, University of Lefke*, 30 Nov-1 Dec, Lefke, Cyprus.
- Çavuş, N., Uzunboylu, H. & Ibrahim, D. (2006). The effectiveness of using learning management system and collaborative tools in web-based teaching of programming languages. *ISEECE 2006, 3rd International Symposium and Education on Electrical, Electronic, and Computer Engineering,* 23-25 November 2006, Near East University, Lefkoşa, Cyprus.
- Çavuş, N., Uzunboylu, H. & Ibrahim, D. (2006). Combining collaborative learning tool with learning management system in teaching programming language. *2nd International Open and Distance Learning (IODL) Symposium, Anadolu University,* 13-25 September, Eskişehir, Turkey.

- Özdamlı, F., Çavuş, N. & Uzunboylu, H. (2006). Öğrenme ortamı olarak kütüphanelerin değerlendirilmesi. *6th International Educational Technology Conference,* 19-21 April, Gazimağusa, Cyprus.
- Çavuş, N. & Huseynov, I. (2004). Design of internet-based learning environment for Computer Information Systems courses: Predesign systems analysis phase. *2nd International Conference on Electrical, Electronic and Computer Engineering*, 11-13 March, Near East University, Lefkoşa, Cyprus.
- Çavuş, N. & Ibrahim, D. (2004). Using learning objects to teach programming languages. *Creating the Future 3rd FAE International Symposium,* 25-26 November, European University of Lefke, Cyprus.
- Çavuş, N. & Hüseynov, I. (2003). Development internet-based learning environment for students in the engineering fields. *Conference on Innovation in Higher Education*, 16-19 May, Kiev, Ukraine.
- Çavuş, N. & Ibrahim, D. (2002). İlkokullarda bilgisayarda eğitimin yaygınlaştırılmasındaki donanımsal ve yazılımsal sorunlar. *XI. Eğitim Bilimleri Kongresi (XI. Educational Sciences Congress)*, 23-26 October, Near East University, Lefkoşa, Cyprus.

THESISES

- Çavuş, N. (1997). European Union and Cyprus. *Graduate thesis* (*M.Sc),* Business Administrative, Faculty of Economics and Administrative Sciences, Near East University, Lefkoşa, Cyprus.
- Çavuş, N. (1995). Student registration package system. *Undergraduate project (B.Sc.),* Department of Computer Information Systems, Faculty of Economics and Administrative Sciences, Near East University, Lefkoşa, Cyprus.

CHAPTER 1

INTRODUCTION

In this section the research problem, the purpose of the study, the significance of the study, assumptions, limitations, and the commonly used terms are described.

1.1 The Problem

Education, which creates desired changes in the human lives, is perhaps one of the most important sub-systems of the society (Ertürk, 1979). The increase in the qualities of other sub-systems of the society (e.g. economy, religion, family, politics etc.) in a way depends on the increase of the quality in education and the education system. If the quality of education is not at the desired level, then this may affect all parts of the society and the whole nation through the sub-systems.

The education in knowledge based societies aims to develop individuals who can use the knowledge technologies easily, who can create and classify knowledge, and who can offer and share with others (Yurdakul, 1998).The individuals who can adapt themselves to changes, and who know that they need to continually learn and improve themselves will have the rights to live in the future (Future's Technology, 1993).

As the human beings move towards becoming part of a knowledge society, fast developments are taking place in knowledge technologies. The changes occurred in knowledge technologies are causing inevitable changes in communities and education systems. In order to adapt this changing knowledge in everyday life it is necessary to use the new educational technology in education and in teaching and learning. Teachers who are engaged in teaching are involved in various studies in order to increase the quality of education and especially they have been concentrating on the duration of learning-teaching methods. Technology is a resource created by combining the ideas of individuals and their abilities to use tools with the natural resources. Thus, the

beginning of technology can be considered to be the beginning of the history of mankind. In order to make the world a better place for living, and to control the nature in the required way, human beings have spent great efforts throughout the history. Thus, the technology is developed in line with the developments in the existing resources, and the discovery and application of new resources, for the benefit of the individuals. (Doğan, 1983)

Fast changes are expected to be observed in all fields of technology in the 21st Century. At the base of these developments lie the technological advances and the research interests of the human beings. The aim of the nations in the developing technological world is to dominate the world and become a knowledge society. Scientists and researchers believe that the advanced nations are the knowledge based nations, and the rate of advancement is related to the amount of knowledge created and distributed by that nation. Keser (2000) says that today knowledge for individuals and nations knowledge is regarded as the richest source and asset. In knowledge based nations the basic tools used by the people to access to knowledge are education and technology. Actually, education and technology are two important factors which counterbalance and affect each other. The individuals in a knowledge based society are able to create new knowledge from the already acquired knowledge and they are able to apply this knowledge to real-life situations. As a result of this, because there has been a large increase in knowledge database, it becomes easier and quicker to follow the new technologies and to use the new technologies in real-life situations. Due to the very fast distribution of the knowledge and technology, the validity period of the knowledge or the technology is shortening; this makes the renewal of the technological tools, the educational programs, and the development of new teaching methods a necessity. Science, technology and information technology are the basic concepts of making education gain a scientific and professional identity.

The individual who can be effective in a knowledge based society should also be effective in the use of the educational technology. Giving individuals the required general skills and helping them set the maximum out of their efforts to learn will only be possible by utilizing the available educational technology. In more contemporary meaning a systematic and scientific approach is needed to practice and evaluate educational technology (Eisele & Eisele, 1994).

As educational technology as a discipline takes the advantage of alternatives presented by new technologies in solving problems that come across in the field of practicing education. The educational technology, helps learning to be easy, rich, encouraging, effective, and meaningful, and makes sure that the man-power and the external resources are directed and used for the required aim. Educational technology is complex and helps at all stages of the learning by organizing the man-power to solve the problems, to design, apply, and evaluate and to create solutions to the problems (Thomas & Koayaskhi, 1987). Educational technology aims to increase the efficiency in education, to establish a scientific foundation in teaching, personalize teaching, and accelerate the rate of learning, and widen the equality of opportunities in education (Oliveira, 1982). The aim of the educational technology is to create a new education concept compatible with the requirements of the present era.

Computer is a device, or a tool that processes certain items following certain steps and certain commands. Computers, which are the contemporary products of human beings, and which have started the era beyond the industry, can be considered to be the most efficient communication and personal teaching devices. Computers, which contributed to the creation of today's knowledge based society, are characterized as contemporary mediums in education (Eisele & Eisele, 1990).

Alkan (1997) argues that serious studies related to the use of new technologies in the field of education are required to determine how teachers can update themselves for the new developments in education especially in the preparation of educational tools and new teaching methods and processes. In parallel with the developments in the information technologies the knowledge has now become unlimited in the global world. In addition, the changes in the social, cultural and economic fields, high speed, security, multi-user capabilities, and similar attributes have caused the computers to become an inseparable part of the everyday life. As a result of their extra-ordinary speed and capacity, and their support for the functioning of other technologies, computers have rightly gained importance among the new technologies (Şimşek, 1995).

The need to use computers in education as a teaching aid has started as a result of increase in interest towards education, and also increase in the number of students, in the amount of knowledge, and in the complexity of the teaching material, insufficient

number of instructors, and the importance of individual skills and individual differences (Alkan, 1984).

As a result of using computers in education, there has been a change in the role of the instructors in education, and how the students should learn to use these tools. Most of the studies imply that students now prefer to be independent, and they have adopted the technology easily since they could have control over it (Wishart, 1990). Also, it has been observed that the confidence and the couragement of students using computers were higher (Akkoyunlu, 1996).

Computers, which are being used intensively nearly in all domains of the human life, and which became an inseparable part of the everyday life are also being used frequently in educational settings. As a result of these developments and in parallel with these developments, there has been a need to update on education accordingly.

The use of computers in education is described in different ways. Looking at the literature related to the use of computers in Turkey it can be seen that the following terms are used abundantly: "*Computer Aided Education* /CAE" (METARGEM); "*Computer Assisted Instruction* /CAI" (Alkan, 1986; Aşkar & Köksal, 1987; Demirel & Ün 1987); "*Teaching Using Computers*" (Ün, 1986); " *Education Using Computers*" (Keser, 1988); "*Computer Managed Instruction*", "*Teaching Based On Computers*" (Baykal, 1986); "*Teaching Prepared Using Computers*" (Aşkar & Erden, 1986). Besides, technology based education (TBL), Computer based training (CBT), Distance learning (DL), and Web based learning (WBL) are some of the most commonly used terms.

The using style of computers in education takes different names such as computer managed teaching, computer based teaching, and computer assisted teaching (Şimşek, 1998). Nowadays, among the new educational technologies, computer networks are the fastest growing and the most widely used and accepted technology in the global world.

Day by day, the technology is becoming part of our daily life. The use of internet and various services using electronic environments are becoming more widespread. Therefore, the educational institutions must utilize the information and communication technologies and also they must train the people who use them. Internet is a world wide publishing system and an ideal mechanism for the distribution of knowledge with no

geographical barriers, and a tool which provides communication and partnership between computers and human beings (Orcan, 1998). Compared to courses delivered in the face-to face settings, courses which are delivered entirely online rely more on technology (Bonk, 2001; Firdyiwek, 1999; Moore, 2003). Technology, especially the internet, provides a common virtual space for students and instructors who are physically separated; internet is widely acknowledged as an essential component of teaching and learning environments in online settings (Liu, 2005).

Recently, due the rapid increase in the popularity of the internet the delivery of learning programs have gradually shifted from local desktop to online-based applications. As more and more technological tools become available for online education, there is an increasing interest among educators and other professionals in the application of these tools in online courses (Hanna, 2003; Moore, 2003). Some researchers (e.g., Ansorge & Colley, 2003; Carmen & Haefner, 2002) argue that technologies such as asynchronous discussion boards and real-time chats have positive effects on teaching and learning. At the same time, researchers realize that these technological tools, like other tools developed by human beings, can be used in profound as well as very trivial and careless ways in educational practices (Althauser & Matuga, 1998; Ottenhoff & Lawrence, 1999).

Faculty members play a key role in using technology successfully in online courses (Garrison, Anderson, & Archer, 2003; Willis, 1994), and their participation is believed to be inseparable for successful online programs (e.g., Schifter, 2004).Generally distance education has been delivered using the technology such as video conferencing, videotape, satellite broadcast, TV broadcast and internet. In distance education, technology is used in three different ways: a) radio and television, b) printed materials, c) internet. The communication between learners and instructors in distance education must be provided by technologies. There is a wide range of technologies such as broadcast radio and television; audio and videotapes; interactive audio and video teleconferencing; various computer and internet technologies, and print technologies that can be used for distance education. Different devices may be used for courseware delivery and for interpersonal interaction, but the backbone technologies along which the signals travel are often the same (World Bank, 2006). The main

problem in distance education using radio and TV transmission is the lack of two-way communication between the instructors and the students (Sherry, 1996).

Among features to be considered are the relative merits of recorded technologies for delivering presentations of subject matter and the merits of teleconferencing technologies for facilitating interaction between instructors and learners. Administrators and instructors have to consider the benefits of relatively high cost technologies such as broadcast television and interactive video compared with the lower costs of text, audio recording and telephone conferencing (World Bank, 2006).

Nowadays, knowledge based societies are highly respected. The knowledge in knowledge based societies is increasing daily. The number of learners is also increasing, and those who can not attend educational establishments because of the geographical distance are using the internet based distance education learning techniques as the only solution to their higher education needs. In the knowledge based societies, the concepts of *student* and *instructor* are changing into *learner* and *facilitator*, and in parallel to this, the teaching method is changing from *instructor-centered* to *student-centered*. Internet is a valuable and a very important tool as it shows this change as part of the everyday life, and not as an utopia (Duman, 1997).

According to İşman (1998), the internet, which is also called as the global communication network, is the resource of the main global trade and main education. Thus, written, verbal, and visual data communication networks also offer global distance education services to academics. Internet provides an interactive environment with the help of computers and internet (e-mail, bulletin, boards and chat) and gives students the opportunity to communicate with peer groups, instructors, experts and running partnerships (Mioduser & others, 2000).

World Wide Web (www) is one of the most commonly used components of the internet for educational purposes. Özden, Yiğit & Yıldırım (1999) define internet as a service which provides knowledge on using networks (internet). Oliver, Herrington & Omari (1999) define the internet as a teaching tool which provides an easy and flexible access to information and supports visual tools, and a powerful type of publication system which can also incorporate hypermedia features.

In today's education systems the web not only provides support but it also forms the backbone of the education system. The web designed for education is generally

called “Web Based Education” (McManus, 1998). All types of students whatever their speeds of learning are can use web-based education. This form of education provides new, varied, effective, and also enjoyable learning environment for the students. Web-based education removes cultural differences, language differences, gender differences, paces of learning, and it provides and supports equality in learning (İşman, 2005).

Building customized learning programs require the use of authoring systems such as Director, Authorware, Dreamweaver, Flash, Frontpage and Rebodemo, which demands design, programming skills, and time. An alternative to using such applications is the deployment of course or learning management systems (LMS). LMS are often viewed as the starting point of any web-based learning program. LMS systems are divided into two groups: a) commercially available LMS systems and b) open-source (free) LMS systems. 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, Atutor*, *KEWL, Claroline* and several others. Open source system 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.

Collaborative learning is one of the important topics in web-based education. With collaborative learning people learn easier as a result of sharing, communicating, and exchanging ideas. Sharing accelerates learning in the given time. Recent research has shown that the technique of collaborative study over the web has not been investigated thorougly (ERIC, 2005). The vision of online collaborative learning is compelling. Learners, enrolled in a common unit of study for training, continuing professional development, or the pursuit of an academic degree, will work together online to solve complex problems and complete authentic tasks (Herrington, Oliver, & Reeves, 2003; Herrington et al., 2004).

More than 80% of higher educations in North America now offer some totally online or blended courses (Allen & Seaman, 2003); yet Wilson (1996) states that the majority of these courses are still taught in a traditional way instead of using constructivist learning strategies. Some studies have reported student frustration with online learning environments for reasons such as confusion about online instructions,

failure to get prompt feedback from instructors, and persistent technical problems (Hara & Kling, 1999; Vonderwell, 2003). Another plausible reason for the failure to adopt pedagogical innovations when moving courses and programs online is that faculty members are rarely given sufficient time to create completely different designs for online courses, and so they fall back on using the technology to replicate the instructional dimensions of traditional courses (Reeves & Reeves, 1997).

The more common approach used in higher education today is replicating the instructional design of traditional face-to-face courses in the online medium (Bonk & Dennen, 2003; Kearsley, 2000; Naidu, 2003). At this stage for the development of online collaborative learning environments, there is a clear need to further the understanding of the more effective and successful approaches and their relationships with underpinning theoretical principles and technological affordances (Anderson, 2003). There is an urgent need to carry out further research (Van den Akker, 1999) to provide design guidelines for enhancing collaborative online teaching and learning methods. There is a renewed enthusiasm for experimental research designs among some educational researchers (Feuer, Towne, & Shavelson, 2002).

Crook (2002) reported on a survey of students in the United Kingdom indicating that although most of them believed that online universities were inevitable in the future, none of them expressed a desire to study at a virtual university, and "many vigorously dismissed the whole virtualization prospect" (p.155). Meanwhile, many authorities assume that learners will automatically embrace collaborative learning. For example, Duderstadt, Atkins & Van Houweling (2002) wrote:

> In these new learning paradigms, the word student becomes largely obsolete, because it describes the passive role of absorbing content selected and conveyed by instructor. Instead, we should probably begin to refer to the clients of the twenty-first century university as active learners, since they will increasingly demand responsibility for their own learning experiences and outcomes (p.64).

Private funding bodies such as the Alfred P. Sloan Foundation (http://www.sloan.org/main.shtml) and the Spencer Foundation (http://www.spencer.org/) as well as government agencies such as the National Science Foundation (http://www.nsf.gov) and the Australian Research Council (http://www.arc.gov.au/) have funded a large number of projects designed to advance

the prospects for collaborative online learning in higher education. Yet, few of these initiatives have been sufficiently integrated with long-term development research agendas (Herrington, Reeves & Oliver, 2004).

An extensive literature survey that has been carried out by the researcher has shown that inside naturally open-source LMS systems the following tools are commonly used: communications tools such as asynchronous discussion forums, real-time video AV (virtual reality), and/or text chat sessions, shared whiteboards, listservers, e-mail etc. But, it could be said without hesitation that, in web-based teaching of programming languages, in order to establish student-instructor and student-student type two-way communication, the communication tools given above are not sufficient. In general, when teaching a programming language, it is not sufficient to use plain text type data exchange between students and the instructor, and between the students. A personalized collaborative editor is an essential requirement in such circumstances. It is usually difficult and sometimes impossible to solve the problems encountered while teaching programming languages by simple text. It is necessary to show what the problem is rather than to describe what it might be.

Recent advances in web-based education, the use of collaborative tools, and the development of these tools have not taken long to attract the attention of the researchers. But, one can say that most of the positive developments in the field of web-based education and the teaching of programming languages using collaborative tools have only been implemented using local networks in classrooms.

In the process of writing this dissertation the researcher could not find any published work on web-based education using collaborative tools, or the teaching of web-based programming languages. When the researcher also searched the educational databases (i.e. ERIC, EBSCOhost, ProQuest, Dec, 2005) she did not come across with any international published work on the issues of teaching of internet and web-based programming languages. Therefore the researcher thinks that scientific research is required on the use of web-based and collaborative tools in the fields of programming language education and teaching.

Based on the aforementioned points it could be said that the new technology can be utilized to solve most of the problems encountered in educational technology. Whenever an LMS is to be selected one has to make sure that the selected system is the

most suitable and compatible one for teaching and learning processes in educational settings. It could be said that the Open-Source LMS systems are the most effective systems. But, it must be stressed again that in an environment where web-based teaching of a programming language is to be used and where the interaction between the student and the instructor and between the students is important, one has to combine the selected LMS system with a personalized collaborative tool. It is seen as a necessity to know where and how to use the new technology during the teaching-learning sessions, and also to know the benefits that will be obtained by the use of such technology.

In a global world where there is no limit to the gathering of information and knowledge, the education is now a life-time activity. Therefore people have to know how to access to knowledge and continue their education, and not to wait for someone to bring knowledge to them. The importance of the computer programming as a career is a known fact which can not be debated. In the present day for an ordinary person to be successful in his/her other job he or she has to have the basic knowledge of operating and using a computer in everyday life. Putting the discoveries of scientific researchers in the field of education of computer programming language into practice could provide major benefits in the process of acquisition and teaching. It could be said that nowadays it is compulsory to use the internet in order to carry out a scientific research.

As part of the developing technology, it has become a necessity to investigate the importance of web-based learning of a programming language, to see how effective it can be, and to assess the success rate of students using such tools. All these topics need to be investigated in detail and the results should be made available to all interested parties.

1.2 The Purpose of the Study

The purpose of this study is to find out the effects of an advanced collaborative learning tool on teaching of programming languages via the web. In order to achieve this purpose the answers to the following questions were sought:

1.What are the opinions of the students and the instructor on the use of the NEU-VLE system?

1.1 What are the opinions of students on the use of the NEU-VLE system?

1.2 What are the differences between the opinions of students, who used the ACLT and SCLT, on the use of the NEU-VLE system?

1.3 What are the opinions of the instructor who used the ACLT and SCLT on the use of the NEU-VLE system?

2.What are the opinions of the instructor and students on the use of collaborative learning tools?

2.1 What are the differences between the student opinions, who used the ACLT and SCLT, on the use of collaborative learning tools in general?

2.2 What are the opinions of the course instructor who used the ACLT and SCLT on the use of collaborative learning tools in general?

2.2.1 What are the opinions of the course instructor who used the ACLT on the use of collaborative learning tools in general?

2.2.2 What are the opinions of the course instructor who used the SCLT on the use of collaborative learning tools in general?

3.What are the opinions of students on the use of the NEU-VLE system?

3.1 What are the opinions of students, who used the ACLT and SCLT, on the usefulness of the NEU-VLE system?

3.2 What is the difference in the opinions of students using the ACLT and SCLT on the usefulness of the NEU-VLE system?

4. What are the learning strategies of the students?

4.1 Is there a relationship between learning strategies of students who used the ACLT and the SCLT?

5. What are the academic success rates of the students who participated in the research?

5.1 What are the success rates of the students who took the Post-Test using the ACLT and traditional methods of collaborative learning?

5.2 What are the success rates of the students who took the Post-Test using the SCLT and the traditional methods of collaborative learning?

5.3 What are the success rates of the students who took the Post-Test using the ACLT and the SCLT?

5.4 What is the difference between the results of the Pre-Test and Post-Test?

5.5 What are the relationships between the Learning Strategies and Post-Test?

1.3 Significance of the Study

Nowadays, computers and the internet are used in almost all areas. This is especially true in the field of education, where not only computers are used, but also various internet tools. Education is seen to be an important factor in everyday life of the human beings. It has become necessary to use computers for self-education, and for following the latest technological advances. One of the best ways of achieving this aim is to use the internet effectively and with full capacity and knowledge. In recent years it has become difficult for the instructors and students to be at the same geographical places simultaneously. As a result of this, the idea of using and applying the new technological tools to the field of education has been accepted by everyone in the field. It is believed that the results of this research will bring a new approach to teaching and learning of programming languages at the universities. In addition, the results of the study are believed to enable the Near East University graduates to follow the new technological advances easier. It is believed that the results obtained in this thesis will enable the educational researchers, instructors, and departmental chairmen to make more effective and fruitful decisions. In addition, it is strongly believed and hoped that this study will be useful for the application of collaborative editors which are absolutely essential, and which provide the two-way communication between the instructors and students during the teaching of web-based programming languages.

As it was discussed in describing the problem, this research study forms one of the first studies in the field of using LMS and collaborative tools for the teaching of programming languages in a web-based environment. The literature search carried out for the teaching of web-based programming languages so far has indicated that most of the other applications are based on simple web pages and the information is relayed to the students via the internet in the form of a one-way communication. The researcher has not come across with an application whereby a dynamic two-way communication is established over the internet between the instructor and the students, just like it happens in a traditional classroom environment.

As universities turn more and more to the utilization of web-based learning, it becomes imperative to lay the theoretical groundwork, explore and describe how particular environments relate to specific educational theoretical frameworks. This experimental study may be of educational value to higher education instructor and administrators, educational technologists, developers of online instructional software, online instructional designers, and educators interested in the possibilities of this virtual learning environment.

The research work carried out in this thesis aims to investigate the following points and make recommendations for their effective use in web-based teaching of programming languages. The study aims:

1. to investigate the web-based teaching of Java programming language, and to investigate new methods for the web-based teaching of programming language in general,
2. to investigate the use of LMS and Collaborative learning tools effectively for the teaching of programming languages in a web-based environment,
3. to investigate the use of new technological tools in education and teaching and to determine the effectiveness of these tools when used in an environment at any geographical location and at any time of the day.

1.4 Assumptions of this Study

The assumptions made in this research are as follows:

1. The students attempted to answer the questions according to their knowledge, their views, and their inclinations.
2. During the tests, the variables, which could not be controlled, affected both the experimental and the controlled groups at the same rate.
3. The students in both the experimental and the controlled groups have answered the questions genuinely and in their best capacity. The answers reflect the real situation.

1.5 Limitations of this Study

This research has been carried out with the following limitations:

1. The research is limited to the studies carried out at the Near East University (N.E.U), within the boundaries of the Turkish Republic of Northern Cyprus (T.R.N.C) and with the students at the Department of Computer Information Systems (C.I.S) who are studying at their first semester of the senior year.
2. The research took part in the 2004-2005 academic year and in Spring semester.
3. The computer programming language used in this research was limited to Java only. The reason for choosing Java was because it is commonly used in most of the C.I.S departments of other universities in the world.

1.6 Definition of Terms

Java Programming Language: Java is a computer programming language which has been developed by the Sun Microsystems engineer James Gosling, and it is a true object orientated, platform independent, high performance, multi tasking, and interpreted language.

Experimental Group: The group which has carried out the web-based learning studies for the Java programming languages.

Control Group: The group which has carried out the learning studies for the Java programming languages, based on classical teaching methods.

Classical Teaching: The instructor centered teaching method where all the students in a class receive same instructions at the same time.

Web-Based Java Teaching: Teaching of the Java programming language using web-based techniques.

Collaborative Tool: A collaborative tool enables students and instructor to establish a two-way communication and to exchange ideas.

Advanced Collaborative Learning Tool (ACLT): The collaborative tool where the students can compile and run interactively inside the tool, and where they can see the instructor's and each others screens.

Standard Collaborative Learning Tool (SCLT): The collaborative tool where the students can not compile and run interactively inside the tool, and where they can not see the instructor's or each others screens concurrently.

Web-Based Collaborative Learning Environment: The educational environment where students can learn at any geographical place, any time of the day, at their own learning pace, whenever they feel they are ready, and where they can establish a two-way communication and exchange ideas with their instructor.

Compile: Compile is the process of converting a programming source code into an executable program.

Source Code: Source code is the actual program written by the programmer. The source code is in ASCI (American Standard Code for Information Interchange) text format which can be displayed and printed. The source code can also be modified (called "editing a program") by the programmer.

Run: Run is the process of executing a program which has been compiled.

Output: Anything that comes out of a computer is called output. The output of a computer can be displayed on a screen or printed by a printer in the form of a hardcopy. Output devices include display screens, loudspeakers, printers, and plotters.

CHAPTER 2

REVIEW OF LITERATURE

The Open University in UK (WEB-1) has been delivering distance education programs using television for over several decades. Many courses including engineering courses have successfully been thought remotely using the television, lecture notes, and home experiment kits. The university started distance education programs in 1970 and by 1980 the student numbers grew to 70,000 and 6,000 students had been graduating each year. Today more than 180,000 students use the online facilities of the Open University. By the advancement of the technology, computers, videotapes, CD-ROMS, satellite broadcasts, and the Internet are being used as the main means of distant education. In China a nationwide educational program via satellite was established in 1986 (The International Encyclopedia of Education, 1993). The satellite TV education network has more than 400 relay stations, and 30,000 receiving stations (İsman, Barkan & Demiray, 2005).

Moore (1989) cites interaction among students as instrumental to learning. In a distance education context, student-to-student collaboration-and thus interaction-appears to happen more spontaneously than in traditional face-to-face instruction. The local site is increasingly recognized as being able to provide a supportive atmosphere that may not be replicated across distance. Moore (1994b) notes that students at their local sites tend to cluster around an informal leader in an environment characterized by "a high degree of participation, division of labor, and collaboration". These new types of collaborative systems, brought about through communications technology, may prove beneficial to learning and teamwork in the future. Indeed, promoting teamwork and collaboration, rather than competition, among students at distant sites has been found to enhance collequality and learning (Jones & Timpson 1991).

Real-time chat is known as synchronous discussion or synchronous communication. Unlike the delayed exchange (asynchronous discussion), real-time chat provides "instructor and students with a forum for an immediate and dynamic interchange of ideas" and "can be an exciting asset to collaborative learning environments" (Cooney, 1998, p.263). It can be used to foster group cohesion and decision making, brainstorming, and build high levels of socialization (Garrison, Anderson & Archer 2003; Kang, 1998). However, researchers (e.g., Zhai & Liu, 2005) find that real-time chat is used far from its full potential in some online courses.

Ohlund et al. (1999) investigated the use of asynchronous (mailing lists) and synchronous (chat sessions) internet-based communication and their impact on instructor's attitude toward collaboration, activity completion rates, and test performance. The study also investigated the impact of collaboration on activity completion rates and instructor performance measured by objective test. Although it was found that attitudes toward collaboration did not affect test performance, the data suggested a relationship between attitudes toward collaboration and use of internet-base communication.

Asynchronous discussion also known as asynchronous communication, threads discussion, and delayed computer conferencing in the literature, have been used for over a decade (Garrison, Anderson & Archer, 2003). It is argued that asynchronous discussion provides greater independence and flexibility in temporal and geographical barriers (e.g., Feenberg, 1989), and more reflective participation (e.g., Zhu, 1998), and helps students master content and develop their collaboration and critical thinking skills (e.g., Duffy, Dueber & Hawley, 1998). Literature shows that asynchronous discussion can be used in the following ways: general discussions, exchanging ideas, working on specific topic areas, and peer commenting (Kang, 1998; Siegel & Kirkley, 1998). Duffy, Dueber & Hawley (1998) criticize that "many designers of conferencing systems have had a simplistic view of discussion as simply talking" (p.74), and argue for a more effective and pedagogical-based conferencing system to support online asynchronous discussion.

Turkey, where the industry has started growing recently has to capture the internet based technological revolution especially in the field of education. The technology can not be expected to be useful and effective in other public sectors if it has not been accepted by the educational sector. For this reason, the application of virtual universities should urgently be considered to be a national project within the national science and technological policy. First of all the public should be educated. The application should start at the graduate level by the technologically advanced universities, and the most sought limited technological topics should be chosen. Virtual education, using technology, communication, and economic measures, must take place without any delay in the research priorities of Turkey. In addition to the areas of computer and information systems, areas such as communication, business studies, and

educational sciences faculties and departments should investigate and develop the topics from their points of view, and special financial support should be provided as a means of encouragement to the individuals engaged in research and development in these fields (Karasar, 1999).

In a doctoral study carried out by Karasar (1999), it was aimed to develop a strategy for the concepts of virtual education and virtual university in the light of communication, education and change, and to determine the future courses and their possible implementations in Turkey.

In a master's thesis carried out by Vural (1999), the effectiveness of individual and group learning methods on internet based learning has been reported. The study group of the research consisted of 36 students from the Ankara University, Faculty of Educational Sciences, and Education program-1 (EPO) and EPO-3 students taking computer courses. In this study no significant statistical differences were found in the success rates between the group in which students were engaged in individual studies, and the group in which students work as a group. No differences were found in terms of gender even though different methods were applied during the research study. However, significant statistical differences were found in the success rates of students based on the arithmetic means of a test carried out between the students working in different classes as groups.

In a master's thesis prepared by Tüzün (1999), the topic of web-based delivery of lessons in higher education institutions has been investigated. In this study the theoretical aspects of web-based education have been investigated. In addition, a sample web-based lesson has been planned, developed and completed.

In a doctoral thesis prepared by Kurubacak (1999), the topics of on-line learning, and the attitudes of students to web-based teaching have been investigated. In a master's thesis carried out by Giray (2000), the topic of integrating a network based intelligent education system with the METU-online has been studied. This study explains how to integrate a network based intelligent system to the MET-online structure. The prepared system helps instructor prepare course syllabuses and also helps students to search the course contents according to their knowledge levels.

In a master's research carried out by Şen (1999), web-based education using the internet and traditional educational methods were compared in Turkey and in the world,

and the effects of web-based education on the learning level were investigated In the statistical analysis carried out in this research, it was found that there was no significant difference between the traditional teaching methods and the web-based teaching method, based on the average results of the last-test, which were corrected based on the results of the pre-test. Also, in the research no significant differences were found in the success rates of students in terms of their gender, age, and the fields of study.

In a master's thesis carried out by Yiğit (1999), the suitability and qualifications of an instructor for the teaching of the Internet using web-based methods has been investigated. In this thesis study because it was required to investigate the current state, students at different ages and from different schools were considered for the study. At the end of the study both numerical and textual results are given.

In a master's thesis prepared by Cebeci (2000), the use of web-based education within the environment of technological education strategies has been investigated. The study showed that web based education will be used in Turkey in the following years and will contribute a great deal to the banking sector and also be used greatly in education.

In a doctoral thesis prepared by Çeliköz (2001), the project activites of students who used hypermedia (www) based learning were investigated. The research, based on qualitative research methods was carried out with four participants. In the beginning, the participants prepared a project idea in the direction of their own requirements and aims, and then in order to realize these ideas they found the necessary data using the www and used it within the projects. The general results obtained in the research were as follows: (1) the participants used different cognitive strategies while searching for data on the www, and these strategies were affected by the investigated properties, and they also affected the formed project by the students, (2) In addition to the knowledge of English, systems knowledge, and knowledge of the topic, the knowledge based computer-internet technologies affected the formed project in different ways., (3) The nature of the formed projects change with the personal properties and with cognitive strategies.

Federico (2001) carried out a research at the Naval Postgraduate School that investigated student attitudes towards various aspects of Web-based instruction. Results of the survey, which were analyzed using a variety of multivariate and univariate

statistical techniques, showed significantly different attitudes towards different dimensions of Web-based education depending on the academic department.

Nicholson (2002) examined differences in the communication levels of master degree students at Syracuse University who used instant messaging (IM) services and those who did not use in the same asynchronous distance education Web-based course. Results showed that students who used IM found it easier to communicate and felt a stronger sense of community.

Jung et al. (2002) investigated the effects of three types of interaction (academic, collaborative, and social) on undergraduate students who were engaged in online education in Korea in terms of their satisfaction, participation, and attitude toward online education. Social interaction with instructor and collaborative interaction with peers were identified as the important factors for enhancing learning and active participation in online discussions.

Some researchers report the viewpoints of online instructor and students and say that human communication takes shorter time in online courses compared to face-to-face courses (e.g., Bonk, Kim & Liu, 2005; Schifter & Monolescu, 2004). Audio and video technologies are argued to help humanize the content delivery of online courses and make learning more engaging and sustainable (e.g., Lee, Tan & Goh, 2004). Audio technologies can be used in such ways as prerecorded lectures, interviews with guests, and sound bytes of content relevant to the course study (McGreal & Elliott, 2004). While video technologies can help alleviate the "page-turning" boredom of online courses, researchers found that they are not well utilized yet (e.g., Teng & Taveras, 2004). The stiff "talking head" of the instructor located at the corner of the course website is the image that quickly comes in one's mind when one considers the use of video technologies in current online courses.

In another study a Web-based tool that allows students to generate multiple-choice questions in a collaborative, distributed setting was evaluated through several comparisons. In this study students first completed a Web-based tutorial on writing effective multiple-choice questions and then authored questions on a given topic. Next, using the Web-based tools, groups of students reviewed and critiqued questions written by others within their group on the same topic. Based on these critiques, students were permitted to modify their original questions. They then were tested on questions

prepared by other groups, either on the same or on other topics. Students who collaborated within a topic scored approximately 7% higher on the test within that topic than students who either collaborated on other topics or did not use the collaboration tool. Of the 336 questions developed, 77% were considered acceptable by the instructor, indicating that the questions could be repurposed for inclusion in future tests. A majority of the critiques were constructive, indicating that the collaborative process was supportive of learning. (Wisher, Robert & Orvis, 2004)

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 (Uzunboylu, 2006) by the European Commission, who provided the necessary infrastructure and equipment, instructor training, encouragement, cooperation, delivery of useful services, and promotion of digital literacy.

Barone & Parod report on the evaluation of a software environment called ClassACT (Class Annotation and Collaboration Tool) in 1997. ClassACT is a hypermedia document management system, a searchable media database, a groupware software application tailored for class based projects. ClassACT was developed at Northwestern University (Illinois) for instructional use, and, although its original goal was to solve a specific problem for a single instructor, it has grown in breadth of functionality and attracted many users and supporters from various disciplines. ClassACT allows an instructor to assemble an on-line collection of multimedia, called a "notebook", for use in a course, and to provide commentary (or annotations) with each of the media in the notebook. Students enrolled in a course using ClassACT have access to the instructor's on-line notebook, and they may create their own versions of the Notebook during the quarter. Students have the choice to keep their own notebooks private (e.g., for self-study) or they may elect to publish their notebooks for the purpose of collaboration or for submission as a formal class assignment.

The Distributed Programming Environment (DPE) is designed and implemented to support an environment for distributed programming on the parallel and distributed programming systems. The DPE implementation is currently working on the Internet. The DPE allows several programmers, project managers, and system managers to cooperate with each other, while they are residing on the different sites all over the world. Cooperative members can work anywhere, even while they are on business

travel carrying notebook computers, by using the DPE with any machine if the machines are connected by the Internet and supported by CORBA (Common Object Request Broker Architecture)/Java. The DPE system provides an environment for distributed programming on the internet.

Karsenti (2001) studied a compulsory web-based course at a Quebec University. Analysis of synchronous conversations, student interviews, and the text of 5,300 e-mails revealed that students needed to acquire new technological skills, which seemingly increased their motivation and enhanced the development of critical thought.

Renaud (2001) has carried out a research at the University of South Africa on the use of distance education in the Computer Information Systems Department. Pascal and Delphi programming languages were taught at the first year of the program. Java programming was then taught in the second year of the program. The study showed that this new teaching strategy allowed the department instructors to teach concepts throughtout their courses rather than isolating them within the programming curriculum. The researchers added that they would be monitoring the progress of students through the new curriculum to see how much students would benefit.

Langton, Hickey & Alterman (2002) designed a tool called GHT (Group Homework Tool) with the aim of building to support synchronous, collaborative coding among novice programmers. Althought the researchers are in the process of evaluating this tool the preliminary findings showed that the combinations of three familiar components of the tool (chat, editor, browser) with some IDE features formed an easy to use environment for working on group programming assignments.

Nokelainen, Miettinen & Kurhila (2002) designed and implemented a real time on-line collaboration tool, EDUCO. The main focus was to demonstrate how the tool can be applied to a real life on-line distance education course. The first experiment with EDUCO was a course at the Department of Computer Science, University of Helsinki, Finland. The topic of the course was Web-based learning. Students (N=24) taking part in the course were expected to form a group of two, pick a topic in the field of web-based learning and prepare a paper and a presentation on the topic. In addition, there were several time-limited mini-tasks given by the instructor on-line, and tasks where the students were supposed to comment on research papers on web-based learning. The data set was gathered in three stages: (1) Pre-Test on the first day of the course measured motivational level and learning

strategies, (2) user log was gathered during the course, and (3) Post-Test after the course measured how students' expectations faced the reality. Preliminary results of the post testing show that:

1) The EDUCO was found to be a useful tool in the matters such as adaptation to respondents learning, cognitive and motivational strategies and means to implement collaborative actions.

2) Presence of EDUCO increased task-related participation and EDUCO was a valued tool for those who had difficulties in participating in face-to-face meetings.

3) EDUCO's tools for seeking work mates (group membership, search function) were truly useful for most of the respondents.

Truong, Bancroft & Roe (2003) describe The Environment for Learning to Program (ELP), an online, active, collaborative and constructive Environment for Learning to Program, which is currently being developed at Queensland University of Technology to help students how to program successfully at an early stage in their learning. ELP allows students to undertake programming exercises by "filling in the blanks" of a partial program. The basic requirements of the system are an internet connection and a web browser which supports the Java Runtime Environment. Research concerning extending the environment to support collaboration between students learning to program is ongoing.

Chang-Hyun & Arnold (2003) have designed and implemented a collaborative programming tool that supports programming in the distributed environment of the internet and real-time multimedia communication, and simultaneous multimedia output among distributed systems. They have presented the implementation of real time multimedia communication facility into a distributed programming environment, which was built for use on the internet. Their future work related to DPE includes audio user interface (AUI) and extension of multimedia communication through whiteboard and voice chatting.

Lotus Notes (http://www.lotus.com/) is definitely one of the pioneers in the area of collaboration and messaging software. Wisher et al. (2004) used a Web-based tool which was evaluated through several comparisons and which allowed students to generate multiple-choice questions in a collaborative, distributed setting. He found that

students who collaborated within a topic scored approximately 7% higher on the test within that topic than students who either collaborated on other topics or did not use the collaboration tool.

A lab-oriented, web-based teaching of internet programming has been implemented successfully at the Open University in Israel (Zviel-Girshin, 2004) and it has been reported that several universities and colleges used this system.

The study of Liu (2005) attempted to investigate the current state of how instructors use technology in online courses. Major results include that asynchronous discussion was perceived as being very important or necessary to be used in online courses; while audio/video and real time chat were perceived as less important or less necessary. In this study how the instructor used these technologies in their courses was reported in the relevant literature. Positive correlations were found between the instructors' perceived importance and necessity of the technology, and how they used it. The results of the study contributed to the relevant research, and were expected to help online administrators, instructional designers, instructional and technical support staff, and tool developers with developing better tools, offering appropriate workshops, and providing corresponding support.

A learning object based teaching of a programming language has been implemented at the Carnegie Mellon University (Adamchik & Gunawardena, 2003).

Many researchers have compared the performance of online students with students participating in traditional classrooms (Moore & Thompson, 1990). Uzunboylu (2004) has found that the English language grammar achievement of the experimental groups' students, who conducted English grammar exercises on the Web, was higher than the control groups' students who conducted those using traditional methods. Schultz (2001), who investigated online education at Virginia Community College, found that students liked the convenience of online education but disliked the lack of personal interaction. Peters (2001) found that students with home computers see online education as more convenient than students who lack computer access. Crotty (2000) identified time as a factor that affected student attitudes, particularly among working students. Although many online students have expressed positive attitudes and support for online instruction (Chang, 2000), few studies have addressed student and instructor experiences (Hara & Kling, 2000; Schrum, 1998). The use of computers, internet

technologies and online education requires more positive attitudes than found among the sample of instructor in this study employed by state schools in North Cyprus, whose attitudes were slightly positive (Uzunboylu, 2007). Many factors affect student attitudes toward online education. Cashion & Palmieri (2002) investigated the perceptions of online students toward online education. The vast majority (71%) believed that online education provided high-quality education.

As a conclusion, if the research related to the teaching of programming languages is investigated over time chronologically, one can see that different technologies were used at different times. During the period of teaching programming languages the first technological aids such as the overhead projector is now considered to be obsolete. Later, with the wide-spread use of computers in teaching and learning one can see that computer aided teaching of programming languages has gained popularity.

With the development of the internet and the globalization of the world, the dependency on place and time to reach knowledge has decreased. As a result of this independence over the internet using web-based teaching, the attention of the researchers moved in this direction. Wide-spread research carried out in this area showed that internet communication tools (such as e-mail, chat, forums etc) are currently used for web-based teaching and learning by instructors and students together, and the students themselves. It was observed that research at the masters and doctoral levels were being carried out in Turkey and in other countries for the web-based teaching of programming languages. It was observed that very little, if none, research is done on the use of collaborative tools, which are required for the teaching of programming languages in a web-based environment. Most of the research in this field is done using web-based education in a limited way. Because of the use of internet in teaching and learning, and the use of web-based teaching are newly developed applications and fields, it is questionable how useful these researches could be in order to satisfy the research and development requirements of the related fields. As a last word, one can say that more research is needed in the fields of web-based teaching of programming languages.

CHAPTER 3

CONCEPTUAL FRAMEWORK

3.1 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 by the technology such as video conferencing, videotape, satellite broadcast, TV broadcast, internet, and so on. In 1996, participation in web-based higher education courses was

estimated to be 1 million students and projected to be 3 million by 2000 (Edelson, 1998).

Current research shows that educational institutions are increasingly embracing new technologies and software to aid instruction. At the same time, the concept of cooperative learning is gaining acceptance and a place in the classroom. The use of an online model for designing and delivering courses in academic settings is increasing rapidly and has become an important topic of the studies. However, this model is not the only tool used to improve online activities into curriculum.

Audio, computer, and video teleconferencing, because of their interactive nature, encourage collaboration. Moore (1994a) describes audio-conferencing as a learner-centered, relatively inexpensive, robust, and flexible medium that can be well integrated with other media in a distance education program. This undervalued technology has been used worldwide to link university students at different sites. For example, Moore reports that he teaches a class via audio-conference from the Pennsylvania State University to ninety students located in nine cities in four countries. Electronic mail networks and listserver represent other modes of technology that promote interaction and collaboration among students at different locations. McMann (1994), in a discussion of the moderator role in computer-mediated conferencing, refers to a situation in which students who have difficulty connecting to the service in the first few weeks of class were assisted, given advice and encouraged on the use of the service. This type of collaborative and supportive action is seldom witnessed in traditional classrooms. Students who were taught via two-way videoconferencing can collaborate on research and coursework with other distance students, instructor, and outside experts (Hakes et al., 1993).

Although distance 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 courses delivered in traditional method in a classroom. Rosetti & Surynt (1984) found that the students who used video conferencing outperformed compared to the traditional face-to-face group. Similarly, Haynes & Dillon (1992) compared the traditional learning and two-way video conferencing and found no significant differences in between these groups in terms of

their learning gains. Some studies have shown that participants in distant education programs were more motivated, self-directed and achieved than the participants in traditional classrooms (Biner et al., 1995).

3.2 Online Learning

Online learning is an important medium for designing and delivering instruction by addressing a variety of learning strategies (Khan & Vega, 1997).

The learners in online generally are responsible for their learning process and results (Reeves & Reeves, 1997), and have the freedom to move anywhere all over the world (Soloway, Guzdial & Hal, 1994), In their learning processes, they are free in their choice of content, time, resources, feedback in their learning processes (Khan, 1997). They can explore existing resources and information according to their needs and interests (Dyrli & Kinnanman, 1996; Farr & Tone, 1994; Khan, 1997), construct their own knowledge by engaging learners' thinking skills (Duffy & Cunningham, 1996; Jonassen, 1999), learn through exploring the foundations, justifications, decisions and value of a fact, principle, skill or concept knowledge (Jonassen, 1999), have a choice whether actively participate in learning activities or just observe them in the background (Kirkley & Bolling, 1995), and meet their own specific needs in self-paced and self-assessing environment (Khan, 1997)

3.2.1 The Process of Learning

Concerning changing needs of learners, it is important to track the recent changes that have taken place in the domain of learning theory. The behaviorists' views of learning as a product of controlled stimulus and rewards have given way to a new view of cognitive and affective factors which contribute to the overall learning process. There are new insights into understanding how people learn in general, gender differences in learning approaches, and how women and men learn with technology, and the role attitudes and other affective factors play in the overall learning environment.

In the cognitive area, new research on brain functions, as well as differences in brain functionality by gender informs us with new implications in teaching and learning.

Different views on the definition of intelligence have recently been posited by Sternberg (1996), Goleman (1996), Coles (1997) and Gardner (1999). Sternberg challenges the traditional paper and pencil approaches to measuring intelligence, and finds that the traditional intelligence tests does not measure practical ability, a person's ability to adapt to diverse conditions, and creative intelligence.

The implications of social aspects of learning have been explored in research, and have presented an opportunity to learn how to better manage successful outcomes using knowledge. A newer concept is the view of the brain as a social being (Gazzaniga, 1985). This is important in understanding that learning can be optimized when learning takes place with others. The model that assumes that the instructor is the information provider and the student is only a passive recipient is now being challenged, due to the new beliefs in learning through collaborative experiences (Cross, 1998).

The collaborative view supports the belief that learning is a continual construction project. People have a finite capacity of short-term memory, and long-term memory depends on the processing and working of short-term memory. The opportunity to build new collaborative learning environments is warranted based on the research which implies that students actually learn better while doing, and learn more when they are actively engaged in their learning. Technology can play a key role in facilitating collaboration.

In the second half of the twentieth century, the most popular approach to teaching and learning has been associated with the theory of constructivisim. This dominant contemporary theory is built upon work done by Piaget, Vygotsky, and Seymour Papert. In the constructivist's view, the learner is an active organism within the environment, not just responding to stimuli, but also engaging, grappling, and seeking to make sense of things. Knowledge is generated internally, not aborted from an external source. Constructivists view motivation as intrinsic, not a product of the behaviorist's rewards and punishments system (Duffy & Cunningham, 1996).

There has been a great deal of research conducted during the 1970s, 1980s, and early 1990s on the effects of computer use on student achievement, attitudes, and other variables, such as learning rate. Research studies cover a wide range of topics, and computerized learning activities that supplement conventional instruction; from the use

of computers as sole instructional mediums, to the use of computers for research, word processing and for programming (Kulik & Kulik, 1984, 1987, 1994). Most of the research studies look at the role of computer aided instruction, often called Computer Based Instruction, or instructional software. It is important to keep in mind that computer based instruction is changing rapidly, and that the scope of studies reviewed covers many different types of computer software. These types of software include drill and practice software which is connected to other curriculum, games, and some integrated learning systems. Computer hardware processing power and costs have made expensive software unaffordable in many schools, so the quality of software used and the approaches used to acquire and deliver the software often compromise the learning quality. Very few of the software programs evaluated in Kulik's studies are compared to the high quality of the software available today (Schutte, 1996).

Over the past 20 years, there have been four different generations of instructional software, following the availability of different operating systems. First generation products were text based, typically running under DOS. Second generation products were built with rudimentary graphics and typically provided practice functionality instead of instruction. Third generation products were designed to deliver a rich media learning experience typically via interactive CD-ROMs. These products included engaging multi-media, such as interactive encyclopedias, which offered limited instruction. Fourth generation products are available now. These products utilize audio, graphics, animation and text in a way that has been proven to deliver increases in learning retention by stimulating both right and left brain engagement. Animation and graphics, combined with programmed logic allows software to adapt to user input, providing a richer learning environment.

Research in the social context of learning provides substantial support that traditional instructor-centered approaches must be replaced with learner-centered environments in educational environments (Alexander & Murphy, 1994). Unlike traditional learning settings, online learning is a complex process that supports a student-centered learning environment, and involves interaction among learners, instructions, contents and the educational environment.

Schutte (1996) reports that a well-designed online learning must provide higher peer contact, better understanding of course materials, greater effect on learning, more

flexibility, and more time spend on classroom work. However, the use of new forms of communication technology necessitates additional assessments of student needs, experience level, and access to technology (Harry 1992; Hedberg & McNamara 1989; Milheim 1991).

3.3 Learning Management Systems

A Learning Management System (LMS) is a software system used to deliver on-line education. Alternative terms often used are *managed learning environment*, *virtual learning management environment*, *course management system* or *learning support system* (Chavan, 2005).

An 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. Some of the important issues when evaluating a learning management system are (Hall, 2003) high availability, scalability, usability, interoperability, stability, and the security. 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 (XML or SOAP), and support the various learning standards such as Instructional Management System (IMS), the Institute of Electrical and Electronics Engineers, Inc.,(IEEE), and the Sharable Content Object Reference Model (SCORM).

LMS systems run on a server and are accessed by the students and the instructor using a web browser. The server is usually located in a university laboratory but can be accessed from anywhere in the world with an internet connection. LMS systems are simply computer programs which enable the instructor to prepare course notes through text, video and audio clips, pictures and other multimedia resources. The syllabus is simply uploaded to the server and the need to create Hypertext Markup Language (HTML) pages and then to File Transfer Protocol (FTP) them to the server has been eliminated. In addition, quizzes and surveys can be prepared to give students rapid feedback on their performance. Forums and chats are other features of most LMS

systems and they provide a means of communication outside the classroom meetings. Chats enable the students to easily and quickly communicate and exchange ideas with other students in the same course. Students can learn about their performances by examining their grade books in private. This point is important as it avoids the delivery of grades by standard mail.

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, Atutor, 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. (Dougiamas & Taylor, 2003). *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 an 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.

3.4 Open Source Software

Although Open Source software has existed since the 1960's (Weber, 2004), only in the last few years it has received more attention. In 1983 the Free Software Foundation was founded by Richard Stallman (Hars & Ou, 2002). The term *Open Source* was introduced in 1998 (Raymond, 1998). Since then more and more companies

have taken an interest in Open Source software. Recently Novell acquired Linux, one of the distributions of the Linux operating system, took their embrace of Open Source a step further (Novell, 2003), and expanded the enterprise market for Linux.

Linux and Open Source are often linked in Open Source literature, and it may seem that Linux and its added software are all there in the Open Source market. However, Open Source software is much more than Linux and Linux- compatible software (O'Reilly, 1999). Many more examples of Open Source software exist, such as the Apache web server, with a market share of almost 70% (Netcraft, 2005), the web language Hypertext Pre-Processor (PHP), the database server My Structured Query Language (MySQL), the office suite OpenOffice.org and a very large number of web applications (Wheeler, 2004).

The source code, or the instructions that make up the "recipe" for software package (Weber, 2004), is freely available to its users in the case of Open Source software. The term Open Source is defined by the Open Source Initiative (OSI) in the Open Source Definition (OSI, 2002). The full definition can be seen in Appendix A and can be summarized as:

- The software must be freely distributable
- The source code must be included in the distribution or there is a well-publicized method of obtaining the source code
- Derived works and modifications are allowed
- The license must not be specific to a product, and not be restricted by other software and be technology-neutral. The following sections give some background information on Open Source software, the development process and the culture, which helps us understand the Open Source movement as a whole and the unique characteristics of Open Source software that are used in the evaluation process.

3.4.1 Open Source Software Development

Open Source software offers the source code along with the software, at no charge. This enables users to change the instructions of the software, change its behavior, add functionality, and so on. It gives anyone the opportunity to participate in the development of the software project (Wheeler, 2004).

Open Source projects are, in most cases, run on the internet. In fact, the internet enabled Open Source projects are supported by forums and they grow (Weber, 2004). Open Source projects' websites carry a great deal of information: discussions, documentation, bug databases, and so on. This information is very valuable for the evaluation of Open Source software. Most Open Source projects encourage users to participate in the project in any way they can, except perhaps in distribution costs, from filing bug reports to development of the source code. When the user wants something changed or added to the software, he is at liberty to do it himself/herself, but by working together with the project community and contribute the changes in source code back to the project, the code will be a part of the software for everyone, which will be kept maintained and problems avoided when upgrading the software. If the user keeps the code secret to himself or herself, then he or she will have to find ways to integrate any corrections or updates to the software (Glass, 2003). Open Source software developers work together voluntarily to create and improve a product they want to use. They also get a certain satisfaction from being part of the project. There are a number of articles available on the motivation of Open Source software development, such as Hars & Ou (2002) and Hertel (2003).

3.4.2 Free or Open Source

The term "Open Source" was first introduced by Eric. S. Raymond in 1998 to eliminate the confusion that came with the term f*ree software*. Here *free* meant freedom, also indicated by the term l*ibre*. Another way to describe it is "free as in speech, not free as in beer" (Weber, 2004, p.5). However, *free* is also used for software that is emphasis at no cost, but without the source code being available. This type of software is often labeled as *freeware*. Today there are still advocates of using the term *Free/Libre Software* instead of *Open Source Software*, mainly on the side of the Free Software Foundation (FSF) (FSF, 2005)

A key principle that is also reflected in the license that is used and promoted by the FSF, the GNU General Public License (GNU GPL), is copyleft. A copyleft license uses copyright to protect the licensed source code from becoming incorporated in closed source software. Anything that is licensed under a copyleft license has to stay under that license, including any derivatives (Weber, 2004).

3.4.3 Open Source Software in Education

Open Source has been getting more attention in education in the last few years. Many large and small corporations have taken an interest in this growing software market that shows some strong differences with traditional software.

Several articles, one of which is entitled which "Open Source Opens E-learning" (Coppola & Neelley, 2004), argue that Open Source is very suitable for use in higher education, because of tight budgets and the fact that educational institutions often have some good software engineers on their staff, among other things. It seems that though Open Source seems a logical choice for universities.

3.5 Collaborative Online Learning

Collaborative online learning is a learning process that emphasizes group or cooperative efforts among learners and instructors on the Web (Hiltz, 1997). Collaborative work covers active participation and interaction. Online learning stresses active participation and interaction between learners and learners, between learners and instructors, and between learners and experts (Bonk, Medury & Reynolds, 1994; Harasim, Calvert & Groeneboer, 1997). Therefore, an online learning model can organize and structure online interactions among learners, instructor, and experts from outside and/or global online sources with no time and space limitations (Sherry & Wilson, 1997; Harasim, Calvart & Groeneboer, 1997; Gamas & Solberg, 1997). This model, also, can encourage and engage learners to work together on their learning activities (Relan & Gillani, 1997).

Collaboration between groups of students at distance locations is another component of successful distance education courses in higher education, one of which appears to be aided by the integrative nature of the technology (Murphy, 1993).

There are several benefits of giving students assignments which they can work on collaboratively. The benefits of collaborative programming has been known and used in industry for some years (Williams & Upchurch, 2001). Roschelle (2003) and Chi et al., (1989) report that 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 have 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? The benefits of collaborative learning are well known and a recent study of students in Introductory Computer Science courses demonstrated that those who worked in pairs performed significantly better on programming projects than students who worked alone (McDowell et al., 2002). Chase & Okie (2000) state that introducing collaborative learning to the curriculum of their Introductory Computer Science courses decreased the combined rate of withdrawal and failure from 56% to 33%. It is also a well known fact that giving students assignments on which they can work on collaboratively allow them to undertake more complicated problems and complete the work in a shorter time scale (Roschelle, 2003). The advantages of collaborative learning using a computer tool has been analyzed in the computer science laboratory and the results have been reported to be very successful (Langton, Hickey, & Alterman, 2002).

3.6 Theoretical Framework

The theoretical framework used for building the virtual learning environment in this experimental study for undergraduate students of Computer Information Systems Department is a blend of learning theories derived from cognitive, “meaning-making” learning theory, situated learning theory and constructivist learning theory.

This experimental study is significant for it looked at pertinent online interactive and collaboration processes in web-based learning as related to a particular constructivist model of learning. The relatedness of web-based, synchronous collaboration and the pedagogical application of constructivist learning theory provided a very interesting focus for this study.

The main stance of this study is that present educational technology may effectively support constructivist learning. Constructivism is emerging as a philosophical stance toward education that aligns itself with the claims about Web-based synchronous collaboration (via collaborative tool). Both constructivism and Web-based synchronous collaboration assume that effective learning relies on active engagement by the student, and high levels of interaction in social-dialogical environments and in real-world situations. Through socially based interaction, such as collaboration, mentoring, peer tutoring, and negotiation of meaning, students are able to construct knowledge, and this leads to meaning-making (Sheingold, 1991; Jonassen et al., 1995).

An increased facilitation of student interaction is moving the distance education paradigm toward networking via the internet and Web, which provide a "many-to-many" communication setup (Harasim, 1990). It appears that Web-based learning may support instructional strategies for improving collaborative activities, a key part of constructivist thinking (Lebow, 1993). In addition, constructivist approaches in education, such as situated learning (Lave & Wenger, 1991) and collaborative learning (Sharan & Sharan, 1992), have gained popularity. Linking constructivist theory and associated instructional strategies to Web-based courses might provide valuable educational results in higher education (Bannan-Ritland et al., 1999).

First, learning, learners and collaborative tools are necessarily the focal points while discussing constructivist learning principles as applied to this experimental study. Learning strategies are defined by Weinstein & Mayer (1986) as thoughts and behaviors that are intended to influence how a person learns, thinks, and motivates self in order to carry out a learning task. Studies indicate that capable learners use a variety of cognitive strategies (select, organize, and integrate information), as well as use metacognitive strategies (plan, evaluate, and regulate learning) (Derry & Murphy, 1986; Glaser, 1978).

Capable learners are also self-directed, as having the capacity to design and carry out their own learning activities (Thomas & Rohwer, 1986).

More recently, Web-based online learning environments have shown promise for more sophisticated group-based learning strategies, such as those found under the wide epistemology of constructivism (e.g., collaborative learning; Kaye, 1992).

Learning strategy, based on a constructivist perspective takes a learner-centered approach, and contends that meaning and knowledge constructed by the learner through a process of relating new information to prior knowledge and experience. Learning is viewed as an active, purposeful, and meaning-generating process that occurs within the learner (Shuell, 1986). Learning involves the transformation of information into meaningful knowledge; that is, personally relevant meaning emerges from utilizing cognitive strategies to generate understanding and construct knowledge from learning events (Jonassen, 1995).

During this study, students as active participants in their own learning are supported by many other researchers in adult learning. Knowles (1980) suggested that to create effective learning environments for adults, it is necessary to involve learners in planning the learning experiences, creating their own objectives and goals, and in evaluating themselves and their peers. Elias & Merriam (1980) posited that effective adult learning comes through discovery, experience, collaboration and interaction with peers; and that this is best accomplished through facilitation by the instructor as opposed to direct teaching.

Brookfield's (1986) ideas who reports that effective adult pedagogy include the following principles: (1) the instructor must be a facilitator, a learning guide; (2) adult learning is a continual active process of collaboration, reflection, self-analysis, and co-empowerment; and, (3) the elements composing peer interaction (feedback, critical reflection, collegiality, self-assessment, peer assessment) are very important .

Studies provide evidence that constructivist based environments, which are student-centered, contribute to student satisfaction and learning (Garrison, 1993; Candy, 1991; LeBaron & Bragg, 1994). Constructivist instructional strategies, such as situated learning, have been found to be suitable for learning at a distance (Hummel, 1993), where learning occurs in contexts of social activity. That is, the cognitive processes of

learning are situated in the interactions with other people, in such activities as problem solving.

For example, the following are researchers' findings that explicate the last point:

1. Independence of the student is a critical factor in learning (Wedemeyer, 1981).
2. The learner needs to have control, and to take responsibility for pace of own progress (Keegan, 1986).
3. The learning environment must be "learner-determined", allowing for self-directed learning (Moore, 1994a).
4. Educational environments can facilitate learning by supporting dialogic exchange of questions, answers, arguments, comments, feedback (Harasim et al., 1995; Holmberg, 1986).
5. High levels of interaction (e.g., discussion, feedback) are an effective way of learning (Perraton, 1988).

Distance education seems capable of absorbing a merger of constructivist learning principles and the latest evolutions of Web-based instructional environments. Gunawardena & Zittle (1995) identified five areas that need to be studied on effective distance instruction: learner-centered instruction, interaction, social presence, cognitive strategies, and collaborative learning.

If the focus of the instructional environment is on interaction, it follows that it would most likely be a learner-centered approach (Bruner, 1966) that facilitates interaction between instructor and classmates. Virtual educational environment which is high in interaction encourages students to develop cognitive strategies (Henri, 1992), and facilitates collaborative learning instructional strategies (Kaye, 1992). The key is surmised to be in the interaction. That is the focal point, the unifying center.

Interaction is a widely discussed phenomenon of distance learning. Going back to a study conducted in 1973, Moore, a leading pioneer in this area, outlined a model of distance education that described distance education as a function of two variables: structure and dialogue. Dialogue represented interaction, communication, and correspondence. Structure referred to the organization of the course (e.g., delivery of instruction via computer conferencing), and contained the dialogue (student-student and

student-instructor interaction). So, different technologically-mediated structures allow for and produce different types, amounts, and high quality of dialogues.

Kearsley (1995) stated that descriptive studies are needed to provide a clear picture of interactivity as it now exists in current distance education courses. He suggested that we need studies that reveal how the different types of delivery systems affect the learning processes (e.g., knowledge-building). He also added that for each distance education program value of interaction should be evaluated on a case-by-case basis.

In this experimental study, a highly interactive and collaborative teaching environment has been created by supporting Moodle with the collaborative learning tool *Groupware Research in Education and the Workforce Project (GREWPTool)* (Taneva et al., 2004). LMS (Moodle) and collaborative learning tool (GREWPTool) are used together in NEU-VLE (Near East University-Virtual Learning Environment) because mixtures of technologies will always produce better results than any single technology. Moodle enables the students to follow the course notes on the web, to carry out quizzes and surveys, and to provide communication outside the classroom by means of chat tools. GREWPTool supports the LMS based learning activity by providing a high level of collaboration amongst students. Students and the instructor can meet and exchange information using the GREWPTool. The thesis has been carried out at the Near East University using the Moodle together with GREWPTool.

CHAPTER 4

THE *MOODLE* LEARNING MANAGEMENT SYSTEM AND *GREWPTool* COLLABORATIVE LEARNING TOOL

4.1 Virtual Learning Environment

Virtual learning environments represent an entirely new form of educational technology. A virtual learning environment (VLE) is a set of teaching and learning tools designed to enhance students' learning experiences by including computers and the internet in the learning process. This environment resides in online, and is dependent on the technology of the internet in order to be able to exist.

The principal components of virtual learning environments are as follows:

- mapping of the curriculum into course topics that can be assessed and recorded;
- tracking of student activity and achievement within the curriculum presented online;
- support of online learning, including access to learning resources, assessment and guidance;
- online tutor support;
- peer group support;
- general communications, including email, group discussion and web access;
- links to other systems, both in-house and externally;

(Everett, 2002; Morrisson, 2003, p.178)

A virtual learning environment may support similar forms of learning to a *real* one but it is not a physical space like a classroom or lecture theatre, and learners may

work closely together while not being active at the same time. Another characteristic of virtual learning environments that brings uniqueness to the development and design of course materials and discussion via online resources is the presence of asynchronous learning. If virtual learning environments physically separate both instructor and students in both time and space, then learning is asynchronous; learning occurs in different places at different times. In comparison, learning is said to be synchronous if learning occurs in the same time and place, usually in a physical classroom setting within a school (Picciano, 2001).

Over sixty VLE courses are available (edu tools, 2004) (http://www.edutools.info/course/). Many are commercial systems, where licenses are sold per student per course and cost many thousands of pounds per year for a large institution, (see Appendix B).

4.2 MOODLE Learning Management System

Moodle is a learning management system - a software package designed to help educators create quality online courses. Such e-learning systems are also called Learning Management Systems (LMS) or Virtual Learning Environments (VLE). Moodle is the brainchild of Martin Dougiamas, who designed the program while working on his Ph.D. at Curtin University of Technology, Perth, Australia. But later it has developed into a powerful, open source system, with over 2000 registered users world-wide.

The word Moodle is an acronym for Modular Object-Oriented Dynamic Learning Environment, which is mostly useful to programmers and education theorists. It's also a verb that describes the process of lazily meandering through something, doing things as it occurs to you, an enjoyable tinkering that often leads to insight and creativity. As such it applies both to the way Moodle was developed, and to the way a student or instructor might approach studying or teaching an online course (http://www.cgi-bin.com/Detailed/1538.html).

Moodle is an ongoing development project designed to support a social constructionist framework of education. Moodle is provided freely as Open Source

software (under the GNU Public License see Appendix C). Basically this means Moodle is copyrighted, but that you have additional freedoms. You are allowed to copy, use and modify Moodle if you agree to provide the source to others; to not modify or remove the original license, and apply this same license to any derivative work.

There are courses for users of Moodle in 40 plus languages and Moodle site claims to have more than 3200 sites in more than 115 countries. The Moodle community within New Zealand has started hosting Moodle user conferences.

4.2.1 System Requirements for MOODLE

Moodle can run on virtually any computer, Windows, Macintosh OSX or Unix, as long as the following components are installed on the computer:

1) An Apache web server, (see Appendix D)

2) PHP (Hypertext Pre-Processor) scripting language (version 4.1.0 or later). PHP 5 is supported as of Moodle 1.4.3.

3) A database server, usually but not limited to MySQL.

Application exists for all platforms and are listed under "Installing Apache, MySQL and PHP" at http://moodle.org/doc/.

Table 4.1 gives the basic properties of the Moodle LMS system.

Table 4.1: Properties of the Moodle LMS System

Version	1.4.3
Release date	01/10/2004
Company	Open Source
Web server	Apache
Scripting language	PHP (version 4.1.0 or later)
Database server	MySQL, PostgreSQL, Oracle, Access, Interbase, ODBC
Operating System Support	Unix, Linux, Windows, Mac OS X, Netware
Language	50 language packs, including: Arabic,

	Catalan, Chinese (simplified and traditional), Czech, Danish, Dutch, English (UK and US versions), Finnish, French (France and Canada Versions), German, Greek, Hungarian, Indonesian, Italian, Japanese, Maori, Norwegian, Polish, Portuguese (Portugal and Brazil), Romanian, Russian, Slovak, Spanish, Swedish, Thai and Turkish.
Size	12.5 MB.
Category	LMS
License	General Public License (GNU)
Download	www.moodle.com
Design Philosophy	Social Constructionist Pedagogy

4.2.2 Moodle Philosophy

The design and development of Moodle is guided by a particular philosophy of learning, a way of thinking that you may see referred to in shorthand as "social constructionist pedagogy" (http://moodle.org/doc/?frame=philosophy.html).

4.2.2.1 Constructivism Learning

Dougiamas (2004) said that students actively construct new knowledge as they interact with their environment. Everything one reads, sees, hears, feels, and touches are tested against their prior knowledge and if it is viable within their mental world, may form new knowledge that they can carry with. Knowledge is strengthened if one can use it successfully in their wider environment. One is not just a memory bank passively absorbing information, nor can knowledge be transmitted to a student just by reading something or listening to someone. This is not to say that a student can not learn anything from reading a web page or watching a lecture, obviously they can, it is just pointing out that there is more interpretation going on than a transfer of information from one brain to another students learn by constructing knowledge, usually by

experience and activity, rather than through the delivery of content (http://moodle.org/doc/?frame=philosophy.html).

4.2.2.2 Constructionism Learning

In the documentation of Moodle LMS, Constructionism asserts that learning is particularly effective when constructing something for others to experience. This can be anything from a spoken sentence or an internet posting, to more complex artifacts like a painting, a house or a software package. For example, you might read this page several times and still forget it by tomorrow – but if you were to try and explain these ideas to someone else in your own words, or produce a slideshow that explains these concepts, then it is guaranteed you would have a better understanding that is more integrated into your own ideas. This is why students take notes during lectures, even if they never read the notes again (http://moodle.org/doc/?frame=philosophy.html).

Diament (2004) reported that in Constructionism, learning occurs if students actually create a product, which could be shared with others. Concerning the theory of Constructionism in this experimental study this learning theory was made use of

- the glossary allows students to contribute definitions of key term
- files by students could be shared by attaching to forum posts
- assignment files could be uploaded and feedback given on line
- with care, students could be share their opinions with classmates and course instructor on collaboration session.

4.2.2.3 Social Constructivism Learning

Social Constructivism extends the above ideas into a social group constructing things for one another, collaboratively creating a small culture of shared artifacts with shared meanings. When one is immersed within a culture like this, one is learning all the time about how to be a part of that culture, on many levels. A very simple example is an object like a cup. The object can be used for many purposes, but its shape suggests it is used some knowledge about carrying liquids. A more complex example is an online course – not only do the "shapes" of the software tools indicate certain things abut the way online courses should work, but the activities and texts produced within the group as a whole helps shape how each person behaves within that group. (http://moodle.org/doc/?frame=philosophy.html).

Diament (2004) reported that Constructivism is best achieved in groups: Moodle has features to encourage discussion and shared learning:

- Central are the discussion forums, where instructor pose open questions for discussion
- Chat rooms can be used for real-time communication
- The workshop module facilitates peer review of assignments
- Contributions to forums can be rated

4.2.2.4 Connected and Separate Learning

Connected and Separate idea looks deeper into the motivations of individuals within a discussion. *Separate* behavior is when someone tries to remain objective and factual, and tends to defend their own ideas using logic to find holes in their opponent's ideas. *Connected* behavior is a more empathic approach that accepts subjectivity, tries to listen and ask questions which is an effort to understand the other's point of view. *Constructed* behavior is when a person is sensitive to both of these approaches and is able to choose either of them as appropriate to the current situation (Dougiamas (2004).

In general, a healthy amount of connected behavior within a learning community is a very powerful stimulant for learning, not only bringing student closer together but

promoting deeper reflection and re-examination of their existing beliefs (http://moodle.org/doc/?frame=philosophy.html).

Separate and connected learning dimension is analogous to objective –connected learning is where there is an emotional response or opinions expressed; separate is the other end of the spectrum. It is suggested that connected learning has more personal involvement and deeper learning. It is most valuable to use this dimension in forum postings and journals.

4.2.3 The Reasons for Choosing the MOODLE

Sabine & Beate (2002) selected 36 platforms and they applied qualitative weight and sum approach and they used to identify the most suitable open source e-learning platform. Nine platforms (ATutor 1.4.1, Dokeos 1.5.5, dotLRN 2.0.3, based on Open ACS 5.1.0, ILIAS 3.2.4, LON-CAPA 1.1.3, Moodle 1.4.1, OpenUSS 1.4 extended with Freestyle Learning 3.2, Sakai 1.0, and Spaghettilearning 1.1) met the criteria and these platforms were analysed in detail. They reported that Moodle obtained the best results in general as well as in the specific adaptation evaluation.

Karin van den Berg (2005) proposed a model for Open Source software evaluation in his master's thesis, which can be used as a tool to find the right software package to meet the user's needs. This research project was performed at Tilburg University in the Department of Information Systems and Management. The goal was to get a better understanding of Open Source software and to make the Open Source software process more understandable for those who evaluate this type of software. Open Source software evaluation model, using the criteria found in Open Source literature: Community, release activity, longevity, license, support, documentation, security, functionality, integration, goal and origin. These criteria were selected because they can be evaluated quickly for each candidate in order to eliminate non-viable candidates and select the best ones. In this case study the model is applied on a candidate list of 36 systems, and evaluation is performed on the top two systems found in the selection step. This evaluation led to a clear conclusion. The best system in this

evaluation is the Course Management System called the Moodle. The results of the case study are consistent with the real life performance of the Course Management Systems.

Moodle was short-listed in the COL (2003) report and the Clements report (2003). Moodle was suspected and therefore not recommended in the year of 2003, due to the fact that is features were not as elaborate as they are now. Moodle has got coverage by many technology-oriented news sources, as well as Linux Journal and a large number or research papers, all of which can be found on the "Moodle Buzz" page (Moodle, 2005). Moodle has also been chosen by a joined effort of two E-learning projects in New Zealand. "NZ Open Source VLE project" (http://ose.nz.org) and "The Open Source Courseware Initiative New Zealand" (http://www.elearning.ac.nz) have chosen to use Moodle after comparing several systems (Ose.Nz.Org, 2004).

McMullin & Munro (2004) said that between 2001 and 2003 the WebCT VLE was successfully deployed on a pilot basis at Dublin City University (DCU) in UK but their future e-learning strategy was initiated in June 2003 for DCU well into the future. The aim is to become "leader in the development of effective learning technologies" (Leading change, 2001). The closed source architecture of proprietary VLEs, such as WebCT, would make it difficult to achieve this objective. An open source VLE, offers the maximum flexibility to develop and experiment with innovative new functionalities, while exploiting the common features of the underlying platform. Many commercial products, WebCT are driven by an American/Canadian pedagogical paradigm; so it is not entirely compatible with UK teaching and learning methodologies. In addition, WebCT is very expensive. In order to achieve their aims, DCU has formed a group and assessed various types of LMS systems. At the end of the assessment, Moodle, Claroline and Bodington were chosen. Each system was then installed on a test server and university staff carried out a detailed appraisal system. The systems were assessed based on the following properties: functionality, usability, general pedagogy, technical viability, accessibility existing user community and projected lifespan of the products. As a result of this overall evaluation, Moodle was identified as the top-ranked candidate for an institution-wide deployment at DCU. Moodle is an open source software so it is usually developed as a public collaboration and the source code is freely available for users to modify.

Now, the Open University's (OU's) Learning and Teaching Office has started a new programme worth nearly £5 million to build a comprehensive online student learning environment for the 21st century. The new LMS, which appeared in May of 2006, and expected to be fully operational in February 2007. Moodle is a free, Open Source software package course management system used by educators to create effective online learning communities. According to OU's about page, they have "around 150,000 undergraduate and more than 30,000 postgraduate students" (http://kairosnews.org/node/4511).

Several articles, among which "Open Source Opens E-learning" (Coppola & Neelley, 2004), argue that Open Source is very suitable for use in higher education, because of tight budgets and the fact that educational institutions often have some good software engineers on their staff, among other things. It seems that though Open Source seems a logical choice for universities, not many have taken an interest in this software so far.

Athabasca University (AU), a leader in distance and online education, has adopted Moodle as its primary vehicle for online teaching. AU is currently piloting 11 undergraduate and graduate courses using Moodle. Implementation of Moodle will be phased in over the next 24 months.

4.3 GREWPTool Collaborative Learning Tool

GREWPTool is a tool developed by the GREWP (Groupware Research in Education and the Workforce Project) team in the Computer Science Department at Brandeis University to support shared editing. It has been developed as part of a research project funded by the National Science Foundation under Grant No. EIA-0082393. Students and the instructor can meet and exchange information using the GREWPTool (available at http://groupscheme.sourceforge.net/grewpedit). GREWPTool is the brainchild of Kenroy Granville, who designed the program while working on his Ph.D thesis.

This effectively drops the constraints of turn taking, and allows for a richer interaction. The result was a powerful tool that can be used to provide interactive

lectures, structure classroom activity, and facilitate paired programming during laboratories.

The GREWPTool is disseminated as an open source project. It is implemented in Java and has been tested on a wide variety of platforms including Windows, Linuix, and Mac (OS 10+).

GREWPTool is composed of 11 integrated pieces of software in the following frames:

1. IM-like chat,
2. online member list,
3. a synchronous shared editor,
4. interactive output screen,
5. a color palette,
6. member list for private message,
7. list of programming languages,
8. compile button,
9. run button,
10. save chat,
11. save program source code.

The chat frame enables communication outside the source code in the editor. Students can watch each other's browsing activities. The editor allows students to write to the same piece of code simultaneously. The color palette uses to choose different color for each member. On the left hand, online students list can be seen. Private message can be sent to the concerned member easily. For this purpose you only click on the name of person. After choosing the programming language from list, the user only click compile button to control the errors. After that, the "run" button can be clicked to run the program. At the end of a synchronous session the chat that took place can be recorded if desired. The source code of the program developed jointly during a session can also be recorded.

4.4 Types of Collaborative Tools

There are basically two types of collaborative learning tools in this study: *the Advanced Collaborative Learning Tool (ACLT)* (see Figure 4.1), and *the Standard Collaborative Learning Tool (SCLT)* (see Figure 4.2). The main difference between the two is that the ACLT enables students to compile, save and run their programs inside the collaborative tool, making the learning process more enjoyable and more user-friendly, especially during the teaching of a programming language. The ACLT also enables the instructor and students to see each others' output screens during a session.

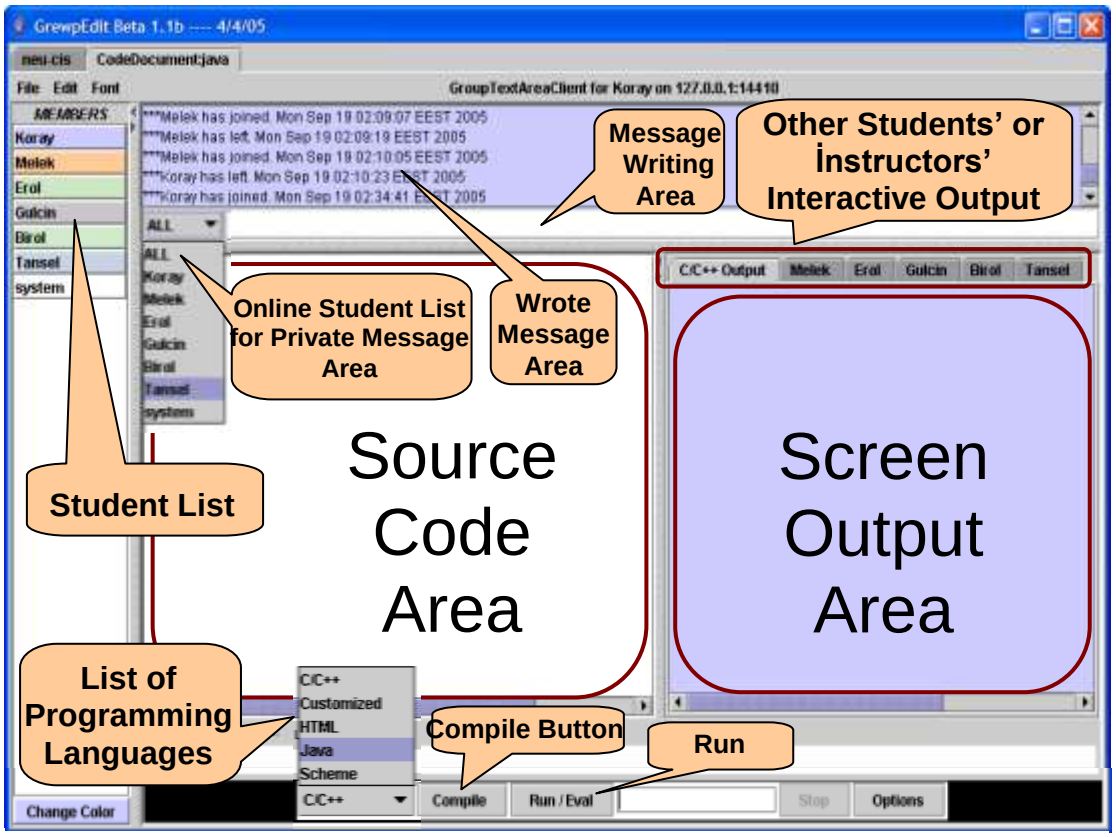
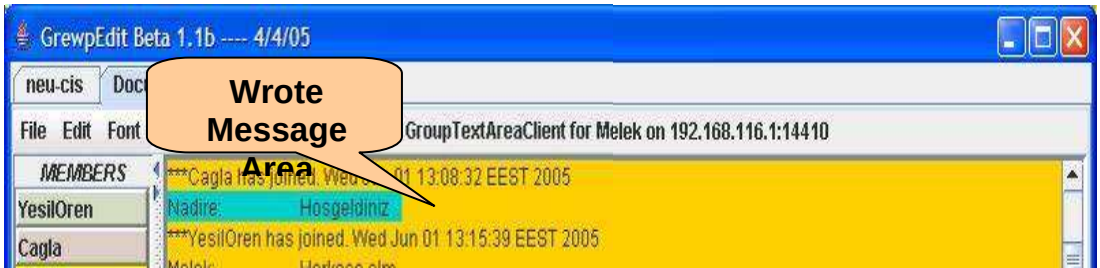


Figure 4.1: Advanced Collaborative Learning Tool



CHAPTER 5

METHODOLOGY

This chapter describes the research model, students, data collection and application, and data analysis. Studies carried out under each heading are described in detail.

5.1 Research Model

This study, which is aimed to prepare the appropriate medium for the teaching of the Java programming language using web-based methods, has taken place within the frame of a control group, based on post-test.

The independent variable of this experimental study, collaborative learning methods, includes three variables: Advanced collaborative group, standard collaborative group, and traditional collaborative learning group. The dependent variables were post-test and the covariate was the result of learning strategies.

The 1st, 2nd and the 3rd sub-aims of the research have taken place around a scientific framework.

An un-biased rule was observed for the realization of the study and based on this rule, two experimental groups, and one control group were formed. Two experimental groups constituted the ACLT and SCLT groups, and the control group was formed from the students following traditional education methods. A figurative view of the research model and the meanings of the used words are given in Table 5.1.

Table 5.1: Research Model

Groups	Randomly	Independent Variable	Post-Test
G_A	R	ACLT	O1 , O3, O5 , O7 , O9 , O11 , O13 , O16
G_T	R	Traditional Learning Method	O14 , O17
G_S	R	SCLT	O2 , O4 , O6 , O8 , O10 , O12 , O15 , O18

G_A = Used ACLT

G_S = Used SCLT

G_T = Traditional learning method

R = Randomly

O1 = Student opinion survey about NEU-VLE

O2 = Student opinion survey about NEU-VLE

O3 = Instructor's opinion survey about NEU-VLE

O4 = Instructor's opinion survey about NEU-VLE

O5 = The survey where student opinions on collaborative tool are used

O6 = The survey where student opinions on collaborative tool are used.

O7 = The survey where instructor opinions on collaborative tool are used.

O8 = The survey where instructor' opinions on collaborative tool are used.

O9 = The survey based on student opinions that the NEU-VLE system is useful.

O10 = The survey based on student opinions that the NEU-VLE system is useful.

O11 = The survey based on instructor' opinions that the NEU-VLE system is useful.

O12 = The survey based on instructor' opinions that the NEU-VLE system is useful.

O13 = Pre-Test based on the academic success rates of the groups.

O14 = Pre-Test based on the academic success rates of the groups.

O15 = Pre-Test based on the academic success rates of the groups.

O16 = Post-Test based on the academic success rates of the groups.

O17 = Post-Test based on the academic success rates of the groups.

O18 = Post-Test based on the academic success rates of the groups.

5.2 Students

This experimental study was conducted at Near East University, in the Department of Computer Information Systems in the Turkish Republic of Northern Cyprus during the 2004-05 Spring semester. The participants were fourth year first semester (seventh semester) students who registered for Java programming language.

A credit based system is now used at Near East University, which means that all the students in the fourth year do not follow the same courses. The advisors who register the students schedule courses to the students based on their personal grades. Thus, the students who were registered to the Java programming took part in this research study. A list was prepared to include the students in their fourth years (seventh semester) that are registered for the Java programming language.

The GCPA (General Cumulative Point Average) grades of the registered students have been calculated and sorted in a descending list. For the course, 18 students were randomly grouped to use the *ACLT*. Similarly, 18 students were randomly grouped to use the *SCLT*, and 18 students were randomly grouped to use the *traditional collaborative methods of learning techniques* (control group).

The lists were distributed to the students and students in the experimental groups were asked whether or not they were voluntary to take part in this study. Two students in the experimental standard collaborative group said they did not want to participate in the study. As a result of this change, these students were moved to the control group. Also, 2 students in the control group wanted voluntarily to move to the experimental group and as a result they were moved to this group. After 4 students changed their groups, the average GCPA grades of the students were calculated again and it was determined that the balance between the average GCPA grades of the groups were not disturbed. One student in the experimental advanced collaborative learning group and a student in the control group exchanged their groups. The average GCPA grades of these students were the same. After this change, the CGPA grade averages of students in the advanced collaborative learning group and traditional learning group were checked and it was noticed that the balance between the two groups was not disturbed. The number of students in each group was 18. According to Fraenkel & Wallen (2006) there are no rules for determining the size of the groups.

In order to determine whether or not the GCPA grades of students in each group will affect the results of the research, and can be necessary to form new groups, the

GCPA of students in each group were tested using one-way ANOVA. There was no real significant difference between the GCPA grades of students in each groups F (2-51) = .40, p = .67. Based on these results it could be said that the groups are suitable for the experimental study. The results of the ANOVA are shown in Table 5.2.

Table 5.2: GCPA Averages of Students in Each Group

Groups	N	Mean	SD	F	p
Used ACLT	18	2.45	.63	.40	.67
Used Traditional Learning Method	18	2.47	.56		
Used SCLT	18	2.29	.73		

*The mean difference is not significant at the .05 level.

Based on these results it could be said that groups are suitable for the research. I.e. there is no real significant difference between the GCPA grades of students in each group.

The collaborative tool was found suitable for students. Participants are fourth year-first semester students studing at the Department of Computer Information Systems. So, we surmise the students had a basic working technical backgrounds and knowledge and moderate comfort level with computer and collaborative tool.

5.3 Data Collection Instruments and Application

In this study, in order to reach the aims in a scientific way, the web-based education Virtual Learning Environment and the collaborative tools which provided the possibility of collaborative study, and the use and preparation of the data collection tools are described below.

5.3.1 Web-Based Virtual Education Environment

The researcher searched the internet to find a suitable open source LMS system which can be used by the experimental group of students. Among the systems which were found after the internet search the Moodle LMS was chosen. The required hardware and software were obtained and the Moodle LMS was downloaded from the internet for an evaluation and initial studies. Each module (activity) inside Moodle was investigated in detail and then the Virtual Learning Environment was prepared based on this experimental study.

A server computer was setup at the Computer Center (CC) of Near East University. The NEU-VLE system had the following properties, and it was loaded as the main system to the server, a spare computer was also used: i.e. a main computer and also a spare computer were both loaded, and made ready for use. The computers had the following specifications:

- 512K RAM
- 40 GB Hard disk
- Pentium IV Processor
- Network Card
- CD-ROM drive
- Windows XP Operating System

The virtual learning education system which was aimed to teach the computer programming languages was given its final form after a certain preparation time, and it had the following features:

- User Manual For Learners,
- User Manual For Instructor,
- The aim and behavior of the Java course that took part in the research,
- The Java resources used in the research,
- The assignments related to the Java courses are used in the research,

- Login,
- Enrollment Keys,
- Chat,
- Forums,
- E-Mail,
- Quiz,
- Self-Test Questions,
- Grades,
- Scale,
- Logs,
- Groups,
- Calendar,
- Participants,
- Related web-sites,
- Announcements,
- Course Syllabus.

Students were given access to the Virtual Learning Environment from outside the University by using the host name: http://cis.neu.edu.tr. In addition, backup information about the prepared system is given on the CD-ROM attached to this thesis. The system can be accessed at any time using the internet explorer and by entering the above site name (Sample pages are given from the main portions of existing lessons in Appendix E). Because the system is password protected, only the opening main page can be seen. In order to get a username and a password, one should contact the researcher.

5.3.2 Collaborative Learning Tools

Internet was searched extensively before starting the research application in order to find a source of suitable open-source collaborative tool which would enable experimental group students to use during the learning of the Java programming language while using the web-based education, and to share information and problems between themselves and with their instructor. At the end of the search and analysis it was decided to use the collaborative tool known as GREWPTool (http://groupscheme.sourceforge.net/grewpedit) and this tool was downloaded to a computer and investigated in detail. An initial trial was then carried out under the supervision of the researcher by a group consisting of 3 students, the Java instructor, and the laboratory assistant. The researcher made observations while the group used the GREWPTool and noted down the areas on which they had difficulty in using, and also noted any activities that they needed. The modifications required while using GREWPTool to teach programming languages were reported to Kenroy Granville who is the developer of the GREWPTool and who is a PhD student at the Computer Science Department of the Brandeis University in the United States of America. A trial lesson was then carried out with him and he was convinced about the necessity and the importance of these changes to be implemented. After the necessary modifications were added, the new GREWPTool was tried again by the researcher, Java instructor, laboratory assistant, and 2 students and it was decided that the tool was ready for the web-based education.

5.3.3 Course Syllabus

The course syllabus used for the Java course was the one which is used at the Central Connecticut State University, which has been authorized by the educational specialists. The screen outputs of this course syllabus were modified but its conformance to the standards was kept. But, specially prepared summary, assignments, and self-test questions were prepared by the course instructor for each chapter and these were adapted into the system by the researcher. Then, the course syllabus was used by 5 students under the supervision of the researcher. Observation was made by the researcher while the students were using the related course syllabus. Finally, the

sections where students had difficulty were reviewed again and the course syllabus was completed and made ready for the usage by web-based education.

5.3.4 Student Opinions of the NEU-VLE System

Students taking the online courses were asked to carry out a survey at the end of their studies in order to determine their opinions to the 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 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.

5.3.5 Student Opinions in Relation to the Used Collaborative Learning Tools

Students taking the online courses were asked to carry out a survey at the end of their studies in order to receive their feedback on the use of collaborative tools. "The Scale of Student Opinion on Collaborative Learning Tools" was prepared by the researcher (2005) in the form of a questionnaire related to collaborative learning tools. Content and design validity of questionnaires were investigated by 15 experts (experts of educational technology, programmers, assessment and measurement experts) in this field and were found to be satisfactory. Each question was phrased to determine whether or not there was a positive response to different aspects of using collaborative tool. Nineteen carefully prepared questions were given to students who used the ACLT to answer in the class. Similarly, 15 questions were given to students who used the SCLT. The 4 extra questions for the first group were specific to the properties of the ACLT which were not available in the SCLT. This questionnaire is formed in 5-point

Likert scale type questions, consisting of 19 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.

5.3.6 Student Opinions about the Usefulness of the NEU-VLE System

Students taking the online courses were asked to carry out a survey at the end of their studies in order to receive their opinions on how useful the NEU-VLE system is, and also to receive feedback from them. The "Student Opinion Scale on the NEU-VLE System" instrument was prepared by the researcher (2005) in the form of a questionnaire related to the usefulness of the NEU-VLE system. The questions were prepared after considering the properties of the NEU-VLE system. Twenty-four 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 24 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.

As a result of the evaluation, it was observed that the *Student Opinion Scale about the NEU-VLE System* was one dimensional and 47.9% of the total variance was explained as one factor. According to the results of the factor analysis, it can be seen in Table 5.3 that the factor weight values of the items in the scale were listed from 0.89 (item 17) to 0.30 (item 24). The reliability studies carried out showed that the total correlation was listed from 0.85 (item 12) to 0.28 (item 24). The Cronbach Alpha confidence coefficient of the scale was calculated as 0.95. Based on this result it was decided that the scale can be used since the validity and reliability measurements gave successful results.

Table 5.3: Validity and Reliability Scores of Each Item in Student Opinion Scale on the NEU-VLE System

	Scale Items	Component	Corrected Item-Total Correlation
1.	It has united the class as it enabled the class to focus on the same topic at the same time.	.69	.68
2.	Everyone could see how much they knew compared to their friends.	.65	.64
3.	Enabled me to look at the course notes before the class sessions.	.59	.54
4.	Enabled the class to operate together (with the support of the collaborative learning tool).	.71	.60
5.	Gave me the opportunity to compete with myself and with my class mates.	.86	.83
6.	Gave the opportunity to me to learn the material easier and to carry on with my studies.	.80	.76
7.	Has prepared me for the possible examination questions.	.70	.64
8.	Has enabled me to test myself before the real examination.	.68	.62
9.	Since it covered the whole class, it helped me on what topics to study.	.59	.54
10.	Enabled me to know the material all the time since it provided tests at the end of every topic.	.72	.67
11.	I was not stressed even I missed some of the questions at the end of every topic.	.51	.47
12.	Has provided a healthy competition environment.	.87	.85
13.	Has helped me to follow the courses in the class easier.	.82	.80
14.	Has helped me to focus on the material delivered in the class.	.83	.82
15.	Has enabled us to discuss the topics clearly which we nay have learned wrongly for whatever reason it might be.	.76	.75
16.	Has enabled us to study the course material continuously before the start of the lessons.	.66	.61
17.	It was enjoyable to have a bit of competition in the class.	.89	.86
18.	The competition among the friends helped us to remember the material easier.	.86	.84
19.	Has provided good studying skills.	.73	.70
20.	Everyone had the opportunity to study the course material at a time convenient to them.	.58	.54
21.	The opportunity of investigating the material	.39	.34

	before the start of a class helped me to prepare better for the class.		
22.	My confidence has grown since the NEU-VLE education system.	.53	.48
23.	My own lesson study ability has developed as a result of the NEU-VLE education system.	.48	.47
24.	I believe that as a result of the NEU-VLE education system I have learned new technological skills.	.30	.28

Cronbach Alpha .95

5.3.7 Student' Opinions on Using Web-based and Collaborative Teaching of Programming Languages Based on Experimental Study

Interview method was used for the Java experimental group students only after the experimental application in order to obtain their general opinions on the experiment conducted using the NEU-VLE system and the GREWPTool.

An interview form was prepared after having the opinions of educational technologists and educational experts before interviews were held by the students (see Appendix F).

After the completion of the application, students were divided into four groups, and interview lists were prepared allocating 30 minutes to each group. The interviews lasted for 2 days; each subject was invited to a specially prepared office where the opinion of each subject was taken. Care was taken to ensure that a social medium was created in the office so that the students felt relaxed

As a result of the interviews which were done after the completion of the experimental application, data were collected contained the opinions of students on using the NEU-VLE system and the collaborative tool during the experimental application.

5.3.8 The Instructor's Opinion on the Collaborative Learning Tools

After the beginning of the experimental application, the opinions of the instructor were sought on the collaborative learning tools (Advanced and Standard) used. Also, the opinions of the instructor were asked on the collaborative tool they used. For this reason, face to face interviews were held by the instructor (see Appendix G). In addition, written statements were requested from the instructor about the web-based education (see Appendix H). The instructor initially prepared a list of their own observations about the NEU-VLE system. Then the written statements of the instructor were added to the data of the study.

5.3.9 Pre-Test

In order to assess the Java programming language knowledge of all the students in the experimental and control groups, same questions as used in the Post-Test were given to the students before the start of the experiment. The researcher asked the students to answer the questions that they could. The answer sheets were examined by the course instructor. However, it was observed that the students left nearly all the questions un-answered. This result showed that the students had no pre-knowledge, even at very low level, about the Java programming language before joining the experiment.

At the end of the examination the grades obtained by the students showed how much pre-knowledge they had about the Java programming language.

5.3.10 Post-Test

After the students took the Pre-Test the experimental study with the NEU-VLE system started. At the end of the 4^{th} month of study (the end of the experimental study) all the students in all three groups were regiven an examination. This examination was named as Post-Test. The questions asked in the examination (see Appendix I) covered the topics taught to the students using the NEU-VLE system from the beginning to the

end of the semester. The grades obtained by the students in the examination show how much they learned the topics being taught to them.

The attributes of Pre-Test and Post-Test are as follows:

- The tests consisted of 5 essay (restricted response) type and 9 multiple choice questions and the results were analyzed using one-way analysis of covariance (ANCOVA) based on the mean values of the test marks.
- Questions were prepared based on course content.
- Same questions are asked to students at the Pre-Test and Post-Test.
- Students in the groups took their tests at the same time and at the same place during two hours at the University. Written examinations were carried out using traditional methods.
- The accuracy and reliability of the test papers were confirmed by two experts in the field of computer programming languages and two curriculum and instruction experts. The papers were modified based on the feedback received from these experts and then the papers have been evaluated by two experts in the field of computer programming languages who did not know the names of students as they were hidden during the evaluation of the papers. The papers were evaluated on a scale of 100 as being the top mark and the results were analyzed based on the average marks.

5.3.11 Determination of the Resources Used outside the NEU-VLE System

Interview method was used after the experimental application to find out if the students in the Java groups used any resources outside the NEU-VLE system, and to determine if any other resources were used at all.

An interview form was prepared by taking the opinions of educational technologists and educational specialists before conducting the interviews (see Appendix J).

After the completion of the application, the students were divided into groups of 4, and interview lists were prepared allocating 30 minutes to each group. The interviews lasted for 2 days; each subject was invited to a specially prepared office where the opinions of each subject were obtained. Care was taken to ensure that a social medium was created in the office so that the students felt relaxed

As a result of the interviews which were conducted after the completion of the experimental application, data were collected about the other resources used outside the NEU-VLE system. This data were then considered when the results of Post-Test were analyzed.

5.3.12 The Case of Resource Usage outside the NEU-VLE System

The case of resource usage outside the NEU-VLE system by the students who took part in the experiment is given in Table 5.4.

Table 5.4: The Distribution of Students Using Resources outside the NEU-VLE

Groups	Used	Did not Use
Used ACLT	0	18
Used Traditional Collaborative Learning Methods	2	16
Used SCLT	1	17

The following results were obtained at an interview from the students who participated the experiment at the end of the semester: 18 students using the ACLT did not use any resources outside the NEU-VLE system; 2 students in the group using the traditional collaborative learning method used resources outside the NEU-VLE system; 17 students using the collaborative tool did not use any resources outside the NEU-VLE system, and 1 student used resources outside the NEU-VLE system. According to these

results, we can say that the resource usage by the 3 groups outside the NEU-VLE system is not at a value to affect the results of the research.

It can be observed that the groups that took part in the experiment had a homogeneous structure. In other words, the variables such as the CGPA grade averages and resource usage outside the NEU-VLE system will affect the learning success of the three groups learning the Java programming language at the similar rate. Based on this data it could be said that the three groups in the course were equivalent to each other as far as their main important properties were concerned.

5.3.13 Determining the Learning Strategies Scale

Students taking the online courses were asked to carry out a survey at the end of their studies in order to determine their learning strategies. Learning Strategies Scale instrument was adapted for use in North Cyprus based upon an instrument developed by Birol (2001) (see Appendix K). Thirty eight carefully prepared questions were given to them to answer in the class. Each question was phrased to determine their learning strategies. This questionnaire is formed in 5-point Likert scale type questions, consisting of 38 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. Cronbach's alpha coefficient for the "Learning Strategies Scale" was .97. This shows that the reliability of instrument is high.

5.3.14 The Application Performed with the NEU-VLE

The experimental group of students who took part in the research was studying in the Department of Computer Information Systems, and as a result, they had enough knowledge on the use of computers and they have not required any pre-training. Also, the general structure of the NEU-VLE system is simple and easy to understand and as a result, there was no need to have additional information on the use of this system.

Similarly, there was no need for any additional information or training before or during the use of collaborative tool.

A meeting with duration of one hour was held with the students who used ACLT and SCLT before the beginning of the application. In this meeting the students were given brief information (1 hour) by their class and researcher on the following topics:

- Information about this study,
- Introduction of the NEU-VLE system,
- Developing skills to use the NEU-VLE system,
- The student behaviour expected from them during this study,
- How to get help from the instructor,
- The information on how to download and install the collaborative tool and how to activate the NEU-VLE system on their computers,
- How to start collaborative tool on their computers,
- Introduction to collaborative tool.

During the period of experimental process the students learning the Java programming language in the experimental group reached the theoretical information offered to them by the NEU-VLE system. They have carried out collaborative studies over the internet at pre-arranged days and times and they learned permanent knowledge with direct experience by doing permanent collaborative studies in a collaborative environment, in their choice of place, and learning pace. The control group carried out studies at the computer laboratories of the university. The experimental group had 2 hours a week lectures while the control group had 4 hours a week.

Experimental groups of students have used the NEU-VLE system and collaborative tool. Group 1 used ACLT and Group 2 used SCLT during the experimental study to perform the educational activities. Students of these groups took classes two hours a week.

Group 3, the controll group, used traditional collaborative teaching method during the experimental study. Students have performed the educational activities in a laboratory environment so that they learn to program in Java. Students of these groups

took classes two hours a weak. The students in the control group followed the same course notes with their lecturers, and also solved the same example programs with their instructor in the laboratory.

The reason why the duration of the lecture hours for the experimental group was shorter than those of the control group was as follows: The students in the experimental groups used to study for their interactive weekly lecture notes using the NEU-VLE system any day and any time they preferred, and they used to ask questions to their instructor or to get help from their friends during the 2 hour period. If the students had no questions to ask then they used to solve example questions with their lecturer.

The topics studied and the example questions solved were identical in both the experimental groups and the control group.

Experimental groups (1 and 2) of students (used ACLT and SCLT) have used the NEU-VLE system and collaborative tool during an academic semester and they have performed the following activities. They

- solved the exercises,
- solved and uploaded the assignments,
- chatted to get help from each other to do the exercises,
- sent and received messages on the discussion forum for learning purposes,
- joined to do the self-tests,
- joined to do quizzes,
- received and sent e-mails to each other and their class instructor for the purposes of learning,
- used collaborative tool to develop programs with each other or together with the class instructor,

Control group of students have performed the following in a laboratory environment so that they learned to program in Java. They

- developped programs on a computer,

- To made discussions about programming languages used,

The researcher and departmental assistant have been available in all synchronously application sessions which were carried out together with the instructor by using a collaborative tool (advanced and standard). The class instructor first attempted to solve any problems encountered during the use of NEU-VLE or collaborative tool. If the class instructor had difficulties answering a question then the researcher or the class assistant attempted to provide a solution to the problem. Because of the low reliability of dial-up internet connections in the TRNC, and as a result of the limited availability of time allocated to practical sessions, the class assistant provided support to the researcher.

5.3.15 The Course Syllabus

Students using the online NEU-VLE system accessed the system from their places of study at their choice of time and a typical session can be reported as follows:

- Students entered the system by linking to the web site: http://cis.neu.edu.tr.
- Students registered on the NEU-VLE system using the username and the password assigned to them.
- The course notes were prepared in a weekly format and could be accessed by the students interactively at any time and from any place. The lecture notes were prepared interactively in SCORM standards.
- After studying the course material students attempted to solve the self-test quizzes. Instructor 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 could randomize the questions in a test so that alternative questions could be presented to the students.

- One of the innovative elements of the NEU-VLE system was that the students and the instructor could 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 class-room.
- Gained confidence at this stage students attempted to solve the weekly assessment questions prepared by the instructor. The instructor and students could exchange information online on the solutions to the assessments.
- Prior to the Post-Test, although not implemented in our study, students could access the various online quizzes, video and media files, sample exam questions etc. so that they could prepare for the real examinations.

NEU-VLE has given the opportunity to the instructor to analyze the progress of each individual student in detail. Students are given the opportunity to see their own activity and progress reports so that they could assess their status within the class.

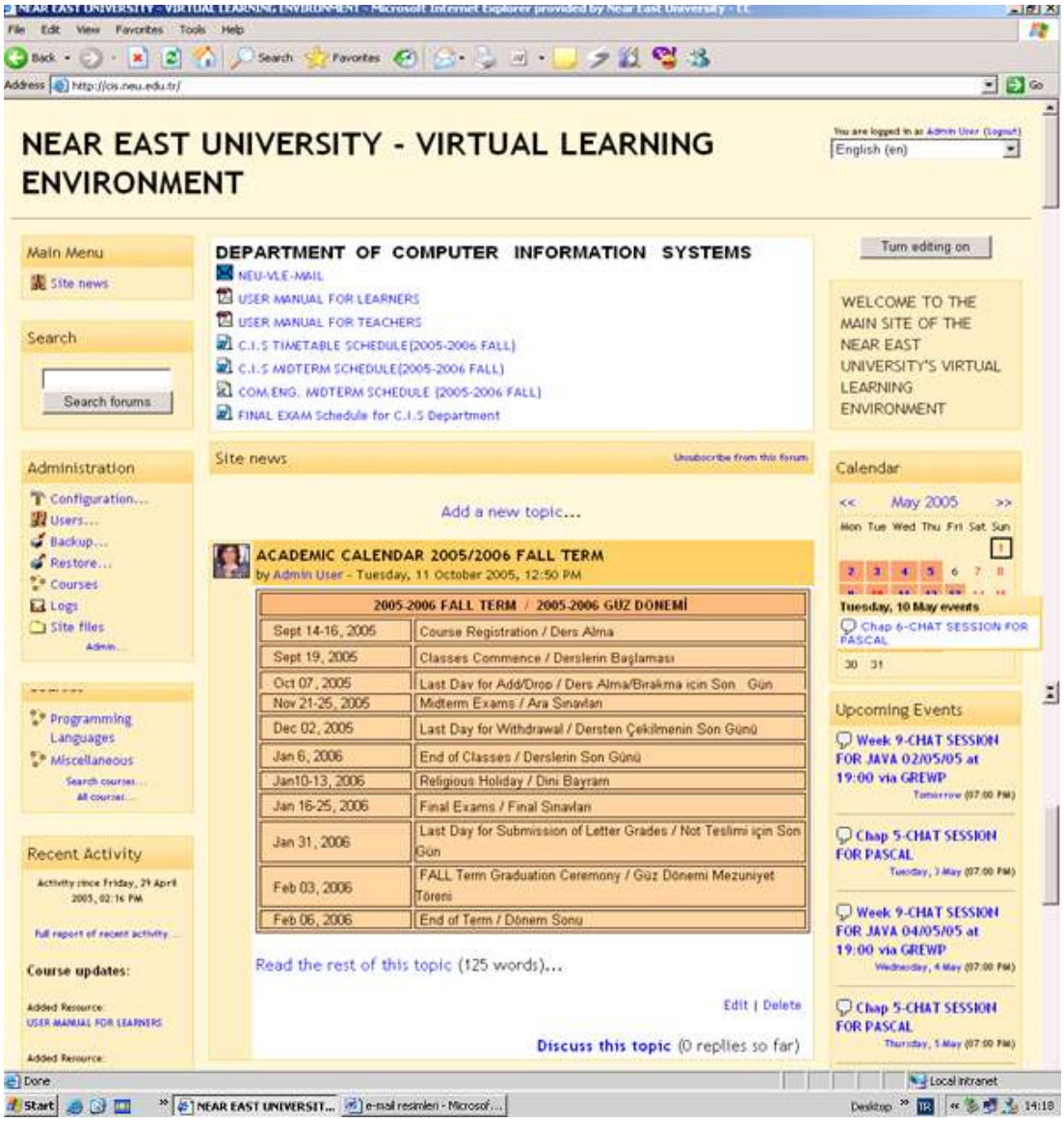


Figure 5.1: A typical Moodle Session

The lecture notes have been prepared on a weekly basis.A typical Moodle screen layout is shown in Fig. 5.1. The lecture notes were largely in text format with audio enhancements at appropriate places. Students normally followed the lecture notes in the order shown on their screens which has been prepared carefully by the instructor. Sections of the lecture notes could be repeated as many times as required until the student was comfortable with the contents. It is recommended that the students attempted to solve the quizzes at the end of each section and obtained a high grade was a requirement. A repeat of the lecture notes was recommended if the quiz results were not satisfactory. A section from the lecture notes is shown in Fig 5.2. We have

attempted to arrange the lecture notes in a simple, easy to follow format with simple and clear images emphasizing key sections of the notes. As described earlier, the lecture notes have been prepared using the SCORM standards and then integrated to the Moodle by the researcher.

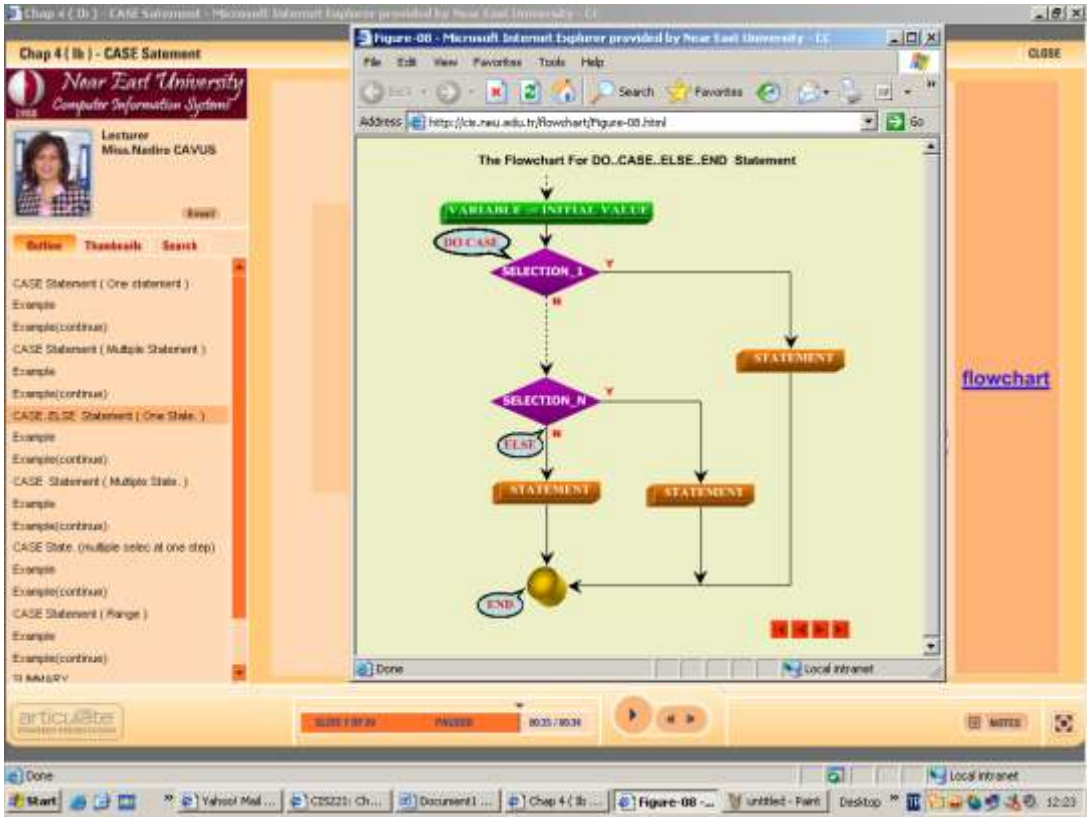


Figure 5.2: Section of Lecture Notes

A complete demonstration of NEU-VLE can be seen at http://cis.neu.edu.tr .

5.3.16 The Application Performed with the Collaborative Learning Tool

When experimental process was carried out, students using the collaborative tool learnt the programming languages in their own study place, in their own time and pace, using the teaching activities offered within the NEU-VLE system. Students have carried out collaborative studies where they could discuss their problems with their instructor or with their class mates using the internet on the pre-announced days and hours of the week. A typical collaborative session lasted for about two hours a week.

Students were encouraged collaboratively to use the NEU-VLE system for the topics offered to them weekly without the help of the instructor. Students could access the collaborative tool on the specified day 5-10 minutes before the start of a session and they could join the group created by the class instructor with their own names. After joining the group, each student selected a different colour. The colour chosen represented the student involved in the session. The name of the class instructor and all of the students who joined the collaborative session could be seen in a list-box on the left side of the screen. The programming language to be used during the collaborative session was then selected and at this point the group was ready to start the learning process. The common editor section of the tool was used by the students so that they could copy the programs developed by themselves to this area of the tool. Thus, students could get help from their class instructor or from their class mates. It became clear from the colour of the text what each student wrote inside the program. During the session a student could either exchange information with all the other people in the group, or with just one particular student in private, or with the instructor. This increased the students' motivation and comfort. During the collaborative tool session students could record and save all communication which took place in the session and then, if they wished, the recording could be re-played. Students using the SCLT could copy the programs developed jointly to their own PCs and then compile and run the programs. On the other hand, students using the ACLT could save the jointly developed program by pressing the "save as" button, and then they could compile the program by pressing the "compile" button at the bottom of the screen. The result of the compilation could be seen in their own screens. After a successful compilation they could run and test their programs. Thus, if there were any errors in the program they could be seen and

corrected. If the error could not be corrected help coulod be sought easily from other group members. A student could see the screen of the instructor or the screen of another student by clicking on the name in the list-box. As a result of this collaborative study students could interact with each other, have discussions, and correct each others' mistakes (see Appendix L), and get help easily from other members of the group.

5.4 Analysis of Data

The results obtained in the research were analyzed, described, and later interpreted by creating tables using appropriate statistical techniques in the direction of the suggestions of statistical experts.

In order to check whether or not there was a real difference in the opinions of students using the ACLT and the SCLT on the NEU-VLE system, the independent sample t-test was used.

In order to asses the opinions of instructor to the NEU-VLE system interviews were held with the instructor. The information obtained from the instructor was described after a scientific analysis of the results. The scientifically based results obtained from the class instructor after a face to face interview were then described scientifically using an analysis technique.

Mean opinion scores, standard deviations and Sig. (2-tailed) were used to assess the opinions of the students on the ACLT and the SCLT. A t-test was performed to find out whether or not there was a significant statistical difference between the opinions of students in each group on the use of ACLT and SCLT.

The opinions of the course instructor were also sought on teaching of web-based Java programming language. After a face-to-face interview with the course instructor it was attempted to determine whether or not the used collaborative tool satisfied the requirements of the taught programming language being taught. The information obtained from the course instructor was described after a scientific analysis of the results. The scientifically based results obtained from the class instructor after a face to face interview were then described scientifically using an analysis technique.

A t-test was applied to the students using the ACLT and the SCLT in order to find out if there was a statistically significant difference in their ideas on the usefulness of the NEU-VLE system.

In order to check whether or not there was a real difference in the opinions of students on the NEU-VLE system to be of help to students who used the ACLT and SCLT, the independent sample t-test was used.

One-way analysis of covariance (ANCOVA) was used to find out whether or not there was a significant difference between the academic success rates of the groups.

The results were analyzed using one-way analysis of covariance (ANCOVA) based on the mean values of the test marks to find out whether or not there was a significant statistical difference between the learning strategies of groups. And finally, one-way analysis of covariance (ANCOVA) was used to find out whether or not there was a significant relationship between the learning strategies and the results of Pre-Test and Post-Test in each group.

5.5 Duration and Resources

This study stared in September 2002 after the preparation of the research proposal, and was completed in August 2006. The work was carried out during this period and its weekly duration is given in Table 5.5. The preparation of the NEU-VLE system and the preparation of some of the data collection tools were done within the same time period.

Some of the expenses incurred during this research were financed by the university, and some were financed by the researcher.

Table 5.5: Time Schedule

WORK DONE	DURATION
• Literature Search	2002-2006

• Downloading, installing and using Moodle	04 Weeks
• Downloading, installing, using and updating GREWPTool	04 Weeks
• Preparation of the Research Proposal	1 Year
• Preparation of the NEU-VLE System	1 Semester (16 Weeks)
• Preparation of the GREWPTool	04 Weeks
• Preparation of Course Syllabus	08 Weeks
• Preparation of Data Collection Tools	08 Weeks
• Application	1 Semester (16 Weeks)
• Data Analysis	04 Weeks
• Writing the Thesis	12 Weeks
• Reading, discussion, and correction of the thesis based on the feedback by educational technologists.	06 Weeks

CHAPTER 6

RESULTS

In this chapter, the results obtained are discussed in view of the fundamental aims of the research.

6.1 THE RESULTS RELATED TO THE OPINIONS OF STUDENTS' AND INSTUCTOR ON THE NEU-VLE SYSTEM

In order to check whether or not there was a real difference in the opinion of students about the NEU-VLE system that used ACLT and SCLT, the independent sample t-test has been used.

6.1.1 The Opinions of Students on the NEU-VLE System

The mean opinion scores and standard deviations for students responses to the 10 statements on the 5-point Likert type opinion survey administered after completions of the web-based program are shown in Table 6.1.

Table 6.1: Scale of Student Opinions on the NEU-VLE System

	Scale Items	Used ACLT		Used SCLT	
		M	**SD**	**M**	**SD**
1.	I enjoyed using NEU-VLE in the class.	4.61	0.61	3.94	1.39
2.	I feel that most of the other students in class liked the NEU-VLE.	3.94	0.64	2.39	1.09
3.	Using NEU-VLE added interest to the class.	4.28	0.83	2.50	1.20
4.	The use of NEU-VLE helped me to	4.28	0.83	2.89	1.60

	learn the material better.				
5.	I prepared more for class knowing NEU-VLE would be used to test my knowledge of the subject.	4.22	0.73	3.00	1.33
6.	I told my friends about using NEU-VLE in the classroom.	4.50	0.99	3.33	1.88
7.	NEU-VLE helped focus the class as a whole on the subject.	3.83	0.86	2.67	1.33
8.	NEU-VLE was a means of involving all of the class members at the same time.	4.56	0.70	3.00	1.68
9.	I believe NEU-VLE should continue to be used in this class.	4.61	0.50	2.72	1.36
10.	I would like for other classes I have to use the NEU-VLE.	4.28	0.75	2.61	1.65
Total items score		43.11	4.59	29.06	12.06

Scoring: 5 = Strongly Agree, 1 = Strongly Disagree

Table 6.1 shows a summary of the survey results. At a glance the results suggest that both online classes had positive opinions for NEU-VLE, with the course for general studies having more strongly 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 SCLT group. One of the reasons for this is that students enjoy using the computer as a tool while learning as it brings great flexibility into their learning practice, and they learn through practice. They can follow the lecture notes in any place and time and answer the questions of the quizzes whenever they are ready.

The least meaningful item for the SCLT group is the 2nd one "*I feel that most of the other students in class liked using NEU-VLE*" (M=2.39). According to this result, the students felt that they have not been happy using the NEU-VLE system which is an interesting results. The reason for this negative result was because during the sessions it was not possible to compile and run a program. Also, the students had no access to the

screens of their friends and consequently there was not much collaboration during the sessions.

The most important items for the ACLT group are item 1 (one) "*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 for the teaching of a programming language.

The least important item (M=3.83) for the ACLT group is item seven (7) *"NEU-VLE helped focus the class as a whole on the subject"*. This item indicates that the NEU-VLE system has not been successful in helping the students concentrate on a topic. But the students in general were pleased and expressed an interest for the use of the system in other courses of the university.

6.1.2 Differences in the Opinions of Students on the NEU-VLE System

In order to check whether or not there was a real difference in the opinion of students on the NEU-VLE system that used ACLT and SCLT, the independent sample t-test has been used and the results were summarized in Table 6.2.

Table 6.2: Differences in the Opinions of Students Groups on the NEU-VLE System

Groups	N	M	SD	t
Used ACLT	18	43.11	4.59	4.62
Used SCLT	18	29.06	12.06	

*The mean difference is significant at the .05 level.

Students were grouped according to whether or not they used ACLT. Opinions towards online education were greater among students who used ACLT (M=43.11, SD=4.59) than among students who used SCLT (M=29.06, SD=12.06). An independent-sample t-test found a significant difference between the two groups ($t=4.62$, $p < .05$).

One of the reasons for this is that, ACLT offers more utilities. For example, the students can develop, compile, and run Java programs together with their friend and with the help of their instructor while using the ACLT. Students can see the screens of all the other students and the instructor and they can get online immediately with the help of their instructor if they encounter any problems. The lecture notes have been prepared such that all the sections are tied to each other. I.e. the topics in the next section are based on the current section. In addition, students can discuss their problems with either the instructor or with any other student privately. This property of ACLT gives the feeling of working collaboratively as in a "real" class.

Although the students who used SCLT could communicate interactively with each other, they could not see the screens of other students. Also, it was not possible to compile or run a Java program inside SCLT and it was necessary to use the Java compiler of the computer, outside the collaborative learning tool. This has been a negative point as far as Java was concerned as it caused waste of time and lost of concentration in the course. It has been observed that this had negative effect on students' progress.

6.1.3 The Results Related to the Opinions of Instructor on the NEU-VLE System

Although the pilot study has lasted for a term only and instructor has 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 SCLT group and 5 students from the ACLT group 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 GREWPTool and as a result, they could ask questions about the course without courageasly.
- 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.
- Instructor has 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 facility to save the whole chat session can provide useful feedback for future improvements in content and style of teaching.
- By solving the self-test questions at the end of each section, students have tested themselves about that section and they were encouraged to re-study the topics they could not understand. This study style removed the probability of not understanding or having difficulties with the future topics. This is because the topics in a programming language course are tied together like the rings of a chain. The next topic could not be followed before understanding the current and the previous topics.

The disadvantages of the NEU-VLE system are:

- There is no visible body reaction and the instructor is not clear if the 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 a LMS on its own was not sufficient to provide the "real class" environment where the students and the instructor can interactively exchange messages during the teaching of a programming language. But when a LMS was used together with ACLT it had been possible to achieve the required "real class" feeling.

6.2 THE RESULTS RELATED TO THE OPINIONS OF STUDENTS ON COLLABORATIVE LEARNING TOOLS

The mean opinion scores, standard deviations and sig. (2-tailed) for students responses to the 19 statements on the 5-point Likert type opinion survey administered after completion of the web-based program are shown in Table 6.3.

6.2.1 The Opinions of Students on Collaborative Tools

A t-test was performed to find out whether or not there was a significant statistical difference between the opinions of students in each group for the use of ACLT and SCLT. Table 6.3 gives the opinions of students in each group on the use of a collaborative learning tool during the study session.

Table 6.3: Scale of Student Opinions on Collaborative Learning Tools

Scale Items	Used Advanced	Used Standard	p	t

		Collaborative Learning Tool		Collaborative Learning Tool			
		M	**SD**	**M**	**SD**		
1.	I felt as if I was in a real class with my class mates.	4.61	.78	2.39	1.33	.000	6.104
2.	Enabled me to study and discuss on the same program with my class mates.	4.78	.43	3.11	1.37	.000	4.936
3.	Enabled me to discuss topics on a one to one basis with my friends.	4.61	.61	2.83	1.42	.000	4.870
4.	Enabled me to use chat and whiteboard on the same screen at the same time, and to learn programming easily.	4.56	.62	3.00	1.37	.000	4.389
5.	Enabled me to communicate with my instructor on one to one basis, and to exchange ideas on a topic.	4.83	.38	3.67	1.37	.001	3.475
6.	I was able to compile and run the programs I developed easily.	4.89	.32	1.50	0.51	.000	23.660
7.	I could communicate easily without being shy with the help of the collaborative tool.	4.44	.61	3.61	1.38	.025	2.343
8.	I was more comfortable during class sessions and this has increased my learning rate.	4.61	.61	3.94	1.26	.051	2.023
9.	I was able to tell my class mates everything I wanted to say.	4.44	.78	2.89	1.32	.000	4.291
10.	I had no trouble communicating with my class instructor with the help of the collaborative tool.	4.61	.61	3.11	1.53	.000	3.866
11.	I was able to ask my class instructor any question I wanted using the collaborative tool	4.56	.62	3.28	1.53	.002	3.294
12.	I was able to communicate and exchange ideas with my class instructor and with my class mates with the help of the collaborative tool.	4.44	.70	3.17	1.47	.002	3.334
13.	Has enabled me to concentrate on my	4.44	.86	3.78	1.44	.100	1.691

	topic while using the collaborative tool in my own place of work.						
14.	I was not shy to ask my class instructor or my class mates any questions I didn't understand with the help of the collaborative tool.	4.17	1.04	4.06	1.30	.780	.282
15.	I think the addition of the collaborative tool to the NEU-VLE system was very useful.	4.67	.49	3.50	1.47	0.003	3.207
16.	The addition of instructor's screen to the collaborative tool helped me to understand the topics easier.	4.78	.55				
17.	The addition of my class mates' screens to the collaborative tool helped me to understand the topics easier.	4.39	.78				
18.	The addition of the capability to run a program inside a collaborative tool helped me to understand the topics easier.	4.67	.49				
19.	The enhancements to the collaborative tool were very useful and as a result the tool has been more usable.	4.72	.46				

Scoring: 5 = Strongly Agree, 1 = Strongly Disagree

The items 16, 17, 18 and 19 were not taken into account in all stages of the analysis. They were used only in the calculations of the Mean and the SD for the group using the ACLT. These 4 items are related to the properties added to the ACLT by the researcher. Because these added items are only in the ACLT and not in the SCLT, they were not taken into account in the analysis of the SCLT. All the other items were taken into account in the analysis of both the SCLT and the ACLT.

As a result of this statistical analysis there was a significant difference of 0.05 in favor of the students using the ACLT and this difference was observed in most of the answers to questions in Table 6.3.

Students were grouped according to whether or not they used ACLT or the SCLT. An independent sample t-test compared total mean scores between the two

groups. Significant difference was not found (p >.05) between the groups at the following items:

- I was more comfortable during class sessions and this has increased my learning rate.
- Has enabled me to concentrate on my topic while using the collaborative tool in my own place of work.
- I was not shy to ask my class instructor or my class mates any questions I didn't understand while using the collaborative tool.

In addition, the answers of students using the ACLT indicated that the lowest average was M = 4.39, and the highest average was M = 4.78. In other words, the positive opinions of students on the use of ACLT are very high.

The general results show that the opinions of the students using the ACLT are higher than those using the SCLT and these results are largely statistically significant. Because the SCLT can not satisfy the needs of the students during a synchronous session, different views were not formed in the students for the use of the collaborative tool.

6.2.2 The Results Related to the Opinions of the Course Instructor on Collaborative Learning Tools

The opinion of the course instructor was sought on the use of the collaborative tools for the Web-based teaching of the Java programming language. After a face to face interview with the course instructor, his opinions on how the used collaborative learning tool satisfied the demands while teaching a programming language were established.

The results of the face to face interview have been analyzed and described scientifically. The scientific results obtained after a face to face interview with the class instructor were described after being analysed scientifically.

6.2.2.1 The Opinions of the Course Instructor who Used ACLT on Collaborative Learning Tool

Although the experimental study has lasted for a term only and instructor has just began to explore the pedagogical opportunities of the collaborative tool, one can make the following observations on the advantages and disadvantages of this tool in distance learning courses:

The advantages of the ACLT can be reported as follows:

- Communication with the students can be on an individual basis as well as on a group basis. The students felt comfortable and confident while using the ACLT and as a result, they could ask questions about the course without being shy.
- 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.
- The facility to save the whole chat session can provide useful feedback for future improvements in content and style of teaching.
- Provides an easy tool for students' to copy programs into their local environments. Thus, they could benefit from these programs while studying the course notes.
- Students could easily compile and run the programs they wrote inside the ACLT.
- Students could see the outputs of the programs they wrote inside the ACLT.
- Instantly compile and run code that has been developed collaboratively by the participation of several students. Thus, they did not waste time copying the programs to their own computers. This situation motivates them.
- The instructor could establish a one to one link with the students and this helped the students relax and eventually be more motivated in the course.
- The students could receive help during a collaborative study from their course instructor or from their friends in the class and this helped them understand the topics easier.
- The students could see the screen outputs of the course instructor and their class mates and this gave them the opportunity to compare these outputs with their own outputs, and thus, they could evaluate themselves.

6.2.2.2 The Opinions of the Course Instructor who Used SCLT on Collaborative Learning Tool

Although the experimental study has lasted for a term only and instructor have just began to explore the pedagogical opportunities of the collaborative learning tool, one can make the following observations on the advantages and disadvantages of this tool in distance learning course:

The advantages of the SCLT are:

- Communication with the students can be on an individual basis as well as on a group basis. The students felt comfortable and confident while using the SCLT and as a result, they could ask questions about the course without courageously.
- 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.
- The facility to save the whole chat session can provide useful feedback for future improvements in content and style of teaching.
- Provides an easy medium for students' to copy programs into their local environments. Thus, they could benefit from these programs while studying the course notes.
- The instructor could establish a one to one link with the students and this helped the students to relax and consequently to be motivated better in the course.

The disadvantages of the SCLT are:

- The students could not see the screen outputs of their programs inside the SCLT.
- The students could not instantly compile and run code that has been developed collaboratively by the participation of several students. Thus, in order to compile and run, they waste time copying the programs to their own computers. This has resulted in students losing their motivation towards the course.

6.3 THE RESULTS RELATED TO THE USEFULNESS OF THE NEU-VLE SYSTEM

A t-test was done between the students using the ACLT and SCLT in order to find out if there was a statistically significant difference in their opinions on the usefulness of the NEU-VLE system.

6.3.1 The Opinions of Students on the Benefits of the NEU-VLE System

The mean opinion scores and standard deviations for students responses to the 24 statements on the 5-point Likert type opinion survey administered after completion of the web-based program are shown in Table 6.4.

Table 6.4: Scale of Student Opinions on the Benefits of the NEU-VLE System

	Survey Items	Used Advanced Collaborative Learning Tool		Used Standard Collaborative Learning Tool	
		M	**SD**	**M**	**SD**
1.	It has united the class as it enabled the class to focus on the same topic at the same time.	4.28	0.75	3.11	1.81
2.	Everyone could see how much they knew compared to their friends.	4.33	1.08	3.56	1.29
3.	Enabled me to look at the course notes before the class sessions.	4.61	0.50	4.11	1.02
4.	Enabled the class to operate together (with the support of the collaborative learning tool).	4.33	0.69	3.06	1.83
5.	Gave me the opportunity to compete with myself and with my class mates.	4.28	0.75	3.33	1.08
6.	Gave the opportunity to me to learn the material easier and to carry on with my studies.	4.33	0.59	3.61	1.20
7.	Has prepared me for the possible examination questions.	4.39	1.04	3.78	0.94
8.	Has enabled me to test myself before the real examination.	4.56	0.98	4.11	0.76
9.	Since it covered the whole class, it helped me on what topics to study.	4.00	0.91	3.72	1.18
10.	Enabled me to know the material all the time since it provided tests at the end of every topic.	4.50	0.79	4.06	0.87

11.	I was not stressed even I missed some of the questions at the end of every topic.	4.06	0.94	3.56	1.04
12.	Has provided a healthy competition environment.	4.17	0.92	3.00	1.24
13.	Has helped me to follow the courses in the class easier.	4.17	0.86	2.61	1.50
14.	Has helped me to focus on the material delivered in the class.	4.11	1.08	3.00	1.50
15.	Has enabled us to discuss the topics clearly which we nay have learned wrongly for whatever reason it might be.	4.44	0.62	3.11	1.57
16.	Has enabled us to study the course material continuously before the start of the lessons.	4.67	0.49	4.22	0.94
17.	It was enjoyable to have a bit of competition in the class.	4.28	0.89	3.22	1.26
18.	The competition among the friends helped us to remember the material easier.	4.22	0.88	3.33	1.14
19.	Has provided good studying skills.	4.00	0.84	3.22	1.35
20.	Everyone had the opportunity to study the course material at a time convenient to them.	4.56	0.9 8	4.17	0.99
21.	The opportunity of investigating the material before the start of a class helped me to prepare better for the class.	4.56	0.62	4.22	1.06
22.	My confidence has grown since the NEU-VLE education system.	4.39	0.61	3.72	1.18
23.	My own lesson study ability has developed as a result of the NEU-VLE education system.	4.22	0.55	3.89	0.96
24.	I believe that as a result of the NEU-VLE education system I have learned new technological skills.	4.67	0.49	4.28	0.96
	Total items score	104.11	11.63	86.00	19.06

Scoring: 5 = Strongly Agree, 1 = Strongly Disagree

The most important items (M=4.67) for the ACLT group are item 16 "*Has enabled us to study the course material continuously before the start of the lessons*" and item 24 (M=4.67) "*I believe that as a result of the NEU-VLE education system I have learned new technological skills*". The item 24 indicates that the students are aware of the closeness of their department with the technology. Also, it showed that the students were clearly aware of the importance of the internet in their future lives. It is not wrong to assume that the reason for the success rates of the students using the ACLT is because of their awareness of the technological advantage given to them by the system they were using.

The least important items for the ACLT group are item nine (9) *"Since it covered the whole class, it helped me on what topics to study"* (M=4.00) and item nineteen (19) *"Has provided good studying skills"* (M=4.00). Item 9 indicates that the course topics to be followed during a semester were offered to the students on weekly lesson plans as part of the NEU-VLE education system. Students felt the need to study before the courses were delivered to them by looking at the date of the week and finding the topics that will be covered in that week. If they did not study the topics before hand, they were anxious as they knew that they could not follow the course. Item 19 indicates that NEU-VLE system has given good studying skills to the students. The system has forced the students to test themselves at the end of every topic, and as a result they found out their missing points and applied what they have learned. Some of the students who were used to receive everything from the instructor were a bit upset and negative since now they had to study and discover things by themselves. But the students in general have been pleased and expressed an interest in the use of the system in other programming language courses of the department.

It is interesting to notice that the twenty-fourth item "*I believe that as a result of the NEU-VLE education system I have learned new technological skills*" has the highest score (M=4.28) for SCLT group, too. This positive result shows that the students chose the C.I.S department consciously. One can say that all the students who used the ACLT and the SCLT realize clearly that the technology is an inseparable part of their future careers and that the technology must be used while learning a programming language.

The least meaningful item (M=2.61) for the SCLT group is the item 13 "*Has helped me to follow the courses in the class easier*". According to this result, the

students felt that they have not been happy using the NEU-VLE system. The reason for this negative result was because during the synchronous sessions with SCLT it was not possible to compile and run a program. Also, the students had no access to the screens of their friends and consequently there was not much collaboration during the sessions. Collaborative study and software used for collaborative study are very important element in teaching programming languages.

In general, Table 9 shows a summary of the survey results. There is a significant difference between the two groups ($p<.05$). Looking at the results it could be said that both online classes had constructive opinions about the usefulness of the NEU-VLE system, but the group with general studies had stronger positive response. But the students who used the ACLT had more constructive opinions on the system than those using the SCLT.

6.3.2 The Differences in Students' Opinions on the Benefits of the NEU-VLE System

In order to analyse whether or not there was a real difference in the opinions of students, who used the ACLT and SCLT, on the usefulness the independent sample t-test has been used with the results summarized in Table 6.5.

Table 6.5: The Differences in Students' Opinions on the Benefits of the NEU-VLE System (Based on Groups)

GROUPS	N	M	SD	t
Used ACLT	18	104.11	11.63	3.44

Used SCLT	18	86.00	19.06	3.44

*The mean difference is significant at the .05 level.

Students were grouped according to whether or not they used ACLT. The opinions of students, who used ACLT (M=104.11, SD=11.63), on the usefulness of of the system were more positive than the opinions of students who used SCLT (M=86.00, SD=19.06). An independent-sample t-test found a significant difference between the two groups ($p < .05$). This difference is to the advantage of the group using the ACLT.

The properties of a collaborative tool which enables collaborative study to be carried out in teaching a Web based programming language are very important. As a result of this, looking at the student opinions on the usefulness of the NEU-VLE system, we can see that the students using the ACLT are more positive than the students using the SCLT. As a conclusion, one can say that the ACLT is very useful in teaching programming languages.

6.4 THE RESULTS RELATED TO THE LEARNING STRATEGIES OF THE GROUPS

One-way analysis of covariance (ANCOVA) based on the mean values of the test marks was used to find out whether or not there was a significant statistical difference between the learning strategies of the groups.

6.4.1 The Results of a Relationship between the Learning Strategies of Students Using the ACLT, SCLT and Traditional Methods of Collaborative Learning

Table 6.6 gives the data for the learning strategies of the students.

Table 6.6: Learning Strategies of the Students

Collaborative Learning Methods	Learning Strategies Mean
Used ACLT	173.83
Used SCLT	168.94
Used Traditional Collaborative Learning Methods	174.50

*The mean difference is significant at the .05 level.

There was no significant difference between the learning strategies means of students using the ACLT (M=173.83), the SCLT (M=168.94) and traditional learning method (M=174.50). One can say that all groups of students have similar properties of learning strategies.

6.5 THE RESULTS OF ACADEMIC SUCCESS

In this section, the success rates of students, the results of Pre-Test, and Post-Test of students obtained in Post-Test are collected and analyzed in detail.

6.5.1 Results Related to the Success Rates of the Students Taking the Post-Test Using the ACLT

In order to find out whether or not there was any statistically significant difference between students using the ACLT and traditional methods of learning, a paired sampled t-test was carried out and the results are shown in Table 6.7.

Table 6.7: The Success Rates of the Students Taking the Post-Test Using the ACLT and the Traditional Methods of Collaborative Learning

Groups	N	Mean	SD	Mean Difference	t	p
Used ACLT	18	72.83	19.81	14.83	2.84	0.01
Used Traditional Methods of Collaborative Learning	18	58.00	10.02			

*The mean difference is significant at the .05 level.

Post-Test results showed a higher success rate for the group using the ACLT. The results of the paired sampled t-test found a significant difference between the two groups ($t=2.84$, $p<.05$) in favour of the group using the ACLT.

The reason why there was significant difference between the two groups in Post-Test could be because students using the ACLT could reach their instructor any time, from their own places of study, with their own learning paces. Because they were not face to face with their instructor, they could ask any questions to them without being shy. This may be considered to be one of the reasons for success.

Based on these results one can say that an LMS together with an ACLT could be used for the successful teaching of programming languages in a web-based environment.

6.5.2 Results Related to the Success Rates of the Students Taking the Post-Test Using the SCLT

In order to find out whether or not there was any statistically significant difference between students using the SCLT and traditional methods of learning, a paired sampled t-test was carried out and the results are shown in Table 6.8.

Table 6.8: The Success Rates of the Students Taking the Post-Test Using the SCLT and the Traditional Methods of Collaborative Learning

Groups	N	Mean	SD	Mean Difference	t	p
Used SCLT	18	58.11	15.74	0.11	0.03	0.98
Used Traditional Methods of Collaborative Learning	18	58.00	10.02			

*The mean difference is no significant at the .05 level.

Post-Test results clearly indicate that students using the SCLT (M=58.11, SD=15.74) had approximately similar success rates as those learned using the traditional methods of learning (M=58.00, SD=10.02). A paired sampled t-test based on Post-Test results has not indicated a significant difference between the two groups (t=0.03, p>.05) in favor of the group using the SCLT.

Post-test results of Java showed an approximately similar success rates as those who received traditional methods ofteaching. It is also interesting to notice that results of the paired sampled t-test did not find a significant difference between the two groups (t=0.03, p>.05) in favor of the group using the SCLT.

Based on these results, one can say that the properties of the selected collaborative tool should be compatible with the teaching of the general structure of the programming language, and this may be considered to be one of the reasons for failure of chosen collaborative tool.

6.5.3 Results Related to the Success Rates of the Students Taking the Post-Test Using the ACLT and SCLT

In order to find out whether or not there was any statistically significant difference between students using the ACLT and the SCLT, a paired sampled t-test was carried out and the results are shown in Table 6.9.

Table 6.9: The Success Rates of the Students Taking the Post-Test Using the ACLT and SCLT

Groups	N	Mean	SD	Mean Difference	t	p
Used ACLT	18	72.83	19.81	14.72	2.47	0.02
Used SCLT	18	58.11	15.74			

*The mean difference is significant at the .05 level.

Post-Test results clearly indicated that students using the ACLT (M=72.83, SD=19.81) had higher success rates than those using the SCLT (M=58.11, SD=15.74). A paired sampled t-test based on Post-Test results has indicated a significant difference between the two groups ($t=2.47$, $p<.05$) in favor of the group using the ACLT.

Post-Test results showed a higher success rate for the group using the ACLT. It is also interesting to notice that results of the paired sampled t-test found a significant difference between the two groups ($t=2.47$, $p<.05$) in favor of the group using the ACLT.

Results of Post-Test indicated that the success rate was higher when an ACLT was used for the teaching of programming languages. The properties of the selected collaborative tool were compatible with the teaching of the general structure of the programming language to be taught, and this may be considered to be one of the reasons for success.

The descriptive results obtained in the experimental study are summarized in Figure 6.1.

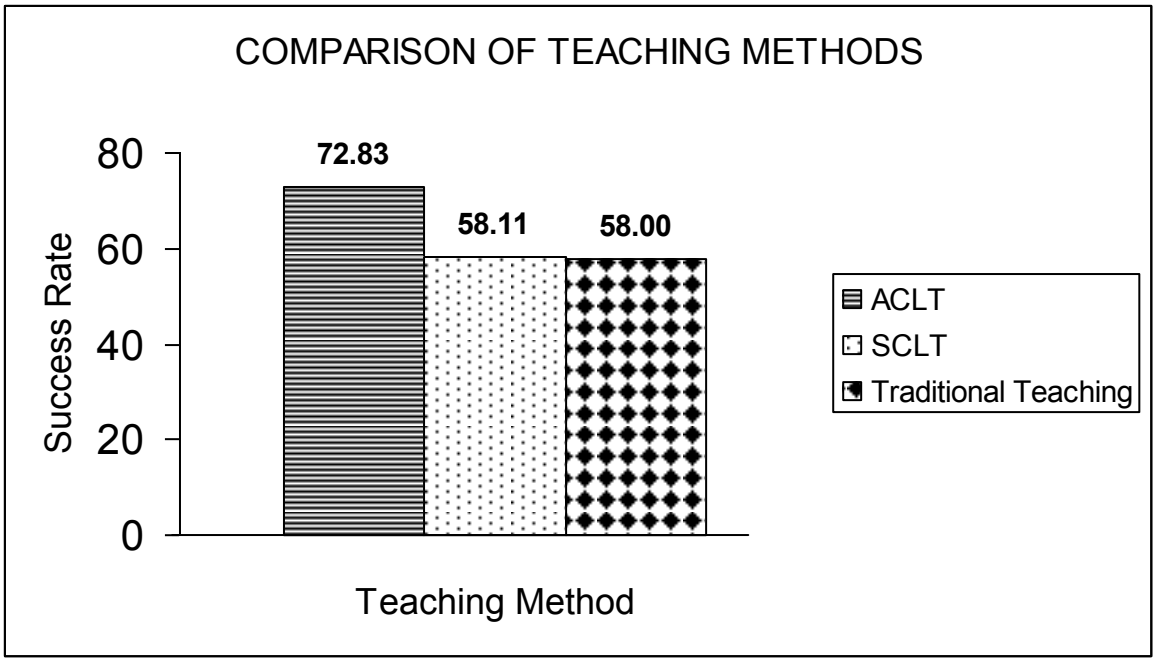


Figure 6.1: Comparison of Success Rates in Web-Based Teaching (Post-Test)

6.5.4 The Results of Pre-Test and Post-Test

One-way analysis of covariance (ANCOVA) was used to find out whether or not there was a significant difference between results of Pre-Test and Post-Test in each group. The results are summarized in Table 6.10.

Table 6.10: Results of Pre-Test and Post-Test

Collaborative Learning Methods	Pre-Test Mean	Adjusted Post-Test Mean
Used ACLT	2.83	72.83
Used SCLT	3.22	58.11
Used Traditional Collaborative Learning Method	3.00	58.00

A one-way analysis of covariance (ANCOVA) was conducted. The independent variable, collaborative learning methods, include three variables: Advanced collaborative group, Standard collaborative group, and traditional collaborative learning method group. The dependent variable was Post-Test results and the covariate was the Pre-Test results. A preliminary analyses evaluation the homogeneity-of-slopes assumption indicated that the relationship between the covariate and the dependent variable did not differ significantly as a function of the independent variable, F (2-48) = 2.79, p = .071, partial η^2 = .10. The ANCOVA was significant, F (2-50) = 6.88, MSE = 205.73, p = .002. The strength relationship between the collaborative learning method factor and dependent variables was weak, as assessed by a partial $\eta^{2,}$ with the collaborative learning method accounting for 21.6% of the variance of the dependent variable, taking marks of the Post-Test.

The means of the Post-Test, adjusted for initial differences were ordered as expected across the three collaborative learning methods. The ACLT group had the largest adjusted mean (M = 72.83), the traditional collaborative learning group had a smaller adjusted mean (M=58.004), the SCLT group had the smallest adjusted mean (M=58.10). Similar with our result, Biner et al. (1995) have concluded that online students are more motivated, more self-directed, and record higher achievement than students in traditional classrooms.

Follow up tests were conducted to evaluated pair-wise differences among the adjusted means. The Bonferroni procedure was used to control for type III error across the three pair wise comparisons. There were significant differences in the adjusted means between both groups that received advanced-standard and advanced-traditional learning methods. Also there were no significant differences in the adjusted means between the standard and traditional learning groups.

Looking at these results it could be seen that in web-based teaching of programming languages the academic success rate is higher than the teaching of programming languages through traditional methods if collaborative learning tool used is in an advanced level.

When one looks at the Post-Test results of the groups using the ACLT and SCLT we see that the success rate of the group using the ACLT is higher. In other words, the students using the ACLT have learned the topics being taught to them at a

higher rate. It can be said that in web-based education the use of ACLT has significance for the success rates of the students.

In general one can say that if it is required to teach programming languages using an LMS system, then an ACLT must be used. If the collaborative learning tool has not got the necessary properties while teaching a programming language the success rates of the students will be lower. Therefore it can be argued that the use of an LMS will lead to negative results. Also, if the collaborative learning tool used is not advanced, traditional teaching methods could give more successful results.

6.5.5 Results of Post-Test and Learning Strategies

One-way analysis of covariance (ANCOVA) was used to find out whether or not there was a significant relationship between the learning strategies and results of Pre-Test and Post-Test in each group. The results summarized in Table 6.11.

Table 6.11: Results of Pre-test, Post-Test and Learning Strategies

Collaborative Learning Methods	Learning Strategies Mean	Adjusted Post-Test Mean
Used ACLT	173.83	72.83
Used SCLT	168.94	58.11
Used Traditional Collaborative Learning Method	174.50	58.10

A one-way analysis of covariance (ANCOVA) was conducted. The independent variable, collaborative learning method, include three approaches: Advanced collaborative learning group, standard collaborative learning group, and traditional collaborative learning group. The dependent variable was Post-Test results and the covariate was the learning strategies results. A preliminary analyses evaluation the homogeneity-of-slopes assumption indicated that the relationship between the covariate and the dependent variable did not differ significantly as a function of the independent

variable, F (2-48) = 1.12, p = .336, partial η^2 = .04. The ANCOVA was significant, F (2-50) = 6.01, MSE = 232.97, p = .005. The strength relationship between the collaborative learning method factor and dependent variable was weak, as assessed by a partial $\eta^{2,}$ with the collaborative learning method accounting for 19.4% of the variance of the dependent variable, taking marks of the Post-Test.

The means of the learning strategies adjusted for initial differences were ordered as expected across the three collaborative learning methods. The ACLT group had the largest adjusted mean (M = 72.83), the traditional collaborative group had a smaller adjusted mean (M=58.00), the SCLT group had the smallest adjusted mean (M=58.11).

Follow up tests were conducted to evaluated pair-wise differences among the adjusted means. The Bonferroni procedure was used to control for type III error across the three pair wise comparisons. There were significant differences in the adjusted means between both groups that received advanced-standard and advanced-traditional learning methods. Also there were no significant differences in the adjusted means between the standard and traditional learning groups.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

This chapter covers the conclusions and recommendations of the study.

7.1 Conclusions

The experimental application carried out in this study indicated that the opinions of students using the ACLT were different in many respects to those using the SCLT. One can say that this is as a result of the enhanced features of the ACLT. Specially, the compile/run option of the ACLT has helped students a lot during the teaching of a programming language. Similarly, ACLT offers every member of the group the ability to see each other's screen. This point has been a major advantage of the ACLT.

At a glance the results of this experimental study suggest that both online classes had a positive opinion on NEU-VLE, with the course for general studies having stronger positive response. The students in general have been pleased and expressed an interest for the use of the system in other courses of the university. But the students using the ACLT were more positive than the students using the SCLT.

It is an important result that the students using the ACLT have shown statistically significant opinions on the use of tools such as asking questions to each other, making discussions, sending messages to each and so on. Although the common properties between the ACLT and the SCLT, such as the ability to communicate with the instructor, sending messages between each other, and the presence of an editor are very important, these properties are not sufficient for the successful teaching of programming languages in web-based environment. One can say that the compiler/run feature and the ability of the instructor and students to see each others' screens have added learning richness and effectiveness to ACLT. This should be considered as a superiority of the ACLT, especially in relation to teaching programming languages. This result is similar to the results reported by Booz (2004). The study "The Instructor Technology Leaders" provided faculty teams with access to an in-house developed

online collaboration tool, the Virtual Curriculum Laboratory, where team members could collaborate on their semester-long team project.

According to author's experiences, it is not sufficient to use only the tools such as chat, discussion forums, or whiteboard in web-based teaching of programming languages. If either the program or the output from the program/compiler can be sent to the instructor, or if better the instructor and the student can see each others' screens and work on the same program collaboratively, then a more efficient study environment can be established. Students can then solve their programming problems easily and with comfort as a result of such collaborative studies. In other words, if the instructor and students work on the same problem at the same time then success can be achieved and students can learn the programming language easier. However, Hietala (2002) investigated almost 60 students on three courses who had an opportunity to use a SCLT. He found that students were not used to working together in a SCLT environment. One possible explanation for this is that only the SCLT was used in the reported study.

It was found that the course instructor was more satisfied to teach a programming language using the ACLT rather than the SCLT. As described in the results section of the thesis, this was mainly because of the compile and run features of the ACLT, and the fact that the students could see each others' and their instructors' screens and exchange information at any time while using the ACLT. The instructor also found that working with the NEU-VLE system had many advantages compared to the traditional method of teaching.

The learning strategies of students in all groups are at acceptable and high levels. This means that the students which took part in the research study had similar learning strategies. As it is known, learning strategies is the property which determines and affects the way individuals make approaches when learning a topic. On the other hand, there seems to be no correlation between the opinions of students about the collaborative learning tools they have been using and their learning strategies. Based on these results one can say that the opinions of groups to the collaborative learning tools have not been affected by their learning strategies. The fact that the opinions of students in both groups were not affected could be valued as a normal result.

This experimental study has shown that significant differences found while using the SCLT are not as a result of students' learning strategies. It is almost certain

that the differences have emerged as a result of the main properties of the ACLT. Sarmiento's (2004) preliminary results show positive outcomes and point to areas where additional research and development is required to investigate the effectiveness of online environments in support of learning.

The results of this experimental study highlight some important issues for teaching programming languages using a synchronous collaborative learning tool in web-based education.

The first important result is that students using the ACLT have shown statistically significant success rates. Although the common properties between the ACLT and the SCLT, such as the ability to communicate with the instructor, sending messages between each other, the presence of a code editor are very important properties, they are not sufficient for the successful teaching of a programming language in web-based environment. One can say that compiler/run feature and the ability of the instructor and students to see each others' screens have added an effective learning power to ACLT. This should be considered as a superiority of the ACLT, especially in relation to teaching programming languages. It is interesting to note that this result is similar to the results reported by Booz (2004), who describes an in-house system enabling faculty teams to access an in-house developed online collaboration tool (Virtual Curriculum Laboratory) where the team members could collaborate on their semester-long projects.

Students using ACLT have been more successful than those using the SCLT group. As an important point, both Nicol & Anderson (2000), and Johnson & Hegarty (2003) saw the benefits to extended practice through the use of technology. One of the reasons for this been more successful in our study is that ACLT offers compile and run utilities. It is the authors' opinion that these tools may have increased the motivation of students, and this point is one of the fundamental reasons why students using the ACLT group were more in favors of the NEU-VLE system. It is not sufficient to use only the tools such as chat, discussion forums, or whiteboard in web-based teaching of programming tools. It is the nature of programming languages that, when students have problems with their programs it may not always be possible to describe these problems easily to their instructor. But, if either the program or the output from the program/compiler can be sent to the instructor, or if better the instructor and the student

can see each others' screens and work on the same program collaboratively, then a more efficient study environment can be established. Also, there is no need to use any additional tools while using the ACLT as it contains the compiler and linker. On the other hand, SCLT requires compiler and linker and thus it can not be used everywhere (for example in an internet café). Students can then solve their programming problems as a result of such collaborative studies. In other words, if the instructor and students work on the same problem at the same time then greater success can be achieved and students can learn the programming language easier and quicker. The work of Tang (1991) has shown that a representation as a final product is less meaningful and communicative than seeing how that representation is produced.

The results of the experimental study showed that a Learning Management System can be made more efficient if it is enhanced by an ACLT. In this study the Moodle has been used together with the GREWPTool for the teaching programming 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 an ACLT so that the benefits of learning in a class-like group environment can be achieved. Because, in general one can say that if it is required to teach a programming language using an LMS system, then an ACLT must be used. If the collaborative learning tool has not got the necessary properties while teaching a programming language the success rates of the students will be lower and as a result it can be argued that the use of an LMS will lead to negative results. Also, if the collaborative learning tool used is not advanced, traditional teaching methods could give more successful results.

Further, the results of the study help add empirical data to the relevant research, and are expected to help online administrators, instructional designers, instructional and technical support staff, and tool developers with developing better tools, offering appropriate workshops, and providing corresponding support.

7.2 Recommendations

The experimental research in this thesis has been on the use of a learning management system together with a collaborative learning tool for the teaching of programming languages to web-based distant education students.

The results of an experimental study carried out at the Near East University showed that a more efficient web-based teaching environment can be created when an ACLT is combined with a learning management system.

Although the results are satisfactory, based on the results of the experimental study and the survey, the method described in this thesis can further be improved by considering the following recommendations:

- GREWPTool should be integrated inside MOODLE.
- If the aim is to teach a programming language using web-based education and an LMS system, it is recommended that more efficient results can be obtained if an ACLT is integrated inside the LMS system.
- Additional programming languages should be integrated inside GREWPTool.
- The collaborative teaching environment described in this thesis is recommended to other universities and technical colleges engaged in teaching programming languages in Web-Based Education.
- The teaching of a web-based programming language should not only be considered as the solution of exercises (e.g., writing example programs). Such a study should be enhanced and supported by the use of available internet tools such as chat, discussion boards, forums, collaborative tools, and similar utilities.
- Students must be able to see the instructor's and each others screen outputs in web based education where a collaborative learning tool is used.
- In parallel to Java, the teaching of other programming languages should also be considered using web-based teaching techniques described in this thesis.
- Experimental studies should be carried out in order to assess the student success rates and the effects of web-based teaching on the understanding of the selected programming languages, and its effects on the ability to gain the skill of writing programs.

REFERENCES

Adamchik, V., & Gunawardena A. (2003). A learning objects approach to teaching programming. *Proceedings of the International Conference on Information Technology: Computers and Communications,* Thessaloniki, Greece, p. 96.

Retrieved April 08, 2006, from: http://www.cs.cmu.edu/~adamchik/PLO/ITCC-03.pdf

Akkoyunlu, B. (1996). "Öğrencilerin bilgisayarlara karşı tutumları". *Eğitim ve Bilim*, vol:20, p.100.

Alexander, P. A., & Murphy, P. K. (1994). *The research base for APA's learner-centered psychological principles*. Paper presented at the American Educational Research Association Annual Meeting, New Orleans.

Alkan. C. (1984). *Eğitim teknolojisi: Kavram, kapsam, süreç, ortam, işgören, uygulama*. Yargıçoğlu Press.

Alkan, C. (1997). *Eğitim teknolojisi*. Ankara, Anı Publication.

Allen, I. E., & Seaman, J. (2003). *Sizing the opportunity: The quality and extent of online education in the United States, 2002 and 2003*. Needham, MA: The Sloan Consortium.

Althauser, R., & Matuga, J. (1998). On the pedagogy of electronic instruction. In C. J. Bonk & K. S. King (Eds.), *Electronic collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse* (pp. 183-208). Mahwah, NJ: Lawrence Erlbaum Associates.

Anderson, T. (2003). Modes of interaction in distance education: Recent developments and research questions. In M. G. Moore & W. G. Anderson (Eds.), *Handbook of distance education* (pp. 129-144). Mahwah, NJ: Lawrence Erlbaum Associates.

Ansorge, C., & Colley, N. (2003, March/April). The role of education faculty in choosing web-based course management systems: An interview with Nancy Cooley. Retrieved September 04, 2004, from: http://ts.mivu.org/default.asp?show=article&id=846

Diament, A. (2004). Using Moodle Virtual Learning Environment Software. PLC Research Programme.

Aşkar, P., & Erden, M. (1986, July). "Mikrobilgisayarların okullarda kullanımı". *Eğitim ve Bilim*, n:61, pp. 21-24.

Aşkar, P. & Köksal, M. (1987, February). "BDÖ'de kullanılan yazılım paketlerinin geliştirilmesinde ve değerlendirilmesinde dikkat edilecek noktalar". *Eğitim ve Bilim*, n:66, pp. 20-23.

Bannan-Ritland, B., Bragg, W., & Collins, M. (1999). Linking theory, educational constructs, and instructional strategies in Web-based course development. In P. Robinson & B. Bannan-Ritland (Eds.), *Web-based computer conferencing*. Sterling, VA: Srylus Publishing. Retrieved February 1, 2006, from: http://www.provost.harvard.edu/factect/factect01/BannanWB.pdf

Barone, R., & Parod W. Jr. (1997). *ClassACT: The evoluation of a collaborative learning tool*. 2nd WebNet 97 World Conferance of the WWW, Internet & Intranet Proceedings, (p.8), 1-5, Nov, Toronto, Canada.

Baykal, A. (1986, January/February). "Eğitimde bilgisayar: Yararları ve yetersizlikleri-I". *Lifelong Education*, n:14, pp. 27-31.

Biner, P. M., Bink, M. L., Huffman, M. L., & Dean, R. S. (1995). Personality characteristics differentiating and predicting the achievement of televised course students and traditional course students. *American Journal of Distance Education,* 9(2), 46-60.

Birol, Ş. (2001). *Öğrenme stratejilerine yönelik karşılaştırmalı öğrenci görüşleri.* Nonpublication master's thesis, University of Ankara, Ankara, Turkey.

Bodington VLE: Retrieved April 19, 2004, from: http://www.bodington.org

Bonk, C.J., Medury, P. V., & Reynolds, T. H. (1994). Cooperative hypermedia: The marriage of collaborative writing and mediated environments. *Computers in the Schools*, 10(1-2), 79-124.

Bonk, C. J. (2001). *Online teaching in an online world*. Retrieved September 10, 2003, from:http://www.publicationshare.com/docs/faculty_survey_report.pdf

Bonk, C. J., & Dennen, V. (2003). *Frameworks for research, design, benchmarks, training, and pedagogy in web-based distance education*. In M. G.

Bonk, C.J., Kim, K., & Liu, S. (2005). *Evaluating an online program*. Paper presented at the 5th IST annual conference, Bloomington, Indiana.

Booz, W. (2004). The virtual curriculum laboratory: An online collaboration sandbox. In C. Crawford, D. Willis, R. Carlsen, I. Gibson, K. McFerrin, J. Price & R. Weber (Eds.), *Proceedings of Society for Information Technology and Teacher Education International Conference* (pp. 2821-2826). Chesapeake, VA: AACE.

Brookfield, S. D. (1986). *Understanding and facilitating adult learning.* San Francisco: Jossey-Bass.

Bruner, J. (1966). *Towards a theory of instruction. Cambridge.* MA: Harvard University Press.

Candy, P.C. (1991). *Self-direction in adult learning: A comprehensive guide to theory and practice*. San Francisco: Jossey-Bass.

Carmen, C., & Haefner, J. (2002, November/December). Mind over matter: Transforming course management systems into effective learning environment. *EDUCASUE.* Retrieved December 07, 2004, from: http://www.educause.edu/ir/library/pdf/erm0261.pdf

Cashion, J. & Palmieri, P. (2002). The secret is the teacher: The learner view of online learning. *National Centre for Vocational Education Research*. Leabrook: South Australia.

Cebeci, E. D. (2000). *İşletmelerde teknolojik eğitim stratejileri kapsamında web tabanlı eğitimler*. Nonpublication master's thesis, University of Yıldız Teknik, İstanbul,Turkey

Çeliköz, N. (2001). *Bir açık-uçlu öğrenme uygulaması olarak hypermedya (www) ortamlarında öğrencilerin proje etkinliklerinin incelenmesi.* Nonpublication doctoral dissertation, University of Hacettepe, Ankara, Turkey.

Chang, C. S. (2000). The effect of attitudes and self-efficacy on college student performance in online instruction. *UMI ProQuest Digital Dissertations*, AAT 9994597.

Chang-Hyun J., & Arnold, A. J. (2003). A portable and collaborative distributed programming environment. *Proceedings of the International Conference on Software Engineering Research and Practice, SERP'03, 1*, pp. 198-203, June 23 - 26, Las Vegas, Nevada, USA. Retrieved August 04, 2006, from: http://jo.ecs.fullerton.edu/research/jo-SERP03-DPE.pdf

Chase, J., & Okie, E. (2000). Combining cooperative learning and peer instruction in introductory computer science. *SIGCSE Bulletin*, 32(1), 372-376.

Chavan, A. (2005). Seven criteria for evaluating open-source content management systems. *Linux Journal Website*. Retrieved on August 9, 2005, from: http://www.linuxjournal.com/node/8301/

Chi, M. T. H., Bassok, M., Lewis. M. W., Reimann, P., & Glaser, R. (1989). Self-explanations: How students study and use examples in learning to solve problems. *Cognitive Science*, 13, 145-182.

Claroline VLE. Retrieved April 19, 2004, from: http://www.claroline.net

Coffman, S. (2001, April). "Distance education has helped to create a whole group of people who don't study on campus: Libraries are starting to use customized communication applications to handle this new off-campus market", C*omputers in Libraries*, pp. 21-25.

COL. (2003). COL LMS open source. *Technical report, commonwealth of learning*. Retrieved on August 8, 2005, from: http://www.col.org/Consultancies/03LMSOpenSource.pdf.

Coles, R. (1997). *Moral intelligence of children*. New York, NY: Random House.

Cooney, D. H. (1998). Sharing aspects with aspects: Real-time collaboration in the high school English classroom. In C. J. Bonk & K., S. King (Eds.), *Electronic collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse* (pp. 263-287). Mahwah, NJ: Lawrence Erlbaum Associates.

Coppola C., & Neelley E. (2004). Open source - opens learning, why open source makes sense for education. *Technical report, R-Smart Group.*

Retrieved on March 30, 2005, from: http://www.rsmart.com/assets/OpenSourceOpensLearningJuly2004.pdf

Council for Higher Education Accreditation. (2001). *Distance learning in higher education*. CHEA update, 3. Retrieved April 08, 2006, from: www.chea.org/Commentary/distance-learning-3.cfm

Crook, C. (2002). Learning as cultural practice. In. M. Lea & K. Nicoll (Eds.), *Understanding distributed learning* (pp. 152-169). London: Routledge Falmer.

Cross, K. (1998, July-August). "Why learning communities? Why now?". *About Campus*, pp. 4-11.

Cross, K. P. (1998). What do we know about students' learning and how do we know it. *AAHE National Conference on Higher Education.* Retrieved July 11, 2002, from: www.aahe.org/nche/cross_lecture.htm

Crotty, T. (2000). *Constructivist theory unites distance learning and teacher education.* Retrieved August 29, 2006, from: http://www.ed.psu.edu/acsde/deos/deosnews/deosnews5_6.asp

Demirel, Ö., & Ün, K. (1987). *Eğitim terimleri*. Ankara: Şafak printing house.

Derry, S. J., & Murphy, D. A. (1986). Deigning systems that train learning ability. *Review of Educational Research*, 56(1), 1-39.

Doğan, H. (1983). "Teknoloji Eğitimi", University of Ankara, Publication of Faculty of Education Sciences, no:128, Ankara.

Dougiamas, M. (2004).Moodle documentation: Philosophy. Retrieved July 18, 2004 from: http://moodle.org/doc/

Dougiamas, M., & Taylor, P.C. (2003). Moodle: Using learning communities to create an open source course management system. *In Proceedings of ED-MEDIA 2003.* Retrieved on March 30, 2005, from: http://dougiamas.com/writing/edmedia2003/

Duderstadt, J. J., Atkins, D. E., & Van Houweling, D. (2002). *Higher education in the digital age: Technology issues and strategies for American colleges and üniversities*. Westport, CT: American Council on Education and Praeger.

Duffy, T. M., & Cunningham, D. J. (1996). Constructivism: Implications for the design and delivery of instruction. In David H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 170-197). New York: Simon & Schuster Macmillan.

Duffy, T., Dueber, B., & Hawley, C. (1998). Critical thinking in a distributed environment: A pedagogical base for the design of conferencing system. In C. J. Bonk & K. S. King (Eds.), *Electronic collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse* (pp. 51-78). Mahwah, NJ: Lawrence Erlbaum Associates.

Duman, A. (1997). *İnternet öğrenme ve eğitim üzerine bir deneme.* Retrieved April 08, 2006, from: http://inettr97.metu.edu.tr/bildiriler/tekh.htm

Dyrli, O. E., & Kinnaman D. E. (1996). Part 4: Connecting with the world through successful telecommunications projects. *Technology and Learning*, 16 (7), 56-61.

Edelson, P. J. (1998). The organization of courses via the internet, academic aspects, interaction, evaluation, and accreditation. *National Autonomous University of Mexico*, Mexico City.

Edutools. (2004). *Edutools course management systems*. Retrieved on August 8, 2005 from: http://www.edutools.info/course/

Eisele, J., & M. E. Eisele (1990). *Educational technology: A planning and resource guide supporting curriculum.* New York & London: Garland Publishing Inc.,

Eisele, J. & M. E. Eisele (1994). *Eğitim teknolojisi, programa destek bir planlama ve kaynak kılavuz.* (C. Alkan, Trans). Türkiye: Eskişehir.

Elias, J. L., & Merriam, S. (1980). *Philosophical Foundations of Adult Education.* Malabar: Robert E. Krieger.

ELP. Queensland University of Technology, Department of Information Technology. Retrieved August 04, 2006, from: http://www.elp.fit.qut.edu.au/overview/

Ertürk, S. (1979). *Eğitimde program geliştirme*. Ankara: Publications of Yelkentepe, 4, p.12.

Everett, R. (2002). Briefing paper number 1: *MLE's and VLE's Explained*. What does a VLE do section, 1. Retrieved July 04, 2004 from: http://www.jisc.ac.uk/index.cfm?name=mle_briefings_1

Farr, R., & Tone, B. (1994). *Portfolio and performance assessment: Helping students evaluate their progress as readers and writers.* Forth Worth, TX: Harcourt Brace College Publishers.

Federico, P. A. (2001). Academic departments and student attitudes toward different dimensions of web-based education. *Journal of Educational Computing Research*, 25(2), pp. 159-175.

Feenberg, A. (1989). The written word: On the theory and practice of computer conferencing. In R. Mason & A. R. Kaye (Eds.), *Mindweave: Communication, computers and distance education* (pp. 22-39). Oxford: Pergamon Press.

Feuer, M. J., Towne, L., & Shavelson, R. J. (2002). Scientific culture and educational research. *Educational Researcher*, 31(8), 4-14.

Firdyiwek, Y. (1999). Web-based courseware tools: Where is the pedagogy? *Educational Technology*, 39 (1), 29-34.

Fitch, L. J. (2004). Student feedback in the college classroom: A Technology solution. *ETR&D*, 52(1), 71-81, ISSN 1042-1629.

Fraenkel, J. R., & Wallen N. E. (2006). *How to design and evaluate research in education*. USA: McGraw-Hill.

FSF (2005). *Why "free software" is better than "open source".* Retrieved on August 8, 2005, from: http://www.fsf.org/licensing/essays/free-software-for-freedom.html.

Future's Technology (1993, May). "Future's Society". 1, p. 3.

Gamas, W., & Solberg, B. (1997). *Classroom collaboration in cyberspace*. Retrieved August, 29, 2006, from: http://www.coe.uh.edu/insite/elec_pub/HTML1997/de_gama.htm

Gardner, H. (1999). *Intelligence reframed: Multiple intelligences for the 21st century*. New York: Basic Books. 292 + x pages. Useful review of Gardner's theory and discussion of issues and additions.

Garrison, R. (1993). Quality and access in distance education: Theoretical considerations. In D. Keegan (Ed.), *Theoretical principles of distance education.* New York: Routledge.

Garrison, R., Anderson, T., & Archer, W. (2003). A theory of critical inquiry in online distance education. In M. G., Moore & W. G., Anderson (Eds.), *Handbook of distance education* (pp. 113-127). Mahwah, New Jersey: Lawrence Erlbaum Association.

Gazzaniga, M. S. (1985). *The social brain: Discovering the networks of the mind*. Basic Books.

Glaser, B. G. (1978). *Theoretical sensitivity: Advances in the methodology of Grounded theory.* Mill Valley, CA: Sociology Press.

Glass, G. (2003). *Education policy analysis archives activity*. Paper presented at the annual meeting of the American Educational Research Association, Chicago.

Goleman, D. (1996). *Emotional intelligence: Why it can matter more than IQ*. London: Bloomsbury Publishing.

Gunawardena, C. N., & Zittle, R. (1995). An examination of teaching and learning processes in distance education and implications for designing instruction. In M. Beaudoin (Ed.), *Distance Education Symposium 3: Instruction* (pp. 51-63). University Park, PA: The Pennsylvania State University.

Hakes et al., (1995), chapters 4 & 7, pp. 37-51 & 73-85.

Hall, J. (2003). *Assessing learning management systems*. Oracle University. Retrieved April 18, 2006, from: www.clomedia.com

Hanna, D. H. (2003). Organizational models in higher education, past and future. In M. G., Moore & W. G., Anderson (Eds.), *Handbook of distance education* (pp. 67-78). Mahwah, NJ: Lawrence Erlbaum Associates.

Hara, N., & Kling, R. (1999). Students' Frustrations with a web-based distance education course. *First Monday*, 4(12). Retrieved October 10, 2003, from: http://www.firstmonday.dk/issues/issue 4_12/hara/

Hara, N., & Kling, R. (2000). Students' distress with a web-based distance education course: An ethnographic study of participants' experience. *Information, Communication and Society*, 3(4), 557-579.

Harasim, L, Calvert, T., & Groeneboer, C. (1997). Virtual-U: A web-based system to support collaborative learning. In B. H. Khan (Ed.), *Web-based instruction* (pp. 149-158). New Jersey: Educational Technology Publications, Inc.

Harasim, L. (1990). Online Education: An environment for collaboration and intellectual amplification. In L. Harasim (Ed.), *Online Education: Perspectives on a New Environment* (pp. 39-64). New York: Praeger.

Harasim, L., Hiltz, S. R., Teles, L., & Turoff, M. (1995). *Learning networks: A field guide to teaching and learning online*. Cambridge, MA: MIT Press.

Harry, B. (1992). *Cultural diversity, families, and the special education system.* New York: Teachers College Press.

Hars, A., & Ou, S. (2002). Working for free? – Motivations of participating in open source projects. *International Journal of Electronic Commerce*, 6, 25-39.

Haynes, K. J. M., & Dillon, C. (1992). Distance education: Learning outcomes, interaction and attitudes. *Journal of Education for Library and Information Studies*, 33, 32-42.

Hedberg, J. G., & McNamara, S. E. (1989). The human-technology interface: Designing for distance and open learning. *Educational Media International*, 26(2), 73-81.

Henri, F. (1992). Computer conferencing and content analysis. In A. Kaye (Ed.), *Collaborative learning through computer conferencing: The Najaden papers* (pp. 117-136). Berlin: Springer-Verlag.

Herrington, J., Oliver, R., & Reeves, T. C. (2003). Patterns of engagement in authentic online learning environments. *Australian Journal of Educational Technology*, 19(1), 59-71.

Herrington, J., Reeves, T. C., & Oliver, R. (2004). A development research agenda for online collaborative learning. *ETR&D*, 52(4), 53-65, ISSN 1042-1629.

Herrington, J., Reeves, T. C., Oliver, R., & Woo, Y. (2004). Designing Authentic Activities in Web-Based Courses. *Journal of Computing in Higher Education, 16*(1), pp. 3-29.

Hertel, R. (2003). Complexification: Some examples from biological evolution. *In: XXIX Seminario sulla evoluzione biologica e i grandi problemi della biologia*, (pp.31-49). Accad Naz Lincei, Roma.

Langton, J. Hickey, T., & Alterman, R. (2002). *TA Groupware*. Tech Report (CS-02-222). Waltham: Brandeis University, Department of Computer Science.

Langton, J. Hickey, T., & Alterman, R. (2002). *Integrating tools and resources: A case study in building educational groupware for collaborative programming*. Retrieved on August 31, 2006 from: http://citeseer.ist.psu.edu/632680.htm

Hietala, P. (2002). Asynchronous conferencing with a twist of synchronicity: In search for tools for collaborative moderation in online discussions. In G. Richards (Ed.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2002* (pp. 441-448). Chesapeake, VA: AACE.

Hiltz, S.R. (1997). Impacts of college level courses via asynchronous learning networks: Some preliminary results. *Journal of Asynchronous Learning Networks*, 1(2). Retrieved August 24, 2006, from: http://www.aln.org/alnweb.journal/issue2/hiltz.html

Holmberg, B. (1986). *Growth and structure of distance education*. London: Croon Helm. Retrieved August 10, 2006, from: http://cde.athabascau.ca/online_book/ch5.html

Holmberg, B. (1990). *Perspectives of research on distance education* (2nd update and expanded edition). Hagen, West Germany: Fern Universidad.

Hubscher-Younger, T., & Narayanan, N.H. (2003). Constructive and collaborative learning of algorithms. *Proceedings of the 34th SIGCSE Technical Symposium on Computer Science Education*, Reno, Navada, USA, 1-58113-648-X, 6-10.

Hummel, H. G. (1993). Distance eEducation and situated learning: paradox or partnership? *Educational Technology*, 33(12), 11-22, ERIC: EJ474681.

İşman, A. (1999). Uzaktan eğitim: EDOK uzaktan eğitim merkezi. *First Distance Education Symposium, November, 15-16* (pp. 93-101). Ankara: Kara Kuvvetleri Eğitim ve Doktrin Komutanlığı.

İşman, A., Barkan, M., & Demiray, U. (2005). *Distance education: The winds of change.* Ankara, Turkey: Pegem Yayıncılık Eğitim Danışmanlık Hızmetleri Tic. Ltd Şti.,

Jonassen, D. (1995). Evaluating constructivistic learning. *Educational Technology*, 31(9), 28-33.

Jonassen, D. J. (1999). *Computer in the classroom mind tools for critical thinking*. (Second Edition). New Jersey: Prentice Hall.

Jonassen, D., Davidson, M., Collins, M., Campbell, J., & Bannan-Haag, B. (1995). Constructivism and computer-mediated communication in distance education. *The American Journal of Distance Education*, 9(2), 7-26.

Jones, C., & Timpson, W. M. (1991). Technologically mediated staff development: A retrospective case study. *The American Journal of Distance Education*, 5(1), 51-56.

Jung, I., Choi, S., Lim, C., & Leem, J. (2002). Effects of different types of interaction on learning achievement, satisfaction and participation in web-based instruction. *Innovation in Education and teaching International*, 39(2), 153-62.

Kang, I. (1998). The use of computer-mediated communication: Electronic collaboration and interactivity. In C.J., Bonk & K. S., King (Eds.), *Electronic collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse* (pp. 315-337). Mahwah, NJ: Lawrence Erlbaum Associates.

Karasar, N. (1999). *Sanal yükseköğretim*. Nonpublication doctoral dissertation, University of Anadolu, Eskisehir, Turkey.

Karin van den Berg (2005, August). *Finding open options an open source software evaluation model with a case study on course management systems.* Tilburg University: Information Management and Science program.

Karsenti, T. (2001). From Blackboard to mouse pad: Training teachers for the new millennium. *Education Canada*, 41(2), 32-35.

Kearsley, G (1998, August). Online education: New paradigms for learning and teaching. *Vision.* Retrieved March 14, 2003, from: http://ts.mivu.org/default.asp?show=article&id=73

Kaye, A. (Ed.) (1992). *Collaborative learning through computer conferencing: The Najaden papers.* Berlin: Springer-Verlag.

Kearsley, G. (1995). The nature and value of interaction in distance learning. In M. Beaudoin (Ed.), *Distance Education Symposium 3: Instruction* (pp. 83-92). University Park, PA: The Pennsylvania State University.

Kearsley, G. (2000). *Online education: Learning and teaching in Cyberspace*. Belmont, CA: Wadsworth /Thomson Learning.

Keegan, D. (1986). *The foundations of distance education*. London: Croon Helm.

Keser, H. (1988, June). *Bilgisayar destekli öğretim için bir model önerisi.* Nonpublication doctoral dissertation, University of Ankara, Ankara, Turkey.

Keser, H. (2000). Eğitimde yeni teknolojilerde öğretmenin değişen rolü. *Adım* (Special Number, Eğitim), Lefkoşa.

Khan, B. H. & Vega, R. (1997). Factors to consider when evaluating a web-based instruction course: A survey. In B. H. Khan (Ed.), *Web-based Instruction* (pp. 375-380). Englewood Cliffs, NJ: Educational Technology Publications.

Khan, B. H. (1997). *Web-based instruction*. Englewood Cliffs, NJ: Educational Technology Publications.

Kirkley, S., & Bolling, E. (1995). *Learner-centered design: Software for the information age*. From: http://www.indiana.edu/~iirg/ARTICLES/AAIM/lcd.html

Knowles, M. S. (1980). *The modern practice of adult education*. New York: Cambridge.

Lave, J., & Wenger, W. (1991). *Situated learning: Legitimate peripheral participation* . Cambridge, UK: Cambridge University Press.

Leading Change (2001). *DCU's strategic plan 2001-2005*. Retrieved April 19, 2004, from: http://www.dcu.ie/president/plan.shtml

LeBaron, J. F., & Bragg, C. A. (1994). Practicing what we preach: Creating distance education models to prepare teachers for the 2s1st century. *The American Journal of Distance Education*, 8(1), 5-19.

Lebow, D. (1993). Constructivist values for instructional systems design: Five principles towards a new Mindset. *Educational Technology Research and Development*, 41(3), 4-16.

Lee. C., Tan, D., & Goh, W. (2004). The next generation of e-learning: strategies for media rich online teaching and engaged learning. *The International Journal ofDistance Education Technologies*, 2(4), 1-18.

Liu, S. (2005). Faculty use of technologies in online courses. *International Journal of Instructional Technology & Distance Learning*. Retrieved November 02, 2005, from: http://www.itdl.org/Journal/Aug_05/article03.htm

Lotus Domino. Retrieved 1999, from: http://www.lotus.com/

McDowell, C., Werner, L., Bullock, H., & Fernald, J. (2002). The effects of pair programming on performance in an introductory programming course. *Proceedings of the 33rd SIGCSE technical symposium on Computer science education, 5-58113-473-8*, 38-42, Cincinati, Kentucky.

McGreal, R., & Elliot, M. (2004). Technologies of online learning. In T. Anderson & F. Elloumi (Eds). *Theory and practice of online learning*. Athabasca, Canada: Athabasca University. Retrieved January 09, 2005, from: http://cde.athabascau.ca/online_book/ch5.html

McMann, G. W. (1994). The Changing Role of Moderation in Computer Mediated Conferencing. *In Proceedings of the Distance Learning Research Conference*, April 27-29, San Antonio, TX, 59-166.

McMullin, B. & Munro, M. (2004). *Moodle at DCU*. Retrieved December 14, 2005, from: http://odtl.dcu.ie/wp/2004/odtl-2004-01.html

Milheim, W. D. (1991). Implementing distance education programs: Suggestions for potential developers. *Educational Technology*, 31(4), 51-53.

Mioduser, D. & Others. (2000). Web-based learning environments: Current pedagogical and technological state. *Journal of Research on Computing in Education*. Fall. ISTE, USA.

Moodle (2005). *Moodle Buzz-Reviews, papers and listings about Moodle*. Retrieved on August 8, 2005, from: http://moodle.org/mod/resource/view.php?id=102

Moodle VLE [Online]. Retrieved September 01, 2004, from:http://moodle.org

Moore M. G. (2003). From chautauqua to the virtual university: A centaury of distance education in the United States. *Information Series*, p.63. Retrieved April 08, 2006, from: http://www.cete.org/acve

Moore, B. C. J. (1989). *An introduction to the psychology of hearing*. (third edition). London and San Diego: Academic Press.

Moore, D. M. (1994a). Autonomy and interdependence. *American Journal of Distance Education*, 8(2), 1-5.

Moore, D. M. (Mike) (1994b). Action and object language. In D. M. Moore & F. M. Dwyer (Eds.), *Visual literacy: A spectrum of visual learning*. (pp. 145-162). Englewood Cliffs, New Jersey: Educational Technology Publications.

Moore, M. (2003). This book in brief: Overview. In M. G., Moore & W. G., Anderson (Eds.), *Handbook of distance education* (pp. 13-22). Mahwah, NJ: Lawrence Erlbaum Associates.

Moore, M. G., & Thompson, M. M. (1990). *The effects of distance learning: A summary of literature* (ACSDE Research Monograph No 15). University Park, PA: The Pennsylvania State University, The American Center for the Study of Distance Education.

Morrisson, D. (2003). *E-learning strategies: How to get implementation and delivery right first time*. Hoboken, New Jersey: John Wiley and Sons.

Murphy, J. (1993). *Restructuring Schools*. Cassell: London.

Naidu, S. (2003). Designing instruction for e-learning environments. In M. G. Moore & W. G. Anderson (Eds.), *Handbook of distance education* (pp. 349-365).

Netcraft. (2005). *July 2005 Web Server Survey*. Retrieved on July 1, 2005, from:

http://news.netcraft.com/archives/web_server_survey.html

News (2006, March 31). *Athabasca University Moves to Moodle*. Retrieved on June 06, 2006, from: http://www.athabascau.ca/media/index.php?id=132

Nicholson, S. (2002). Socialization in the "virtual hallway": Instant messaging in the asynchronous web-based distance education classroom. *Internet and Higher Education*, 5(4), 363-372.

Nicol, M. M., & Anderson, A. (2000). Computer-assisted vs. teacher-directed teaching of numeracy in adults. *Journal of Computer Assisted Learning*, 16, 184-192.

Nokelainen P., Miettinen M., Tirri H., & Kurhila J. (2002). A tool for real time on-line collaboration in web-based learning. *Proceedings 14th of ED-MEDIA 2002 World Conference on Educational Multimedia, Hypermedia & Telecommunications,* June 24-29, Denver, Colorado, p. 7.

Novell. (2003). *Novell announces agreement to acquire leading enterprise Linux Technology Company SUSE LINUX*. Retrieved on August 8, 2005, from:

http://www.novell.com/news/press/archive/2003/11/pr03069.html

Ohlund, B., Andrews, S., Yu, C. H., Jannasch-Pennell, A., & DiGangi, S. A. (1999). *Impact of asynchrounous and synchronous internet-based communication on collaboration and performance among K-12 teachers*. Paper presented at the Annual

Meeting of the American Educational Research Associatio, Montreal, Quebec, Canada.

Oliveira, J. B. A. (1982). "Eğitim Teknolojisinden Etkili Yararlanma". Perspectives, *UNESCO*, 12(3), 361-374.

Oliver, R., Herrington, J., & Omari, A. (1999). *Creative Effective Instructional Materials fort the World Wide Web*. Retrieved April 08, 2006, from:

http://www.scu.edu.au/sponsored/ausweb/ausweb96/educn/oliver

News. *Open University going Moodle.* Retrieved August 29, 2006 from: http://kairosnews.org/node/4511

Orcan, S. (1998). *Internet*, Ankara: Türkiye Ulusal Enformasyon Altyapısı Proje Ofisi-TUENA, pp. 3-4.

Ose.Nz.Org (2004). *LMS technical evaluation*. Retrieved on August 8, 2005, from:

http://eduforge.org/docman/view.php/7/18/LMS_Technical_Evaluation-May04.pdf

OSI. (2002). *Open Source Definition*, version 1.9.

Ottenhoff, J., & Lawrence, D. (1999). Ten paradoxical truths about conference software in the classroom. *Syllabus*, 13(3), pp. 54 & pp. 56-57.

Özden, Y., Yiğit, Y., & Yıldırım, S. (1999). *Web tabanlı internet öğreticisi: Bir durum çalışması*. Bursa: University of Uludağ, EBIT communiqe.

Perraton, H. (1988). A theory for distance education. In D. Sewart, D. Keegan, & B. Holmberg (Eds.), *Distance education: International perspectives* (pp. 95-113). New York: Routledge.

Peters, L. (2001). *Through the looking glass: Student perceptions of online learning.* Retrieved April 18, 2006, from: http://www.marylandonline.org/prospective_students/articles/looking_glass/show?show=factors

Picciano, A. (2001). *Distance learning: Making connections across virtual space and time.* Merrill Prentice Hall: Upper Saddle River, New Jersey, pp. 70-71.

Raymond, E. S. (1998). *Goodbye, "Free Software"; hello, "Open Source"*. Retrieved on February 24, 2005, from: http://www.catb.org/~esr/open-source.html.

Reeves, T. C., & Reeves, P. M. (1997). Effective dimensions of interactive learning on the world wide web. In B. H. Khan (Ed.), *Web-based instruction* (pp. 59-66). Englewood Cliffs, New Jersey: Educational Technology Publications.

Relan, B., & Gillani, A. (1997). Incorporating interactivity and multimedia into web-based instruction. In B. H. Khan (Ed.), *Web-based instruction* (pp. 231-237). Englewood Cliffs, NJ: Educational Technology Publications.

Renaud, K. (2001, December). A strategy for teaching programming from a distance. ACM SIGCSE Bulletin, 33(4). USA: ACM Press New York, NY, pp. 39-42.

Roschelle, J. (2003). Learning by collaborating: Conceptual change. *The Journal of the Learning Sciences*, 2, 235-276.

Rosetti, D. K. & Surynt, T. J. (1984). Video teleconferencing and performance. *Journal of Business Communication*, 22(4), 25-31.

Sabine G. & Beate L. (2002). *An evaluation of open source e-learning platforms stressing adaptation issues*. Retrieved April 17, 2006, from: http://www.campussource.de/aktuelles/docs/icalt2005.pdf

Sarmiento, C. (2004). *Assessing market transfer effects generated by court Rulings in the Hawai'i longline fishery*. Honolulu, HI: USA Western Pacific Regional Fishery Management Council.

Schifter, C. & Monolescu, D. (2004). Evaluating a distance education program. In D. Monolescu, C. Schifte & L. Greenwood (Eds.), *The distance education evolution: Issues and case studies* (pp. 163-184). Hershey, PA: Information Science Publishing.

Schifter, C. (2004). Faculty participation in distance education programs: Practices and plans. In D. Monolescu, C. Schifte & L. Greenwood (Eds.), *The distance education evolution: Issues and case studies* (pp. 22-39). Hershey, PA: Information Science Publishing.

Schrum, L. (1998). On-line education: A study of emerging pedagogy. *New Directions for Adult and Continuing Education,* 78, 53-61.

Schultz, C. (2001). Surveys of distance learning in the Virginia Community College System, *Inquiry*, 6(2), 34-38.

Schutte, J.S. (1996). *Virtual teaching in higher education: The new intellectual Superhighway or just another traffic jam?* Report on study conducted at California State University, Northridge. Retrieved July 21, 2000 from: http://www.csun.edu/sociology/virexp.htm

Şen, N. (1999). *İnternet tabanlı öğretimin etkililiği*. Nonpublication master's thesis, University of Ankara, Ankara, Turkey.

Sharan, Y., & Sharan, S. (1992). *Expanding cooperative learning through group investigation*. New York: Teachers College Press.

Sheingold, K. (1991, September). Restructuring for learning with technology: The potential for Synergy. *Phi Delta Kappan*, 17- 27.

Sherry, L., & Wilson, B. (1997). Transformative communication as a Stimulus to web innovations. In B. H. Khan (Ed.), *Web-based instruction* (pp. 67-73). Englewood Cliffs, NJ: Educational Technology Publications.

Sherry, L. (1996). Issue in Distance Learning. *International Journal of Educational Telecommunications*, 1(4), 337-365.

Shuell, T. J. (1986). Cognitive conceptions of learning. *Review of Educational Research*, 56(4), 411-436.

Siegel, M., & Kirkley, S. (1998). Adventure learning as a vision of the digital learning environment. In C. J. Bonk & K., S. King (Eds.), *Electronic collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse* (pp. 341-364). Mahwah, NJ: Lawrence Erlbaum Associates.

Şimşek, N. (1995). *Yazılımın tasarım standartlarının bilgisayar ortamında öğretmeye etkisi*. Nonpublication doctoral dissertation, University of Ankara, Ankara, Turkey.

Şimşek, N. (1998). *Öğretim Amaçlı Bilgisayar Yazılımlarının Değerlendirilmesi.* Ankara: Siyasal Publication, pp. 21-22.

Soloway, E., Guzdial, M., & Hal, K. (1994). The challenge for HCI in the 21st century. *Interactions*, 1(2), 36-48.

Sternberg, R. J. (1996). *Successful intelligence: How practical and creative intelligence determine success in life*. New York: Simon & Schuster.

T. O'Reilly. (1999). *Ten myths about open source software*. Published on O'Reilly (http://www.oreilly.com) Retrieved on August 8, 2005, from: http://opensource.oreilly.com/news/myths_1199.html.

Taneva, S., Alterman, A., Granville, K., Head, M., & Hickey, T. (2004). *GREWPTool: A system for studying online collaborative learning*. *Brandeis Computer Science Tech Report*, USA.

Tang, J.C., (1991). Findings from observational studies of collaborative work. *International Journal of Man-Machine Studies*, 34(2), 143-160.

Teng, T., & Taveras, M. (2004). Combining live video and audio broadcasting, synchronous chat and asynchronous open forum in distance education. *Journal of Educational Technology Systems*, 33(2), 121-129.

The International Encyclopedia of Education, (1993).Washington Action Corp. USA.

The Open University, (2005). Retrieved December 14, 2005, from: http://kairosnews.org/node/4511

Thomas, J. W., & Rohwer, W. D. (1986). Academic studying: The role of learning strategies. *Education Psychologist*, 21(1), 19-41.

Thomas, R. M., & Koayaskhi, N. V. (1987). *Educational technology-its creation, development and cross-cultural transfer.* Oxford: Perganon.

Truong, N., Bancroft, P., & Roe, P. (2003). A web based environment for learning to program. *ACM International Conference Proceeding Series,* Darlinghurst, Australia: Australian Computer Society, Inc., ISSN:1445-1336 , 0-909-92594-1, 35, 255-264.

Tüzün, H. (1999). *Yüksek öğretim kurumlarında ders içeriğinin web tabanlı olarak aktarılması.* Nonpublication master's thesis, University of Gazi, Ankara, Turkey.

Uzunboylu, H. (2004). The effectiveness of web assisted english language instruction on the achievement and attitude of the students. In P. Kommers & G. Richards (Eds.), *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications* . Chesapeake, VA: AACE, 727-733.

Uzunboylu, H. (2007). Teacher attitudes toward online education following an online in-service program. *International Journal of E-Learning*, 6(2), 267-277.

Uzunboylu, H. (2006). A review of two mainline e-learning projects in the european union. *Educational Technology Research and Development*, 54 (2), 201-209.

Van den Akker, J. (1999). Principles and methods of development research. In J. van den Akker, N. Nieveen, R. M. Branch, K. L. Gustafson, & T. Plomp, (Eds.), *Design methodology and developmental research in education and training* (pp. 1-14). The Netherlands: Kluwer Academic Publishers.

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

Vural, H. F. (1999). *İnternetin öğretiminde bireysel çalışma ve grupla öğrenme yöntemlerinin etkililiğinin değerlendirilmesi.* Nonpublication master's thesis, University of Ankara, Ankara, Turkey.

WEB-1, The Open University. Retrieved April 19, 2004, from: www.open.ac.uk

WebCT VLE. Retrieved April 19, 2004, from: http://www.webct.com

Weber S. (2004). *The success of open source*. Harvard University Press, ISBN 0674012925.

Wedemeyer, C. A. (1981). *Learning at the back door: Reflections on nontraditional learning in the lifespan*. Madison: University of Wisconsin.

Weinstein, C. E., & Mayer, R. E. (1986). The teaching of learning strategies. In M C. Wittrock (Ed.), *Handbook of research on teaching*, New York: Macmillan.

Wheeler D. (2004). *How to evaluate open source/free software (OSS/FS) programs.* Retrieved on February 17, 2005, from: http://www.dwheeler.com/oss_fs_eval.html

William, L., & Upchurch, R. L. (2001). In support of student pair-programming. *Proceedings of the 32nd SIGCSE technical symposium on computer science education*, Charlotte, North Carolina, USA, *1-58113-329-4*, 327-331.

Willis, B. (1994). *Distance education strategies and tools*. Englewood Cliffs, NJ: Educational Technology Publications.

Wilson, B. G. (Ed.). (1996). *Constructivist learning environments: Case studies in instructional design.* Englewood Cliffs, NJ: Educational Technology Publications.

Wishart, J. (1990). Cognitive factors related to user involvement with computers and their effects upon learning from an educational computer game. *Computers Education*, 15(1-3), 145-150.

Wisher, R. A., Belanich, J., & Orvis, K. L. (2004). A question-collaboration approach to web-based learning. *American Journal of Distance Education*, 18(3), pp. 169-185, Retrieved March 05, 2004, from: http://doi:10.1207/s15389286ajde1803_4.

World Bank, (2006). Retrieved February 01, 2006, from: http://www1.worldbank.org/disted/Technology/technology.html

Yiğit, Y. (1999). *Learning the internet through the internet: A case study*. Unpublished master's thesis, Middle East Technical University, Ankara, Turkey.

Yurdakul, B. (1998). *Eğitimde bilgisayar teknolojisine ilişkin uygulamaların değerlendirilmesi.* Unpublished master's thesis, University of Ankara, Ankara, Turkey.

Zhai, M., & Liu, S. (2005). *Technology use in an online program*. Paper presented at the 21st Annual Conference on Distance Teaching and Learning. Madison, Wisconsin.

Zhu, E. (1998). Learning and mentoring: Electronic discussion in a distance-learning course. In C.J. Bonk & K. S. King (Eds.), *Electronic collaborators: Learner-*

centered technologies for literacy, apprenticeship, and discourse (pp. 233-259). Mahwah, NJ: Lawrence Erlbaum Associates.

Zviel-Girshin, R. (2004). Web-based lab-oriented teaching of internet programming course. *World Conference on Educational Multimedia, Hypermedia and Telecommunications*, 1, 740-746. Retrieved April 18, 2006, from: http://dl.aace.org/15488