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E-learning: Study with One Course and Two Environments

Master's Thesis

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Introduction

E-learning is widely used in universities and other organizations all over the world, either to support classroom learning or on its own. The University of Tartu is no exception. According to the Annual Report of University of Tartu 2005 (Sõstar, 2006), there were 335 e-courses in University of Tartu in 2005 and about 8500 students participated in those courses. Most of those are not 100% e-learning courses, instead e-learning is used in addition to classroom lectures (blended learning). The number of courses is increasing every year. At the beginning of 2007 there were over 1100 e-courses and around 15 000 users in the e-University consortium member-universities in Estonia (Ruul, 2007). More and more instructors are starting to use the help of e-learning to teach their courses.

Usually, a special kind of web-based content management system is used for running e-learning courses. These systems hold all the course content and information of the students and also provide the interactive tools to support learning process. While using such systems makes the e-learning experience much easier, it also induces some problems. When all courses are managed in one system and for some reason it is needed to start using some other system, the situation becomes problematic. The transfer of existing courses to the new system is often difficult, but it is a task that many organizations are facing.

Another problem that e-learning instructors often have, is the heterogeneous previous knowledge of the students. In many cases, this can be an obstacle, especially in such courses, where the students are from different faculties, or in adult learning situations. This is also a problem in the regular classroom education, but even more so in e-learning, where the participants can be from all over the world.

The attitude of students towards e-learning or learning content management systems is also an important factor in e-learning. There have not been any major surveys in the University of Tartu in that regard.

The objectives of this work are related to the problems mentioned above. The first part of this thesis gives the necessary background information for the second part. The second part describes an experiment of teaching a course in parallel in two different learning environments. In the course of this experiment the preceding problems were addressed. A course was

transferred between those two systems to gain a practical experience of such a process. Also, this course was redesigned to accommodate for the students with heterogeneous background knowledge. A survey was conducted among the course participants to gain their reactions to e-learning and to the learning environments used.

The objectives of this work can be outlined as follows:

- explore the problem of content transfer and gain a practical experience of the transfer of courses,
- find a way to consider the heterogeneous knowledge of the students in a chosen course,
- examine the students' attitude towards e-learning and the learning environments used.

This work is divided into six chapters. The first chapter explains the concept of e-learning and describes the need for standards in e-learning. Also, a closer look at some of such standards is taken. The second chapter deals with learning content management systems (LCMSs), in particular with two of them that are used in the University of Tartu – WebCT and Moodle. The third chapter is dedicated to the transfer of content between such learning environments. The fourth chapter describes the pedagogical models and problems in e-learning. Special attention is paid to the problem of heterogeneous background knowledge of the students. In the fifth chapter, the experiment with one course in two learning environments is described and one possible solution for teaching a course with heterogeneous students is offered. Also, the transfer of one course between WebCT and Moodle is described. The sixth chapter is dedicated to the survey of the participants of this course.

The thesis also includes two appendices. Appendix 1 contains the frequency tables of some of the answers to the survey questions. Appendix 2 is the glossary of e-learning terms used in the thesis.

1. Overview of E-learning and Its Standards

E-learning is a wide area of research and this thesis describes only some of the problems in e-learning. The following chapter gives a general overview of e-learning and its standards.

1.1. What is e-learning?

There are many different definitions for e-learning, but usually it is defined as a form of education that uses information technology in some way. Mostly, e-learning is thought of in relation with the Internet, although sometimes it can make use of offline tools and technologies, for example, materials on a CD-ROM or even electronic devices such as pocket computers or MP3 players. In the context of this work, e-learning is mainly discussed in connection to the Internet.

E-learning is ideal for distance education. Formerly, distance education had many shortcomings. Since it was mostly accomplished with sending students material (printed material, audio or video tapes) by mail or broadcasting through radio or television, it was costly and slow. Materials couldn't easily be modified – any change meant the extra cost of preparing and sending the updated materials to the students. E-learning helps to overcome those flaws. Using Internet gives the students almost instant access to the online materials and changes can be made quickly and without the extra cost. Also, e-learning can make use of student communication, which was not well achievable before.

E-learning allows the students to work at their own pace. They can choose the place and time for studying and do not have to attend lectures in person. E-learning is especially suitable for students, who also have other responsibilities, like work[1] or family. It also enables students from different geographical regions to work together.

E-learning can also be adaptable to learner's needs, for example, e-learning course can cater to the needs of students with different learning styles. For instance, an e-learning course can offer audio and video files in addition to textual learning materials to suit the needs of students with audio-visual learning styles.

An argument against e-learning is that as it lacks the face-to-face interaction with the teacher and

1 According to the survey conducted by the Federation of Estonian Student Unions (FESU), 59% of university students in Estonia are working in addition to studying (FESU, 2006).

other course participants, it can create a sense of isolation in the students. With e-learning, education is no longer a social experience. In most cases, this is not true anymore. As e-learning is mostly Internet-based, there are many ways the student communication can be facilitated, for example with e-mail, forums, chat rooms, wikis, instant messengers, audio- and video-conferencing tools, etc.

Although e-learning is mostly used as a form of distance education, it can also be used in combination with regular classroom learning (so-called blended learning). It is suitable for many age groups, from secondary school to adults. For example, students still have to attend the lectures, but they can submit their homework in a learning content management system (LCMS).

Learning content management system is a type of web-based system that is designed with a specific purpose of managing e-learning courses. An LCMS is typically used for organizing content and delivering it to the learner and also for managing and tracking users. Typically, the LCMS contains many courses that the students can enroll in. LCMS must be able to track students' progress in all of them. In the context of this work, unless otherwise specified, e-learning is assumed to make use of some kind of learning content management system.

An important aspect of e-learning is the notion of reuse of learning material. With the amount of digital learning content produced every year, chances are that there already exist materials about a particular topic. It would be a waste of time and money for each organization and each instructor to write their own version about that topic. Whereas in the past it was impossible or at least very inconvenient for a lecturer from New York to share their learning material with a lecturer from Oxford, then nowadays it is not only possible, but very advisable. Due to the digital nature of e-learning materials, they are easy to reuse. There exist so-called learning object repositories – large databases that contain thousands of learning materials. From there, course instructors can find suitable materials for their course. Examples of such repositories are ARIADNE[2], Merlot[3], edna[4], etc. To make it easier to find materials from such repositories, learning materials are described using meta-data. Such materials are often referred to as learning objects.

A learning object is an ambiguous term – not everybody means the same thing by a learning object. In the widest sense, it is a piece of learning material A learning object can be a picture, a

2 ARIADNE Foundation Homepage, http://www.ariadne-eu.org
3 Multimedia Educational Resource for Learning and Online Teaching (Merlot), http://www.merlot.org
4 Education Network Australia (edna), http://www.edna.edu.au

text, collection of texts, video or audio clip, test, interactive Flash game, etc. It can be of any format – an HTML file, a PNG file, an AVI or MOV file. According to some, a learning object does not even have to be digital. To be effectively usable, a learning object should be self-contained – it shouldn't need any other material to be comprehensible. In the context of this work, a learning object is a self-contained piece of digital learning material that is described by meta-data.

E-learning is widely used in universities, other educational institutions and commercial organizations all over the world. It is growing more and more popular, and an increasingly large number of institutions are working on creating better tools for e-learning. This increasing popularity of e-learning creates the need for common standards for e-learning tools and materials.

1.2. E-learning standards

With the multitude of e-learning tools available, the need for standards is clear. It is not hard to imagine, what would happen, if each vendor would use their own proprietary format for storing course data. It would be difficult, if not impossible, to switch from one tool to another. If an organization has used a particular vendor's LCMS for years and then decides to start using some other LCMS for some reason, they probably want this switch to be as easy as possible. If the old and new LCMSs use different formats for storing their data, then the content would have to be either converted in some way (if possible) or probably just be transferred by hand. In large organizations with many courses, this would be extremely time-consuming and costly.

Standards can be used to ensure that content created in one LCMS can be used in another LCMS, providing they both conform to the same standard. For example, tests created in one environment are usable in the other system. Other examples of transferable material are learning objects, syllabi, learner information, etc. Also, when creating learning objects and describing them with metadata, there should be a consistent way of doing so. Otherwise, it just nulls the benefits of being able to search for those objects. For example, if different repositories would require metadata in different formats, the user would have to create separate sets of metadata for each repository.

A learning content management system is usually responsible for many things. For example, the system has to manage the learning content and deliver it to the students. It also needs to manage

the students' information, their grades and progress in a course. There are standards that specify how to do each of those things.

Mostly, e-learning standards can be divided into three general categories by their purpose (Ellis, 2005):

- **metadata standards** – specify the way to describe the learning content. Using metadata makes it easier to store, index, search and retrieve learning content across multiple platforms and content management systems. Metadata can be internal (stored inside the learning object) or external (stored outside the learning object in a separate file). Usually metadata is described by an XML document. Metadata standards describe which elements should this particular document have, what kind of information to store about the learning content and how to store it. For example, metadata can contain the description of a particular piece of data, its author, last date of modification, copyright notice, location of this learning object, learning objectives, intended audience etc.

- **content packaging standards** – specify, how to package learning materials in a standardized way. This gives the advantage of using the same content in different learning content management systems and makes exporting and importing materials and exchanging them between content management systems easier.

- **learner profiles** – describe, how to exchange learner information between systems or different system components. Examples of such information can be personal data, grades, learning history, accessibility information, certifications, degrees, etc.

Using standards may not always make things easier. Creating metadata is an excess chore and it may not always pay off immediately. If the organization has no initial intent of sharing their learning objects, they may not want to bother with metadata. Using the standards when creating the system may make it harder to implement and may always not be needed in the immediate future. But they should be considered, as applying the standards later may be either impossible or at least a very daunting task.

There are many organizations involved in creating and maintaining standards for e-learning. There are also many different standards. In this work we examine more closely three standards that are referred to later in this paper – Learning Object Metadata (LOM), IMS and Shareable Content Object Reference Model (SCORM).

1.3. Learning Object Metadata (LOM) Standard

LOM is a standard developed by Institute of Electrical and Electronics Engineers Learning Technology Standards Committee (IEEE LTSC) (IEEE, 2007). IEEE LTSC was created in 1997 and it consists of several working groups. Each group is working on a different standard. The group in charge of the Learning Object Metadata standard is called WG12.

Learning Object Metadata is defined by the IEEE as „the attributes required to fully/adequately describe a Learning Object" (WG12, 2007). IEEE defines the Learning Object as „any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning". LOM standard describes the minimal set of attributes that are needed for managing, locating and evaluating those Learning Objects. This leaves other organizations the freedom to extend this standard as best suited for their needs. For example, such attributes are the type of the object, author, owner, terms of distribution and format. LOM can also include pedagogical information about the Learning Object, such as teaching style, grade level and prerequisites. The Learning Object can have more than one set of metadata.

LOM forms the basis for some other metadata standards, such as IMS and SCORM.

1.4. IMS

IMS (IMS GLC, 2007) is a standard developed by the IMS Global Learning Consortium. IMS/GLS is a non-profit organization that has over 50 members that come from very different areas of learning community. Those members include hardware and software vendors, educational institutions, government agencies etc., who are working together to promote learning using technology.

IMS offers wide range of learning technology standards and specifications (17 at the time of writing). Among those are IMS Metadata specification, IMS Question and Test Interoperability (QTI), IMS Content Packaging and IMS Simple Sequencing. We'll take a closer look at those four, because IMS Content Packaging specification is used in WebCT for exporting and importing content modules and IMS QTI for exporting test questions. The other two are also used in SCORM standard.

- *IMS Content Packaging* describes how to aggregate learning materials (whole courses or parts of them) into distributable packages. Packages created using any tool that conforms

to IMS Content Packaging specification should be usable in other IMS-compliant systems. Content packaging describes the structure and location of learning materials. An IMS content package is a logical directory that contains top-level IMS Manifest file and subdirectories containing the actual resource files. The IMS Manifest file is an XML file named *imsmanifest.xml*. It is used to provide meta-data about this package and to specify the actual physical locations of the learning resources. The package can contain a whole course, part of the course or multiple courses. The content package is typically compressed into a single file (usually using ZIP file format), in which case it is called a Package Interchange File (PIF).

- *The IMS Question & Test Interoperability Specification* describes how to store question and test data and their results, also how to exchange this data between systems.

- *The IMS Learning Resource Meta-data* specification explains how to describe the learning materials to make them easier to find. This specification is based on IEEE LOM specification with modifications made by IMS.

- *The IMS Simple Sequencing* specification describes how the learning activities should be sequenced – in which order and under which conditions should they be shown to the learner. The sequencing of those learning activities should be consistent across different IMS-conformant systems.

IMS is one of the most well-known e-learning standards. Their Content Packaging and QTI specifications are widely used in some of the leading e-learning platforms, for example WebCT[5] and ANGEL[6].

1.5. Shareable Content Object Reference Model (SCORM)

SCORM is a standard developed by Advanced Distributed Learning (ADL) Initiative (ADL, 2007). ADL was formed by the USA Department of Defense in 1997 with the purpose of modernizing the education and training of the US armed forces. The aim of ADL is "to promote common, open, international specifications and standards that enable reuse and interoperability of learning content". To achieve this, ADL is working closely with other standards organizations, most notably with IEEE LTSC, IMS GLC, Aviation Industry CBT Committee

5 WebCT was merged with Blackboard in 2005 (Blackboard Inc., 2005) and continues under Blackboard brand. Information about WebCT can be found in http://webct. com

6 ANGEL Learning, http://www.angellearning.com/

(AICC)[7] and Alliance for Remote Instructional Authoring and Distribution Networks for Europe (ARIADNE). Parts of those organizations' standards and specifications are combined into SCORM to form a set of standard practices and guidelines for the e-learning community. Primary goals of SCORM are moving content (learning objects) between learning environments, reusing that content and making it searchable across different LCMSs and media repositories.

Specifications and standards of other organizations have been bundled into technical books. At the moment there are four of such books.

1. *The SCORM Overview* offers general information about ADL and SCORM. This does not offer any technical information, but provides high-level description of each of the following books instead.

2. *The SCORM Content Aggregation Model* (CAM) details how the learning objects should be aggregated, described and sequenced. It describes how to build content aggregations (for example, learning objects, modules, lessons, courses, etc), how to package them in a way that allows exchanging them between systems and how to label them with meta-data, so that they could be easily found. CAM also explains how to apply sequencing and navigation details to a content package. This book relies heavily on IEEE LOM specification, IMS Content Packaging specification and IMS Simple Sequencing specification.

3. *The SCORM Run-Time Environment* (RTE) explains the run-time communication of learning objects and the requirements for the Learning Content Management System (LCMS) that the content is used in. SCORM-conformant content needs also a SCORM-conformant LCMS to be successfully delivered to the learner. This document describes how the content interacts with the LCMS, how the content is delivered to the learner and how to track learner's progress through the content.

4. *The SCORM Sequencing and Navigation* (SN) describes the sequencing of the SCORM-conformant content. Sequencing rules are included in the content aggregation and their purpose is to ensure that the branching and flow of the learning activities is consistent across multiple LCMSs. SN is based on IMS Simple Sequencing specification.

Like IMS, SCORM is also a very popular and widely used standard. Many LCMSs support

7 Aviation Industry CBT Committee (AICC) Homepage, http://www.aicc.org

SCORM-conformant learning objects (WebCT, Moodle[8]) and there are tools available for creating such content (eXe[9], ToolBook[10]).

In the next chapter we'll take a closer look at two LCMSs used in University of Tartu – WebCT and Moodle.

8 Moodle Homepage, http://moodle.org
9 E-learning XHTML editor (eXe), http://exelearning.org/
10 Toolbook Homepage, http://www.toolbook.com

2. Learning Content Management Systems

In this chapter, an overview and comparison of two learning content management systems used in University of Tartu is given. Those systems are commercial WebCT and open-source Moodle.

Both systems are actually hosted in the Estonian e-University (e-University, 2007a) servers. Estonian e-University is a consortium of Estonian universities, which University of Tartu is a member of. E-University pays for the license of WebCT and all the universities in the consortium can use it. Moodle is the primary e-learning platform for Estonian e-Vocational School.

2.1. WebCT

WebCT is one of the most well-known learning content management systems. It was founded in 1995 in The University of British Columbia by Murray Goldberg. The first version was released to public in 1996; since then it has evolved into an enterprise-scale course management system used all over the world. (WebCT Inc, 2001) In 2005, WebCT Inc. was merged with rivaling educational software vendor Blackboard Inc[11]. The joined companies continued under the Blackboard name and brand (Blackboard Inc., 2005).

Until 2007, WebCT Campus Edition 4.1.1 was used in University of Tartu. In 2006, it was decided to switch to WebCT Campus Edition 6.0. In the Fall semester of 2006, both versions were used in parallel, but only the WebCT 6 remained available in 2007 (e-University, 2006).

WebCT uses certain parts of IMS standards. Content modules can be exported into IMS-conformant content packages. Such packages can also be imported. Furthermore, whereas test questions in WebCT 4.1 could be exported in proprietary WebCT format, WebCT 6.0 is able to export them as IMS QTI compliant packages. Also, WebCT 6.0 allows inserting SCORM-compliant learning objects as learning content.

2.2. Moodle

Moodle (Moodle, 2007a) is an open-source course management system. It was created by Martin Dougiamas, who, as a WebCT system administrator at Curtin University of Technology, was frustrated with the complexity of WebCT and decided to create a simpler system. Moodle 1.0

11 Blackboard, http://www.blackboard.com

was released on August 20, 2002. Since then, it is being actively developed and many new features and better performance have been added.

At first, Moodle was meant primarily for universities and colleges, but is now also used in secondary and primary schools, non-profit organizations and private companies. Currently there are 25 107 known Moodle sites (organizations that use Moodle and have notified Moodle.org about it) from 176 countries. There are over one million courses and over 10,3 million registered users in those sites. (Moodle, 2007b) The version of Moodle currently used in the University of Tartu is 1.5.3.

Moodle is focused on social constructionist pedagogy. The basic idea of social constructivism is that students are able to learn more effectively when they are constructing things for others to experience. For example, they may read a text, but they understand and remember it better if they have to explain this to other students. Moodle is focused on encouraging communication between students, urging them to learn from each other as well as from the teacher. For that, Moodle includes many communication and collaboration tools, like forums, wikis, study journals, chatrooms, etc.

Moodle claims to be able to export and import content conforming to SCORM and IMS Content Packaging Standards. It is possible to upload a SCORM or, starting from Moodle 1.6, an IMS content package as as a learning tool. Also, Moodle can export quiz questions in IMS QTI format. Import of this standard is not yet possible.

Moodle is written in PHP and uses a SQL type database (for example, MySQL or PostgreSQL). It can be installed on a Windows, Mac, Linux or FreeBSD platform. The most common configuration is PHP, MySQL database server and Apache web server on Linux.

2.3. Comparison of WebCT and Moodle

The following comparison of WebCT and Moodle is based on EduTools product reviews and comparisons (EduTools, 2007). The systems compared are Moodle 1.5, WebCT 4.1 and WebCT 6.0. Not all available tools in these systems are compared, but only the subset of them that is important for this work.

The following table (Table 1) describes those tools and other important properties of these LCMSs.

Tool	Moodle	WebCT 4.1	WebCT 6.0
Groupwork	Students can be divided into groups. There are three group modes available – no groups, visible groups (students can see other groups' forums and wikis) and separate groups (groups are not aware of other groups). Most of the tools in Moodle support group modes, for example forums and wikis.	Students can be divided into groups by instructor or randomly by the system. Groups can have their own discussion forum and group homework area.	In addition to the features in WebCT 4.1, students themselves can choose which group to join. Any course content can be selectively released to a group.
Collaborative authoring	Moodle includes a wiki that can be edited by the whole course or a student group.	Student presentation area can be used to upload pre-made web pages	No student presentation area, but web site upload assignment can be assigned to a group. This is not the best way, as the uploaded zipped web page cannot be edited online.
Discussion tools	Posts can be viewed threaded or flat, they can include attachments and images. Posts can be formatted using Moodle HMTL-editor. Students can receive e-mail for each post or a daily digest of posts from a particular forum, they can also subscribe to the forum's RSS feed. Posts can be graded by the instructor or	Posts can include attachments. Posts are threaded, threads can be expanded or collapsed. Discussions can be visible to the whole course or just to one group. Instructor can specify access rights (read, write, post anonymously). A formatting	Mostly the same as in WebCT 4.1. In addition, discussions can be associated with any course content and posting can be limited to specific time periods. Posts can contain HTML. Statistical summary can be generated showing students

Tool	Moodle	WebCT 4.1	WebCT 6.0
	peer reviewed by other students. Forum can use one of three group modes in Moodle. There are three types of forums – discussions and replies are allowed; no discussions, but replies are allowed and no discussions, no replies.	text editor can be used. Discussions can be saved or printed for offline use.	participation in discussions. There are three types of forums available – threaded, class blog and journal.
Assignments	Three assignment types are available – single file upload, online text and offline activity.	Only one assignment type – text with file upload.	Students can also upload zip file containing a web site.
Internal e-mail	Internal e-mail is not available, but instant messages can be sent to any registered user.	Messages can be searched, archived and forwarded to an external e-mail account.	Messages can be searched, archived, forwarded to an external e-mail account and combined into a file for saving or printing.
Self-assessments	No separate module, but regular tests can be used with grading disallowed.	Self-tests can be added directly to a learning material, they don't have to be composed before. Self-test questions can't be reused in other tests.	Self-tests use the same question bank as regular tests. Existing self-test can be linked to a learning material.
Tests	Tests use a common question bank from which	Tests use a common question bank.	In addition to question types

Tool	Moodle	WebCT 4.1	WebCT 6.0
	they can be added into the test. Question types available are multiple choice, true/false, short answer, numerical, calculated, matching and cloze. Questions can contain images, video and other media files. Questions can be randomized in a test, so can the answers of a multiple choice question. Tests can be timed and only accessible for a certain period of time. Instructors can set the number of attempts. Questions can be imported from multiple formats. Tests made with HotPotatoes software can be directly inserted into the course.	Available question types are multiple choice, short answer, calculated, matching and paragraph. Tests can be timed and only accessible for a certain period of time. Question order can be randomized, students can be allowed to take the test multiple times. Questions can be imported from external text file.	available in WebCT 4.1, WebCT 6.0 also has the following question types - combination multiple choice, true-false, jumbled-sentence, and fill-in-the-blank. Questions can contain images and video and can be imported from external IMS QTI-compliant sources. Tests can be released for a set period of time or using any other release criteria.
Standards	SCORM 1.2 or AICC compliant content can be imported, quiz content can be exported in IMS QTI 2.0 format.	WebCT 4.1 claims compliance with IMS Content Packaging 1.1.2, IMS QTI 1.1 (also with IMS Enterprise 1.1 and Microsoft LRN 2.0).	In addition to standards WebCT 4.1 is compliant with, WebCT 6.0 also has a certificate of compliance with SCORM 1.2 level LMS-RTE3 and IMS QTI 1.2.

Table 1. Comparison of Moodle 1.5, WebCT 4.1 and WebCT 6.0.

Even though Moodle and WebCT are different in many aspects, most basic and frequently used tools, like discussion forums and assessment tools, are available in both systems. Both also offer many opportunities for organizing groupwork and different types of assignments. The systems also differ in ideologies (commercial vs open-source). WebCT offers more features and opportunities for customizing the course and the learning materials. Moodle lacks the complex tuning options, but at the same time it has a more simpler and cleaner user interface, which might be more preferable for some users.

The next chapter describes a theme very closely tied with LCMSs – content transfer.

3. Content Transfer

LCMSs have been around for the past 10 years. At first, the main task in e-learning was only creating the courses. Nowadays, the transfer of courses from one system to another is also a reason for concern. Like any other computer system, no course management system lasts forever. They are in constant development. New systems are emerging and some of the old ones get to the end of their lifespan. Due to rapid changes in information technology, a system that is not regularly modified gets outdated very soon. When a vendor ceases to develop their system further and discontinues offering the support to its users, the learning environment can be practically considered dead. So what should an organization, that uses such a system, do? They might continue using the system for some time and later face the consequences of the system being too slow, not able to support the number of students needed, etc. Or they might decide to move on to a new platform.

There are also many other situations where it might be necessary to move the course from one LCMS to another. Let's take a look at some of such cases.

Most commercial systems offer wide range of functionality and are therefore quite expensive. An organization may discover that they don't need all the functionality after all and the cost of the system is also too great. The institution might then consider switching from their current platform to some other.

Sometimes, an organization has a course that would also be useful for other universities or institutions. They may want to allow the other institutions to use that same course or they might want to sell it. Whether or not the other organization uses the same course management system, they still face the task of setting the course up in that organization's learning environment.

It also might occur that an instructor is asked to deliver a course in some other university that does not use the same LCMS. Since the students should be able to take the course in the same system that they are using for their other courses, the course must be set up in the native LCMS of the other university. A similar situation occurs, when course instructors go to work for some other institution and they want to take their existing courses with them.

The need to transfer content from one platform to another occurs more frequently than can be expected. It's not just something one or two institutions have to deal with. Sooner or later every

organization has to think about it.

When the decision is made to move to a new platform, the time to do so must be chosen. The best time for it is when there are no courses in progress. In universities and other educational institutions this can usually be done between semesters. It is not a good idea to move courses during the active study period, though in some cases it can't be helped. For example, this might occur when the course is running permanently, with no breaks. This is very characteristic for such self-learning courses, where the student can take a course at the time when it's convenient for them, not at the time determined by the instructor. Typical examples of such courses are introductory or continuing education courses in big organizations, where workers must be able to access the course at any time. For example, in big international fast food companies, where there is high employee turnover, new workers are hired continuously; therefore the introductory courses have to be available at all times (Davis, 2006). In those cases, the change can usually be done gradually, keeping both environments up and running in parallel for some time period and allowing learners to finish their course in the old environment.

Moving a course from one platform to another involves many things. Mostly, these can be divided into two large categories – moving the learning materials and setting up matching tools in the new environment for learning activities. In some cases, there is also the transfer of learner information and data created by different learning tools to be considered.

The learning content of a course is usually something that most LCMSs are capable of handling and displaying. Examples of content are regular texts (web pages, text pages, external formats like PDF or DOC), pictures, audio or video files, etc. The course content can be learning materials, but also instructions and descriptions of assignments. Most LCMSs are able to handle any type of content – an HTML file can usually be added to any LCMS. There are also some exceptions to this rule, for example, complex learning materials that are comprised of other materials. Examples of such are SCORM learning objects, which are in the simplest sense just ZIP files that may contain several texts, images, audio or tests. They can only be effectively used in a SCORM-conformant environment, where they can be executed and used in a way intended by the author.

More problematic than the moving of learning content into the new course, is the way the content is structured in a course and the task of transferring large quantity of learning materials. If a course only contains a few HTML files, it is not too difficult to download them from one

LCMS and upload them to another. But if there are hundreds of such files and they are divided into content modules or blocks in some way, then a method is needed for transferring this content in a way that retains the structure.

Also, the change or shift in the paradigm can be an obstacle when transferring courses. The new version of the environment or the new environment may be very different from the old and operate on completely different principles. For example, lately new kinds of learning environments are emerging that use social software, like blogs, wikis, social bookmarks, photo sharing, etc. in teaching. Those tools can be combined into a course with some feed aggregator. It would be very hard, if not impossible, to move a course into such distributed environment. In this work, only regular, central LCMSs are covered.

The problems also occur with the tools used in the LCMS – forums, wikis, chatrooms, assessment tools, etc. Not all LCMSs have all types of tools. A tool that exists in one LCMS may not be present in another. Or the systems may have similar tools, even named the same, but they are handled differently. This poses difficulties when deciding to switch learning environments. Tools, that are actively used in one system, may not be available in the other system. In that case, the alternative tools must be found in the new system or the suitability of that system reconsidered. For example, if a big part of a course's educational activities are carried out using forums and the new system doesn't have forums, then the instructor must redesign the activities or use tools outside the LCMS.

Even if similar tools can be found in both environments, it still leaves the problem of transferring the data linked with the tool, such as forum posts or glossary entries. Often, it is not necessary to move the tool information, but sometimes it is. When a tool is actively used in the learning process, for example, if students are adding entries to the course glossary periodically, then it might be important to transfer that information also to the new environment. It also might be necessary to move the forum posts, chat logs, assignment data, etc. If the new system does not have that tool or if it is completely different, it is not possible to transfer that information. This might be a problem in some cases. And even if the same tool is present in both systems (for example, a forum – a tool, that is probably present in most systems), there is no guarantee, that the posts can be transferred, as the systems probably use a different format for storing the data of that tool. This is a situation, where the need for common standards is obvious. In other cases, it might not be necessary to move tool information at all, for example, when accumulated data, such as forum discussions, are deleted after each time the course ends, so that new students can

start with a clean slate.

Another big problem is with moving the tests. Usually, learning environment contains some sort of a question bank, where questions are created individually and can later be added to any tests. The problem is that each LCMS seems to use their own format for storing the test questions, which makes them hard to exchange between systems. This situation is improving and nowadays there are several commonly used formats. For example, Moodle claims to be able to import questions from 12 different formats and export them into 4 formats. But even if the test questions can be successfully imported, there is still the problem with tests themselves. Since tests usually include many options, starting from their visibility to students and ending with options of showing feedback, not all systems implement all options. This is also the area, where standards are needed. Since creating and testing questions and tests is a time-consuming activity, the common standards would mean that they wouldn't have to be created from scratch when transferring courses. One standard, which specifically deals with tests and test questions, is the IMS QTI specification. More and more LCMSs (WebCT, Moodle, ANGEL) are starting to support this standard.

It might also be necessary to transfer student information, for example their personal data or grades. This also poses many difficulties. Students must have new accounts in the new system. Sometimes they can be created automatically. Students can register themselves into the new system or the system administrator or instructor can do it for them. Since student personal information is not usually associated with the course, it might not be transferred. The students' grades are and they might either be transferred automatically, the instructor might have to do it manually or they can't be transferred at all. For example, in WebCT, the teacher has the option to download the grade book as a spreadsheet and then later import the students' results into a new WebCT course. The limitations are that the students with the same user name must already be enrolled into the course. Moodle only allows the download of students' grades; it does not offer the import functionality. However, Moodle can import grades from another Moodle course. For example, tests, assignments and other assessable tools can be backed up with Moodle backup utility and restored into another Moodle course. This automatically enrolls the students to this course and adds their grades from those tools into the grade book.

Even though both systems may claim to comply to the same standard, reality is often different. Transfer may fail completely or be partially successful, for example, it is possible to transfer tests but not the course structure. It may be possible to transfer content piece by piece, but this is

often a tedious task, especially when the courses are large.

Let's examine some scenarios for content transfer:

1. The most ideal case for content transfer would be, if in one system user can choose to export the whole course and download the resulting file. In the new platform, the file can be uploaded, imported into the new course and everything is transferred correctly. The materials retain their structure, the tests are imported properly and the tools are also set up correctly. If a particular tool can't be found in the new system, the data is not imported. This type of transfer would be the easiest for the user, as most of the work would be done automatically.

2. Another case would be where one system is capable of exporting chunks of content, for example, a learning module or a test with questions. Those chunks could then be imported into the other system. The modules will have to be exported one by one, imported into the new system and arranged there as they were in the previous system. This requires more input from the user and is more complex. Although, sometimes it is preferable to be able to export only parts of material. For example, when creating a new course, only some materials or tests from some existing course might be needed. In those cases, it would be convenient when only certain modules or particular tests can be exported. WebCT allows the export of a specific content module, which can later be imported into another WebCT course or into a course in a system that allows the import of IMS content packages.

3. If all else fails, it is always possible to just download the materials, upload them into the new system and arrange them there by hand. As for the tests, sometimes it is possible to at least export and import the test questions and recreate the tests manually. When it's not, the test questions will also have to be recreated. This may be manageable for small courses, but is very tedious in large courses as that means that the course designer will have to create the course all over again. When hundreds of courses have to be transferred, this is not a good solution.

4. We have examined content transfer only as moving the course into a new platform or a different version of the same platform. Content can also be transferred between the different instances of the same system. Most LCMSs offer the option of backing up course data and restoring courses from backup. This functionality can be used, for

example, to restore a clean course with no student information in the beginning of each semester or backing up the courses when moving from one server to another. A real-life example of such transfer would be the pre-course of CEENet's *Wired Education* section (CEENet, 1999), which took place in May and June, 1999, in University of Turku, Finland. The course was WebCT-based and had about 90 participants. In August, there was a post-course in Hungary. The course was backed up in Turku WebCT server and sent to Budapest, where it was set up in their WebCT server. About 30 people from the original course attended the post-course in Budapest. Since all the learner's grades and course data was available, the course went on as planned.

Sometimes, it is also possible to exchange the content between the different courses in the same learning environment, even without first exporting or backing up data from the original course. For example, Moodle offers such functionality.

Nowadays, most systems claim to conform to some standard or the other. For example, WebCT 6.0 can import test questions in IMS QTI format and Moodle 1.5.3 claims to be able to export test questions in IMS QTI format. This should mean that systems that use the same standard should be able to exchange their content. In reality, this is often not the case. Even though the transfer between the different versions of the same system works fairly well (as can be expected), the transfer between different systems often doesn't. For example, in theory, test questions exported from Moodle 1.5.3 in IMS QTI format should be importable into WebCT 6.0, but in reality, they are not. The reasons for that may be that the standards (or more rightly, the specifications) are still in development and change quickly. The different versions of those standards may not be backwards compatible and the systems may use different versions of those standards. Also, as some of the standards are with a quite loose schema and contain optional elements, the vendors may interpret and implement the standards differently.

As new systems are emerging quickly, content transfer is becoming more and more important. It may be tempting to move from the old platform to a new and better one. Organizations may also want to run different LCMSs in parallel and let the instructors themselves decide which system they want to use. In that case they have to be prepared to move courses from one system to another. Content transfer should be easy and not require tremendous efforts from the user. Unfortunately, in reality, this is not yet so.

4. Pedagogical Problems in E-learning

The following chapter describes some pedagogical models in e-learning that should be considered when creating e-learning solutions. Also, a brief look is taken at some problems in e-learning, in particular the issue of heterogeneous background knowledge of students.

4.1. Pedagogical models in e-learning

E-learning is becoming very popular and is used all over the world. More and more organizations are beginning to use e-learning in some way. After the initial costs, it is cheap and available to lot of people at the same time. It is convenient for distance learning students and people, who are already working. It is often thought, that e-learning magically makes everything better and solves all the problems. Often, it is not taken into account, that e-learning, like any new technology, is not without its faults and the implementation of e-learning should be carefully considered.

There is a diversity in learning. People are different, they have different knowledge, they come from different cultures, especially in international courses. These issues should be taken into account when creating an e-learning experience. Khan's (Khan, 2001) framework of e-learning dimensions (Figure 1) describes the factors that help to create a meaningful e-learning environment for diverse users.

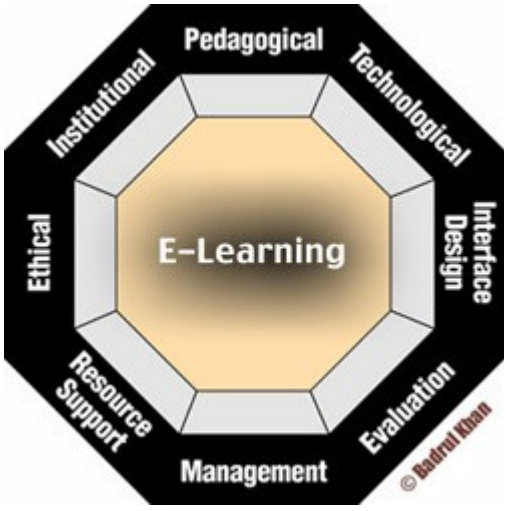

Figure 1: Dimensions of e-learning (Khan, 2001)

The dimensions described by Khan are

- **institutional** (concerning matters in the organization, like administrative and academic affairs and student services),
- **pedagogical** (matters concerned with teaching and learning – learning content, method of teaching, etc.),
- **technological** (technology infrastructure in e-learning environments, like hardware and software),
- **interface design** (overall look and feel of e-learning environment),
- **evaluation** (assessment of learners and evaluation of instruction and learning environment),
- **management** (maintenance of learning environment and distribution of information),
- **resource support** (instructional and technical support, career counseling and learning environment resources) and
- **ethical** (social, cultural and geographical diversity, etiquette, legal issues, etc).

These dimensions should be taken into account when implementing e-learning in an organization.

It should also be considered, how the people will use e-learning – the basic principles of how they learn. In today's rapidly changing world, the most successful skill a person can have is the ability to adapt, to learn new things and unlearn others. The notion of life-long learning is becoming more and more important. In the old times, people rarely changed their occupation and technologies they used in their work changed slowly, over decades or even centuries. A blacksmith learned everything necessary for his job and didn't have to learn anything new ever again. Nowadays, new technologies are emerging with rapid speed and people must be able to keep up. The so-called transmission model, where the students are the passive receivers of information they are expected to memorize, is no longer enough. The need is for people who are able to use their existing knowledge to make connections between the new and already known information, thus building new knowledge. This is the basic principle of constructivist theory.

Constructivism implies that students learn best when their learning is contextual (taking into account the previous knowledge of student), active (engaging in activities that require analysis, debate or criticism to receive information, also learning by doing) and social (working with others). This theory is widely used in e-learning, as the learners of today – the so-called Net Generation – are used to socializing online, sharing information with others. (Brown, 2005)

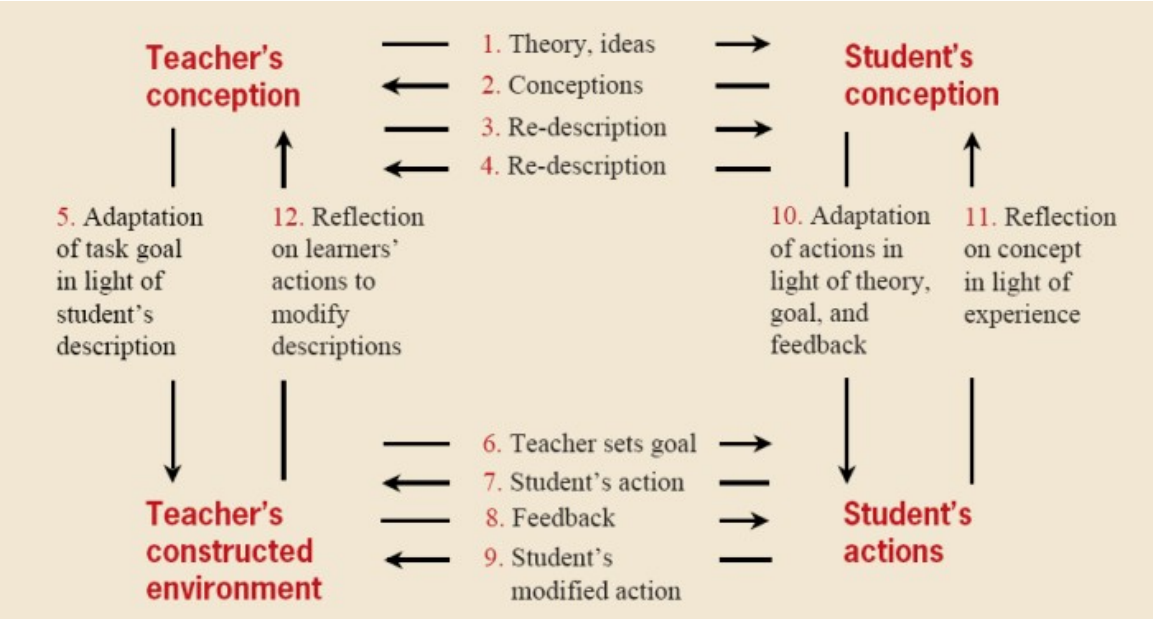

Figure 2: A conversational framework for learning (Laurillard, 2002)

Diana Laurillard uses the principle of social constructivism in her "conversational framework" (Laurillard, 2002) for learning. The idea of this framework is presented in Figure 2. The framework describes the iterative dialog between the student and the teacher on two levels – theoretical and practical. It emphasizes the importance of both theory and practice, forcing each participant to make a connection between those two. This is done through the processes of adaption (practice in relation to the theory) and reflection (theory in relation to the practice). This framework can be used to test the applications in e-learning – is it possible to use this model in the particular application. Just making lecture notes available in the Internet doesn't measure up to this model, a course in LCMS using various social interaction tools and offering interactive content does.

It is a popular claim, that e-learning standards and systems can be "pedagogy neutral" (not supporting any particular pedagogic approach), but not all agree with it. Govindasamy (2001) claims, that for the implementation of e-learning to be a success, it should be built on strong pedagogical foundations – pedagogic principles should be included in the LCMS. Usually the learning tools available are not influenced by pedagogy, the vendors even pride themselves on

being pedagogy neutral. Most LMS providers see themselves as providers of technology and don't care about the underlying pedagogic principles. The LCMSs are packed with features, some of which are never used, because they don't fit into the pedagogic approach chosen by the instructor. This is a waste of the organization's money, as they've paid for the functionality that they never use.

Govindasamy warns that "the impact of not considering the underlying pedagogical principles when implementing e-Learning will undermine the implementation process. Among other things, it will result in faculty members resisting the change, learners staying away from the e-Learning courses, poor performance of learners, and poor quality of content" (Govindasamy, 2001). He proposes five parameters, whose pedagogical attributes should be taken into account. These are:

- **Developing content** – faculty members are no longer only instructors, they are also expected to be content experts, instructional designers, graphic artists, media producers, programmers as well as instructors. They can't be expected to change overnight; this transformation should be slow and over time. Govindasamy also equalizes a learning object with one lesson, which should include pretest to see if student needs to revise any prerequisite material and determine the quantity and span of the learning content delivered. The theoretical content should be interspersed with practical items and the lesson should end with the posttest to assess the student's mastery of the lesson.

- **Storing and managing content** – content should be tagged with metadata to make later searching and locating easier.

- **Packaging content** – the courses are comprised of individual learning objects. The emphasis is on "just-in-time learning", which is good for individual learning and career progress as it helps to bridge specific knowledge gaps.

- **Student support** – all possible problems the students could run into must be taken into account and appropriate responses added to the learning material. He proposes the use of Laurillard's conversational framework (described on page 28), for facilitating interaction between teacher and student and giving constructive and meaningful feedback

- **Assessments** – the main question is whether to test higher-order or lower-order thinking skills. Questions that test the higher-order skills and that can still be automatically graded are more difficult to construct. Question types usually used are multiple choice,

true/false, matching and short answer. These are mainly used for testing the lower-order skills. For higher-order skills it is better to use essay questions, assignments, projects, etc, although they can't usually be automatically tested.

The previous models (Khan's dimensions, Laurillard's framework, Govindasamy's parameters) describe some of the aspects that should be considered when implementing e-learning. Be it guidelines for building an e-learning system or methods for best using e-learning, they emphasize the importance of pedagogical background in the learning process. There are many problems in e-learning and at least some of them can be eliminated or subdued with proper handling.

4.2. Problems in e-learning

E-learning is precisely about that – learning. It's not as much about the instructor teaching something to the students, it's about students learning something. The instructor's job is to create an environment for learning and guide them in this process, not just present them the facts and expect them to memorize them. While this is also true in classroom learning, it is even more so in e-learning, where instructors don't have the same control over their students (Gamble, 2007). While the students are in the classroom, the instructor can assess their reactions – how they are responding to the material (are they bored, confused, interested, etc.) or do they look like they need help. The teacher can adjust the lecture accordingly or offer the students immediate help. In the e-learning environment, a lot of this control is lost. The instructor can't see what the students are doing or how they are studying. They can't help the students immediately, they can only do so if the student specifically asks for help, which not all students do. E-learning relies on the students to be able to learn by themselves (self-directing students). They have to have the sufficient skills and motivation to do so.

There are many factors in e-learning that might prevent the student from getting most out of the e-learning experience. We will describe some of them that are most important in the context of this work.

- **Students' attitude towards e-learning.** As mentioned earlier, it is important in e-learning, that students are willing and able to learn by themselves. They should also have basic skills to do so, for example, it would be helpful, if they already know how to surf the web and send e-mail. There have been many surveys concerning student attitude

towards e-learning, for example (Brinkerhoff & Koroghlanian, 2005) and (Keller & Cernerud, 2002). Some surveys concentrate on student's reactions on some particular learning system, for example, on Blackboard (Watson & Rutledge, 2005) or WebCT (Morss & Fleming, 1998).

- **Student satisfaction with the learning environment.** Based on EduTools website (EduTools, 2007), most LCMSs incorporate the most basic teaching tools. For example, most e-learning environments have a wide set of communication tools like forums, chat rooms, whiteboard and assessment tools etc. But in spite of that people tend to like or dislike different learning management systems. This happens mainly on emotional level or is connected to the visual user interface or complexity of the system. This emotional attitude either supports learning or sets additional obstacles. If the student doesn't like the learning system, he or she can also be negative about the course itself. Basis for such attitude might not be very rational. While non-IT specialists may be quite indifferent to the choice of learning management system, future IT-specialists usually have closer relationship to all kinds of web-based systems and can be more criticizing.

- **Access to technology.** Students have to have an access to Internet to use e-learning. Not all students have Internet access or even a computer at home, so they might have to visit a computer class, a library or an Internet café to do their coursework. They also need to have access to other technical tools, for example, if the course requirement is that a student must produce an audio or video file as the result of an assignment, it must be ensured that all students have access to microphones or cameras. Or if the course contains audio or video content, the students must have access to a computer that is able to play sound.

- **Quality of content**. In most cases, the course content is also prepared by the instructor. Not all instructors are able to produce quality teaching materials that are suitable for e-learning. When an organization decides to utilize e-learning, the instructors previously accustomed to classroom lectures may have difficulties fitting into their new role of content developer (Govindasamy, 2001). They might not have sufficient skills for producing digital content, be it text, image, audio or video.

- **Diversity of learners**. Students are becoming more and more diverse. When creating courses, the different cultural, geographical and knowledge backgrounds of students

should be reckoned with. In the beginning of a course, students coming from various backgrounds may have dissimilar expectations for the course as well as the different background knowledge. This may cause problems in the creation of the course as well as during the course.

The topic of heterogeneous knowledge of the students is more closely examined in the next sub-chapter.

4.3. The problem of heterogeneity

The heterogeneity of students can be either "a burden or resource" (Porter et al., 2006). The students in universities and other educational institutions are becoming more and more heterogeneous in many aspects. Chan (2003) divides such diversity of students into four categories - cultural, age, gender and learning style differences. The fifth category van be added to that list - the differences in the previous knowledge of students.

In his keynote speech at the Estonian e-University conference "E-learning in an E-country: Strategies and Technologies", Normak (2007) explains the changes in the traditional model of academic education that can cause the diverse previous knowledge. The traditional model of higher education is usually a top-down and linear one. During the bachelor studies, some field of interest is studied, generally in quite a wide scale, but not very deeply. The master and doctoral studies then usually focus on some specific subfield of this given field and in more depth. This is possible, because the general knowledge about this field is gained in the bachelor studies. After graduating from school, student gets a job in this particular field, for example, IT students go to work in IT field. This traditional model is no longer accurate. The top-down model is starting to be replaced with the needs-based model. Potential employers are more interested in employees with specific certificates than with abstract academic knowledge. The career paths are getting more diverse, students can continue their master studies in fields different from their bachelor studies. They also don't have to limit their job options only on a single field anymore.

In the traditional model of education, the groups of students in one course are presumed to be quite homogeneous in their prior knowledge of the course. This can be assumed, since the students are mostly from the same department and have studied the same prerequisite courses. In reality, the groups of learners are becoming more and more heterogeneous. The students are taking courses from other departments and universities. More and more students are studying

abroad for a semester or two, for example, via the Erasmus programme. Also, in his speech Normak left out the adult learners, who already have work experience and are trying to earn their first or second degree. Participants of one course can have diverse previous knowledge, skills, interests and cultural background. Earlier, when instructors designed a course, they could do so with one, "average", student in mind. They could make assumptions about this student's prior knowledge and choose the materials and training activities accordingly. Nowadays, there is no "average" student. Each student has a different set of skills and knowledge, that might not overlap in the confines of one course.

Normak states that traditional classroom learning is no longer effective when dealing with such students. When delivering a classroom lecture for heterogeneous students, the diversity in background knowledge can cause problems. Some students might not know anything about the subject, others may already know quite a lot. The instructor can focus on the students with lesser knowledge and start at the basics, but this might fail to stimulate the more advanced students. On the other hand, if the lecturer concentrates only on the more knowledgeable students and explains more advanced material, then the others might have problems catching up. In a classroom environment, giving each student individual and relevant tutoring is not possible. In e-learning, the heterogeneous knowledge of students can be taken into account, for example as in the lesson structure described earlier on page 29.

The diversity in the background knowledge can cause additional problems. Porter *et al.* (2006), who are dealing with teaching statistics to a very heterogeneous group of students, report the anxiety of students, who lack the prerequisite background and their reluctance to ask for help. In their case, the problem of heterogeneity was tried to solve by providing opportunities for students from non-mathematical backgrounds to get additional help. This was accomplished by the use of an e-learning environment, where there were additional materials on basic prerequisite mathematics and tutorials on how to use the statistics software. Also, the students were encouraged to use the discussion boards and form study groups. To minimize the student anxiety, there was no final exam, but many low-stake assessments during the course instead.

Normak also states, that when dealing with heterogeneous student groups, it is important to be sure of the objectives. Is the objective maximizing each individual student's knowledge or the total knowledge of the group? Before, the total knowledge of the group obtained from the course was about the same as the knowledge each individual student got from the course. Today, the total knowledge of the groups should be much larger than the knowledge of one individual

student. The knowledge students acquire from the course should build upon their existing knowledge and their personal interest. The students should be able to learn from each other as well as from the instructor. In both cases, the tools and methods used should be chosen accordingly. There are no universal solutions for each of those cases, because every situation is different. Each instructor has to come up with their own method that best fits their own particular case.

E-learning is still quite a new field of research and there are many problems yet to solve. The next chapter describes an experiment of teaching a course simultaneously in two learning environments and offers one possible approach to students with heterogeneous background knowledge.

5. The Experiment with Heterogeneous Groups

The following chapter describes the experiment carried out in Spring, 2006 and 2007 in the University of Tartu.

5.1. The goals of the experiment

The need to transfer courses from one learning management system to another has been explained in the previous chapters (Chapter 3). To gain the practical experience of this kind of transfer, a small course was transferred between two LCMSs used in University of Tartu (WebCT and Moodle).

There were also two additional goals for this experiment. One of them was to gather students' comparative attitude towards those LCMSs and find out how much does the LCMS influence their success in the course. The other was to find a a way to teach the students with a very heterogeneous preliminary knowledge.

5.2. Description of the experiment and the selection of the course

To test out the previous goals, a course to experiment on was needed. “Application Software: Internet”, a small course in the Faculty of Mathematics an Computer Science of University of Tartu was chosen, because it was small enough to transfer the materials and run it in two environments. It also had enough students (around 100 each year) to gather their attitude to those LCMSs. The course also uses several different tools and different media types, which makes the transfer non-trivial and more useful in the scope of this work.

The “Application Software: Internet” is one of the elective courses taught in both Faculty of Mathematics and Computer Science and Faculty of Physics and Chemistry of University of Tartu. The course is quite small – it is worth 1 Estonian credit point or 1,5 ECTS. Its purpose is to educate students on Internet and prepare them for further courses that need Internet-using skills. As such, it is mostly aimed at first-year students, but usually there are also some older students (generally less than 10%). Since this course is meant to be introductory, it is not likely that they would gain much from the content of the course, aside from an easy credit point. Therefore, those students are usually appointed as tutors for others. Their tasks are to remind the students of deadlines, help them with possible problems and grade their assignments.

This course is presented in e-learning environment only; no classroom lectures are delivered. It is one of the few fully e-learning courses in University of Tartu. Most courses use blended learning form where e-learning only supports classroom learning. This course has no classroom lectures; students can do all their work at home. Only the final test is supervised and takes place in a computer lab. This test is also restricted to a particular IP-address, so it can only be taken by students in presence.

The LCMSs used in this experiment were WebCT and Moodle. Both are the systems used in the University of Tartu. The experiment was carried out in two consecutive years - 2006 and 2007. The version of WebCT was different in those years, since at the end of 2006, Estonian e-University switched from WebCT Campus Edition 4.1 to WebCT Campus Edition 6.0. That also presented the opportunity to try out the content transfer between different versions of the same LCMS. The version of Moodle currently used is Moodle 1.5.3.

The students of the course were divided between those systems – about 50% percent of the students took it using WebCT and the other 50% used Moodle. Course materials and tasks for learners were the same in both environments.

In 2007, the course also had partial m-learning support. The materials of one module (texts, self-tests and audio summaries) were made available for mobile phones. The m-support was created by Martin Hunt and Tanel Tensing as part of their bachelor thesises. But as the m-learning is not important in the context of this work, it will not be described further in this text.

5.3. The structure of the course

The first year university students in Estonia have very different experience and knowledge about Internet. Some know quite a bit, the others can barely use e-mail and search engines. In the course, there were also students from different faculties, both from the Faculty of Mathematics and Computer Science and the Faculty of Physics and Chemistry. The problem of heterogeneity was attempted to manage by using a specific course structure.

The course is divided into compulsory and elective parts. In 2006, the compulsory part contained four blocks with compulsory themes. The elective part was divided into four optional themes and students had to choose two of them for further study. In 2007, due to material rearrangement, there were only 3 compulsory parts. Learning materials are short and many of them are supported with self-tests. All materials are in Estonian. Students also have two individual tasks,

two group tasks and two compulsory tests (four in 2007) during the course and one, supervised test in the end of the course.

Since there are many students, the ordinary collaboration through forums is not fruitful. Therefore the participants were divided into small groups (each had about 10-12 members in 2006 and 7-10 members in 2007). Every group had its own forum and student presentation area, where they had to display the outcome of their individual and group tasks.

One of the individual tasks is to compile audio summary of some blocks of materials. Students can do it by choosing one of the three languages in use in our university – Estonian, Russian or English. The best of those will be used next year as additional learning materials as many students have different mother tongues than Estonian.

In such a small course it is not possible to cover all topics students are interested in connection to Internet. The last task of the students is to compile a small essay on some additional theme. The quality assurance of essays is organized through compulsory peer review system, where one task of the reviewer is to test the work for plagiarism.

The group tasks were different each year. In 2006, the group task was to find problems concerning Internet in which they were interested as a group and also to find good additional materials on them. In 2007, students had to list Internet services they were already using and add the protocols used in those services.

The same course is also used as a teacher training course for Estonian school teachers. The materials of the course are all the same, but the tasks are different for teachers. For example, they have to evaluate and test the audio reviews made by students.

5.4. Content transfer

Until 2006, the Internet course had only been carried out in WebCT. To teach the course in Moodle as well, the course had to be recreated in Moodle. All the learning content had to be transferred from WebCT to Moodle. Fortunately, it wasn't necessary to transfer any student information or tool information, e.g. forum discussions. This was because the transfer took place between semesters and this kind of data was not important for the new course. In fact, it was even preferable not to have that data, as the new students were supposed to start with a clean course. The following sub-chapters detail how this transfer was done and what problems were

encountered.

5.4.1. Transfer from WebCT 4.1 to Moodle

WebCT 4.1 was used in University of Tartu until the end of 2006. This transfer was done in February, 2006.

Firstly, to recreate the WebCT course in Moodle, it had to be determined if all the tools used in the course in WebCT had their counterparts in Moodle. Quite many of them had. Some of them weren't exactly the same as in WebCT, but they could be used for the same goal. For example, in WebCT 4.1, there is a student presentation area where the group can set up their homework. In Moodle, the Wiki module (absent in WebCT Campus Edition 4.1) was used for the same purpose. Also, Moodle had no internal e-mail. Instead, the students used the Moodle messaging feature quite actively for communicating with the tutors. In WebCT, most of the learning materials were accompanied by self-tests. Moodle doesn't offer separate self-test functionality, so tests made with HotPotatoes[12] were added to those materials. The only feature for which an alternative could not be found, was the WebCT whiteboard. Since whiteboard was used in the learning process only as an optional feature for students to collaborate and was not used very actively in reality, the absence of it wasn't a large drawback.

In this case, tool data like forum messages, chat logs or student information and grades were not needed to be transferred. Students were expected to create their own Moodle accounts and other tools were just created in Moodle, with no need to export them from WebCT. A wiki was set up for use as a student presentation area, where students could work on and display their homework.

The second objective was to carry over all learning materials and tests from WebCT to Moodle. First, it was attempted to do that by exporting individual content modules from WebCT and importing them into Moodle as new SCORM package as recommended in Moodle documentation (Moodle, 2007c). This resulted in some PHP error messages, the reason of which is unknown. Perhaps the SCORM support in our version of Moodle was not yet fully implemented, as any other SCORM modules could not be imported into other projects either. This was a serious disappointment, as it would probably have lessened the transfer workload.

Since the materials could not be imported into the Moodle course, all the learning material files from WebCT had to be downloaded and then uploaded into Moodle. The materials contained 35

12 HotPotatoes Homepage, http://hotpot.uvic.ca/

HTML-files, 1 PNG-image and one Real Media video clip. Some materials were linked with a self-test in WebCT and a way was needed to reconstruct that in Moodle. Those self-tests were finally recreated as HotPotatoes tests and added after the corresponding materials in a Moodle section.

Some difficulties were expected with the tests. There was a possibility that all the questions would have to be inserted into Moodle individually. Luckily, Moodle could import test questions downloaded in WebCT text format and only the three tests had to be recreated and questions added to them. The only problems that arose were caused by different question handling of WebCT and Moodle. For example, Moodle expects the sum of positive answers to be exactly 100%, WebCT also allows other percentages (if there are three equal positive answers, then their sum would be only 99%). Also, matching questions can contain only two pairs in WebCT; Moodle needs at least three such pairs.

Since this course is quite small, transfer like this was feasible. Had the volume of content been greater, it would have not been quite so simple.

An important note is that there have been scripts developed for transferring WebCT 4.1 courses to Moodle, for example the one described in the official Moodle forum (Stowell, 2005). The script can import the whole course and also set up the Moodle tools corresponding to those in WebCT. For example, WebCT Organizer pages are turned into Moodle topics and self-tests into Moodle quizzes. Still, it seems to have some shortcomings with quizzes. Not all question types or quizzes with images import correctly. Also, it does not transfer the forum posts.

The downside of using this script is that it can only by used by a Moodle administrator and it only works on files created by WebCT Content Migration Utility, which is only accessible to a WebCT administrator. From the point of view of the course designer, nothing is changed. Since we had no administrator access to either of those systems, we couldn't try out those scripts. Also, the script can only import one course at a time, but it's still better than each instructor re-creating their course from the scratch.

The downside of such scripts in general is that they have to be specifically developed for two particular systems and particular versions of those systems. It is not a universal solution and may not work in all cases. Also, developing such scripts is an extra work for the organization, even though it may make the transfer easier later. Transfer should be doable even by course designers

themselves and it should not require any technical knowledge or running command line scripts.

There doesn't seem to be any such scripts for WebCT 6.0.

5.4.2. Transfer from WebCT 4.1 to WebCT 6.0

In the beginning of 2007, University of Tartu switched form WebCT 4.1 to WebCT 6.0. There was a six month transition period (during the Fall semester), during which both versions could be used.

The transfer from WebCT 4.1 to WebCT 6.0 was relatively painless, as could be expected. WebCT 4.1 content was exported as a content package. The content package was then imported into WebCT 6.0 course. There were no problems during the transfer; the only problems that came up were related to the differences between those versions. For example, the creation of self-tests in WebCT 6.0 is different from WebCT 4.1. An unwelcome surprise was that WebCT 6.0 didn't have the Student Presentation Area anymore. Since lot of the work of the students in WebCT was based upon using that tool, it was a real problem. Finally, it was decided to use outside wiki for those tasks.

5.4.3. Transfer from WebCT 6.0 to Moodle

WebCT 6.0 is used in the University of Tartu since 2006. The transfer from WebCT 6.0 to Moodle occurred during the Spring semester of 2007. Most of the course was already transferred the year before. In 2007, some changes were made to the course, for example some materials were modified and supplemented with their audio summaries. Also, the structure of materials was redesigned, therefore requiring also the changes to the tests and test questions. The changes were first carried out in WebCT and then reconstructed in Moodle.

It turned out that keeping learning materials up-to-date in two different learning environments was more of a hassle than expected. Since the course materials in the Internet course are being changed every year, the changes made in WebCT version had to be repeated also in Moodle materials. What made this all the more difficult, was that the materials could not simply be re-inserted into Moodle. Since Moodle does not offer a functionality to attach objectives to a material like WebCT does, those objectives were directly added into the page's HTML code. In the case of reinserting the materials, those would have been lost. There was also no way of knowing which materials had been changed. So in the end all the materials were analyzed with

text comparison tool and all found changes were realized in Moodle by hand. This is certainly not the most suitable solution and in the long term, a better way of keeping materials up-to-date in multiple environments, is needed.

Another problem was with the tests. Moodle is able to import test questions in WebCT proprietary text format that was used in WebCT 4.1. WebCT 6.0 uses only the IMS QTI format for exporting test questions. Unfortunately, Moodle is not yet able to import questions in this format. That means that all the modifications to the questions as well as the new questions had to be inserted into Moodle manually.

Even though we only had to transfer a small course, it was quite a lot of trouble. This sort of transfer is not feasible with a large number of courses. The need for common interoperable standards for content packaging is great. Fortunately, there already exist some of such standards (IMS Content Packaging, SCORM) and the LCMSs vendors are starting to implement those more and more. In the future, course transfer may be quite a bit easier.

5.4.4. Transfer from Moodle to WebCT

The only export functionality Moodle offer, is the course backup. The backup file is only usable in Moodle. Therefore the transfer from Moodle to WebCT would be much like the transfer from WebCT to Moodle – the materials would be compressed in Moodle and unpacked into WebCT.

As for the Moodle quizzes, the test questions can be exported in IMS QTI format that is also used in WebCT 6.0. The attempts to import the questions that were exported from Moodle failed. This is probably due to version differences in the standards as Moodle uses IMS QTI 2.0 and WebCT 6.0 is compliant with IMS QTI 1.2.

This chapter described a course that ran in parallel in two different learning environments. At the end of this course, the students were asked to participate in a survey about this experiment. In the next chapter, the results of this survey are discussed.

6. The Survey

One of the objectives of this experiment was to evaluate the students' reaction to the course and to the learning environments used. This chapter describes the evaluation of the course. The three entities evaluated are e-learning, course structure and learning environment.

To measure tuition effectiveness, Kirkpatrick's training evaluation model (Kirkpatrick, 1979) is often used. Originally developed for evaluating employee training programs, it is now widely used to assess effectiveness of any training. This model consists of four levels – reaction, learning, behavior and results. The first level (reaction) measures how well the trainees like the course. The second level (learning) determines the amount of learning taking place. The third level (behavior) records the changes in the trainee's on-the-job behavior. The fourth and final level (results) estimates the success of training in economical terms, such as reduced cost, increased productivity, etc. Each level builds upon the results of earlier levels, thus giving more specific information about the effectiveness of training, but at the same time requiring more time and effort to carry out. Since the goal was to gather student's satisfaction with the course, only the first level of Kirkpatrick's model is evaluated in this work.

To gather data for the evaluation, the students were asked to fill in a questionnaire at the end of the course. The questionnaires were similar for both Moodle and WebCT groups and contained questions about e-learning in general, the structure of the materials and the usability of LCMS. Some questions were inspired by @duline project report (Laanpere, 2005). Quite a lot of the questions asked in the survey are omitted from this thesis, as they are not important in the context of this work. They were mainly questions about the course materials and the course itself; one block of questions was also dedicated to m-learning. The m-learning survey answers are used in the bachelor thesises of Martin Hunt and Tanel Tensing. With some exceptions, the questions were measured on a five-point Likert scale. In most cases possible responses were “strongly disagree”, “disagree”, “indifferent”, “agree” and “strongly agree”. Other question types used were yes/no questions and open-ended questions.

The survey was carried out in two consecutive years – 2006 and 2007. The survey was not anonymous; answering the questionnaire was one of the prerequisites for passing the course. In 2007, some small changes were made in the survey, mainly for adjusting to the move from WebCT 4.1 to WebCT 6.0. For example, as mentioned earlier, external wiki had to be used

instead of student presentation area and some questions had to be modified to reflect this change.

In total, the survey was answered by 152 students, of those 79 in WebCT and 73 in Moodle. The following table (Table 2) gives an overview of the students' enrollment, the course completion rates and participation in the survey in both environments. It must be noted, that in 2007, tutors were used in both environments. As the tasks and overall course experience for tutors was different from other students, they are not counted in course completion numbers. The tutors also didn't participate in the survey.

Year		**WebCT**	**Moodle**	**Total**
2006	**Enrolled**	58	50	108
	Passed	42	41	83
	Completion percentage	72,4%	82,0%	76,9%
	Survey	32	41	73
2007	**Enrolled**	63	45	108
	Tutors	6	5	11
	Students enrolled	57	40	97
	Passed	48	33	81
	Completion percentage	84,2%	82,5%	83,5%
	Survey	47	32	79

Table 2. Enrollment, course completion and participation in the survey

As we can see from the above table, the course completion percentage (how many percent of those who enrolled actually passed the course) is more or less the same, around 80%, with the exception of 2006 WebCT group, where the course completion percentage is about 10% less than in all the other groups. This indicates, that at least in the scope of this course, it does not matter whether to use WebCT or Moodle.

The graph in the next figure (Figure 3) gives a visual interpretation of enrollment and course completion.

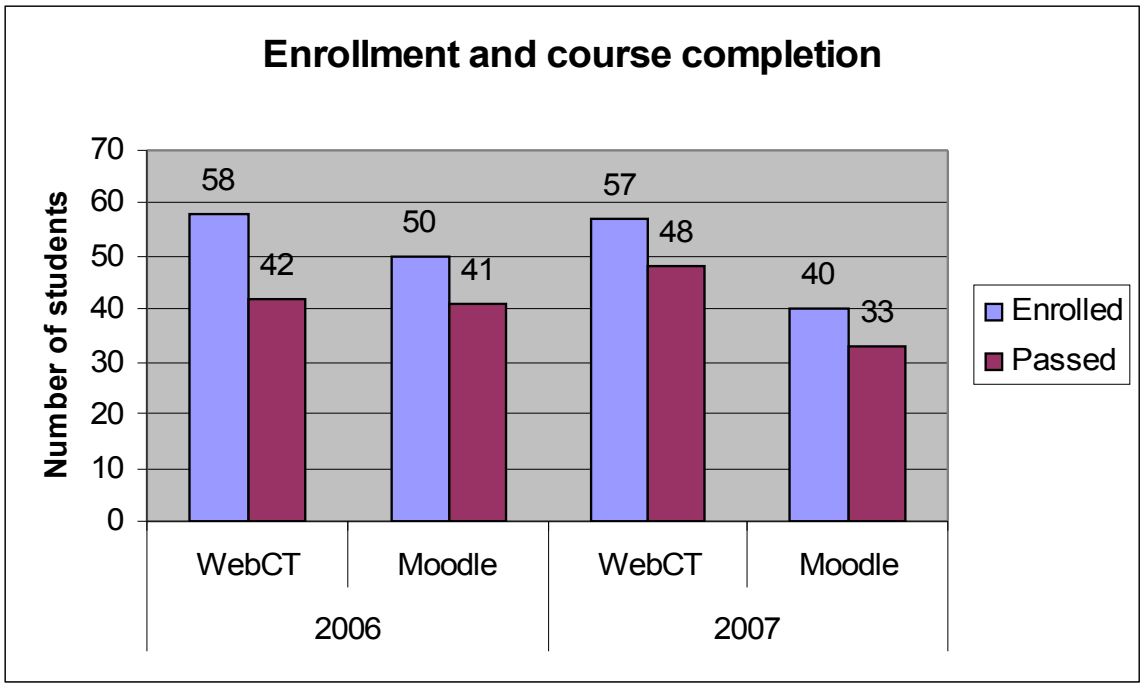

Figure 3: Enrollment and course completion

The analyses of the survey can be divided into three parts – what did students think about e-learning, the course and its structure and their learning environments.

6.1. Students' attitude toward e-learning

One objective of this survey was to find out students' overall attitude to e-learning. Questions that they were asked in this context, were about their previous e-learning experiences, their opinion about pure 100% e-learning courses and their preference to e-learning vs classroom learning in the context of this course. These are the questions 1-3 in Appendix 1.

Students' answers to question 1 ("Have you ever participated in a course where e-learning was used?") are shown in Figure 4.

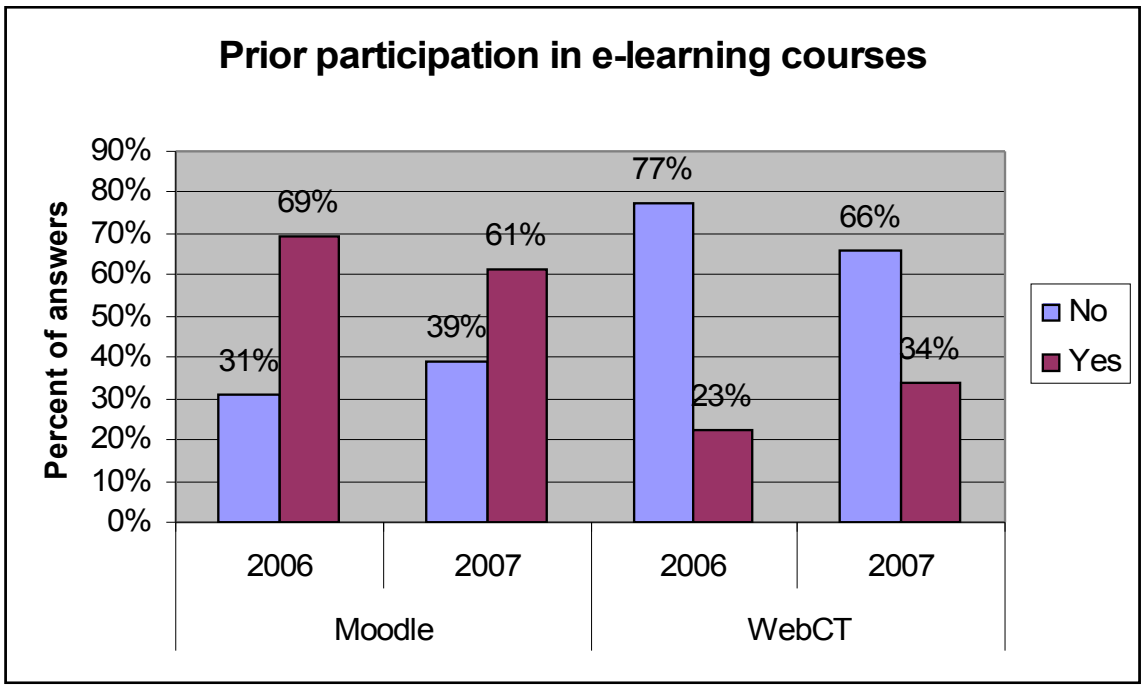

Figure 4: Responses to the question "Have you ever participated in a course where e-learning was used?"

There occurs an interesting anomaly between WebCT and Moodle students. Whereas majority of Moodle students say they have used e-learning in some form before, majority of WebCT students indicate otherwise. This is especially strange, since most of the students (with only 2 exceptions) confirmed that they had used WebCT before this course. This might indicate that the students' are not sure what is considered e-learning and what is not. In the courses mentioned by the students, e-learning is only used to support classroom lectures and for managing homework and grades. When students were asked in which courses and how the e-learning was used, they mostly indicate that the materials and homework (including tests) were available in WebCT. It is possible that students, who answered negatively to question 1, don't consider this kind of blended learning to be "real" e-learning, which might explain this controversy.

Students' answers to question 2 ("How did you like 100% e-learning course?") are shown in Figure 5. The responses indicate that students are positive about pure e-learning courses.

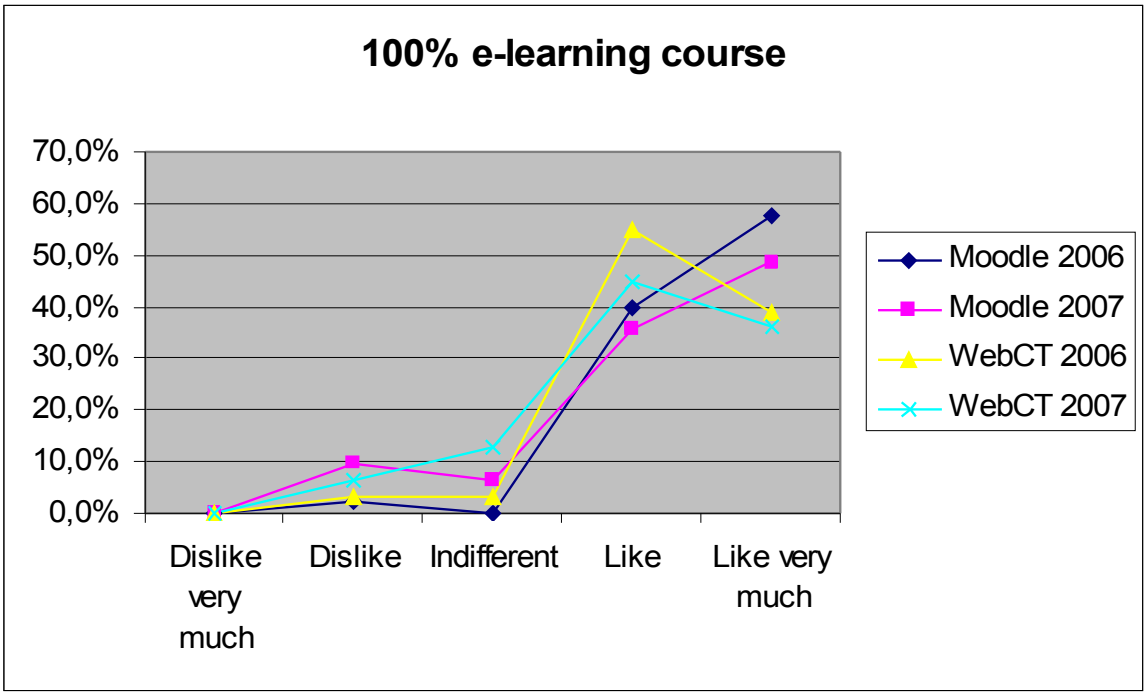

Figure 5: Distribution of answers to the question "How did you like 100% e-learning course?"

Answers to question 3 ("If there were lectures in addition to the e-course, would you have attended the lectures?") are shown in Figure 6. The majority of students indicate that they would not have attended the lectures. Only a small portion of students is indifferent or willing to attend the lectures.

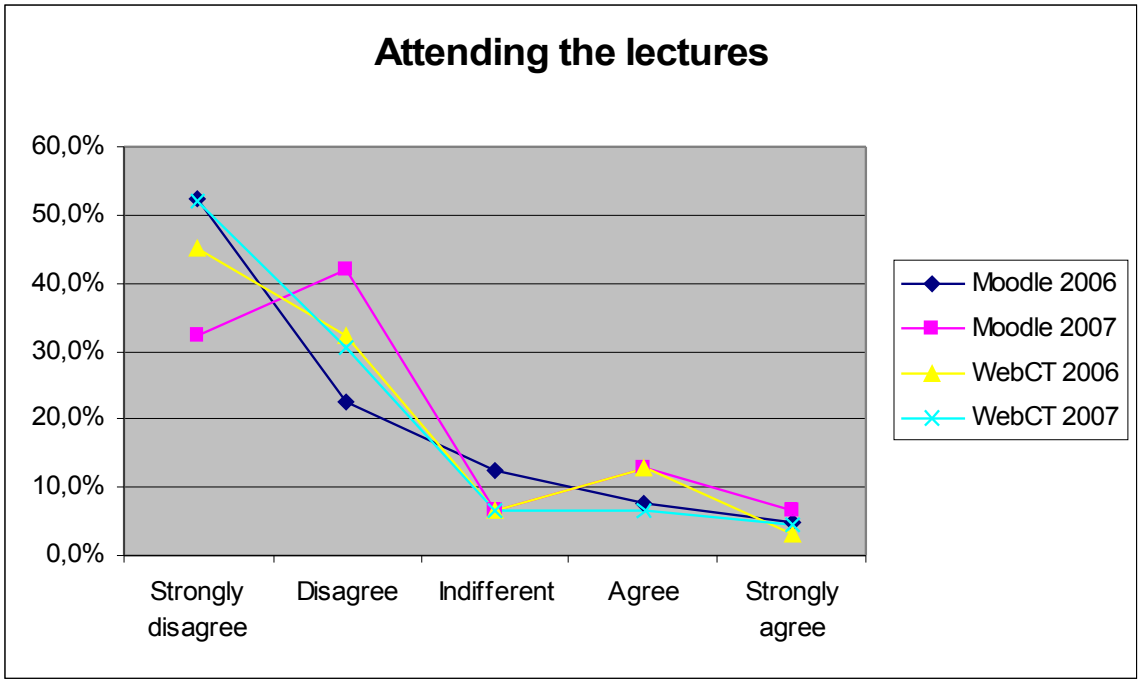

Figure 6: Distribution of answers to question "If there were lectures in addition to the e-course, would you have attended the lectures?"

Students' responses to the e-learning were mostly positive. When asked, if in the future they would agree to participate in some other e-learning course, only one person disagreed. Also, in responses to the question about what they liked most about the course, 47 people mentioned that it is completely web-based, they don't have to attend lectures and can study in their own time. No student mentioned that they didn't like that the course was online. This indicates that the students are willing to use e-learning in their studies.

6.2. Students' attitude toward the course

The second objective of this survey was to find out if the students approved the structure of the course. As mentioned earlier, the course materials were divided into compulsory and electable parts. The students were asked whether they thought this structure was suitable. The responses to this question are presented in Appendix 1 (question 4) and also in the following figure (Figure 7).

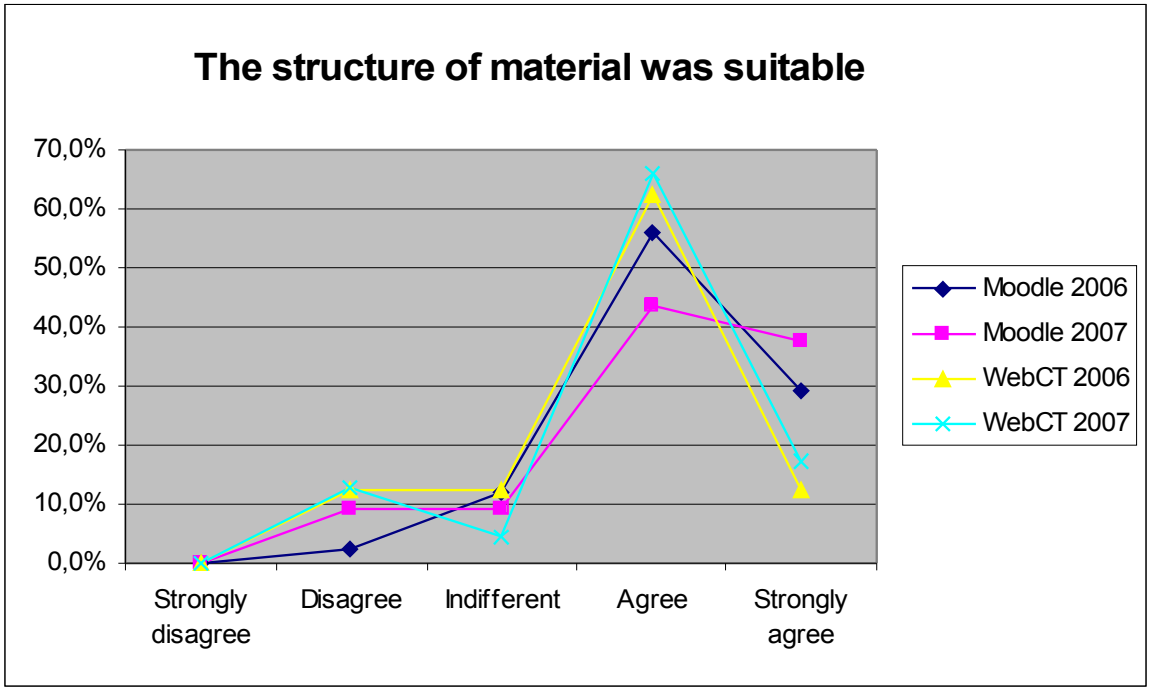

Figure 7: Distribution of responses to the statement "The structure of the material (compulsory and optional parts) was suitable"

The students are mostly positive about this statement, only some of them are indifferent or disagree. This means that the majority of students are finding this structure suitable for their learning needs.

The students were also asked to answer open-ended questions about what they liked and didn't

like about the course. In the following table (Table 3) are presented some of the more often occurring responses to those questions and the number of students who expressed that particular opinion.

Recurring themes	Moodle		WebCT		Total
	2006	2007	2006	2007	
What did you like most about this course?					
web-based course, no lectures	7	10	10	20	47
interesting course content	6	4	0	9	19
audio summary	2	3	1	1	7
communication with the group	4	0	2	0	6
interesting assignments	1	1	1	1	4
tests	2	0	1	1	4
writing the essay	0	0	2	1	3
What did you not like about this course?					
writing the essay	2	3	3	3	11
working in groups	3	3	3	2	11
audio summary	1	1	2	4	8
too much work for one credit point	2	2	0	2	6
absent or late study guides	0	0	5	1	6
tight schedule	2	1	0	2	5
reviewing essays of other students	1	1	1	2	5
random assignment to groups	3	2	0	0	5
too many assignments	0	1	0	2	3

Table 3. *Recurring opinions about what the students liked and didn't like about the course*

The students' responses were quite diverse. What some liked about the course, others didn't. For example, this was the case with audio summaries and essays. Some students named them as the things they liked most about the course, others said they didn't like doing those assignments at all. Most students pointed out that they liked that the course was completely web-based, they didn't have to attend any lectures and they could choose their own time to do the work required in the course. Some students wrote that they liked communicating with other students online, others had trouble with group work and complained that their groupmates didn't do their share of the work. Some also didn't like that they were randomly assigned to groups and they would have preferred to form the groups themselves. There were some students who said that the course schedule was too tight and that there were too many assignments. It was mentioned that there

was too much work for one credit point. Still, the majority of students seemed to think the course was just the right size for one credit point (question 5, Appendix 1).

6.3. Students' attitude toward the learning environments

The third objective for this survey was to get students' attitude towards their learning environment. The students were asked to assess how attractive, user-friendly and well-structured was the learning environment they used (either WebCT or Moodle). They could also give their opinions about what they liked and didn't like about those environments. At the end of the course, the students were encouraged to visit the other LCMS (the one they didn't use during the course). This was mostly intended for WebCT students, since most Moodle students were already familiar with WebCT, but only two WebCT students had used Moodle before this course. The students were then asked, which LCMS they preferred. Next, we will analyze the responses to those questions.

Questions 6-8 in Appendix 1 are dealing with the different properties of learning environments. In the next figure (Figure 8), responses in a five-point Likert scale to the statement "The learning environment was attractive" are given.

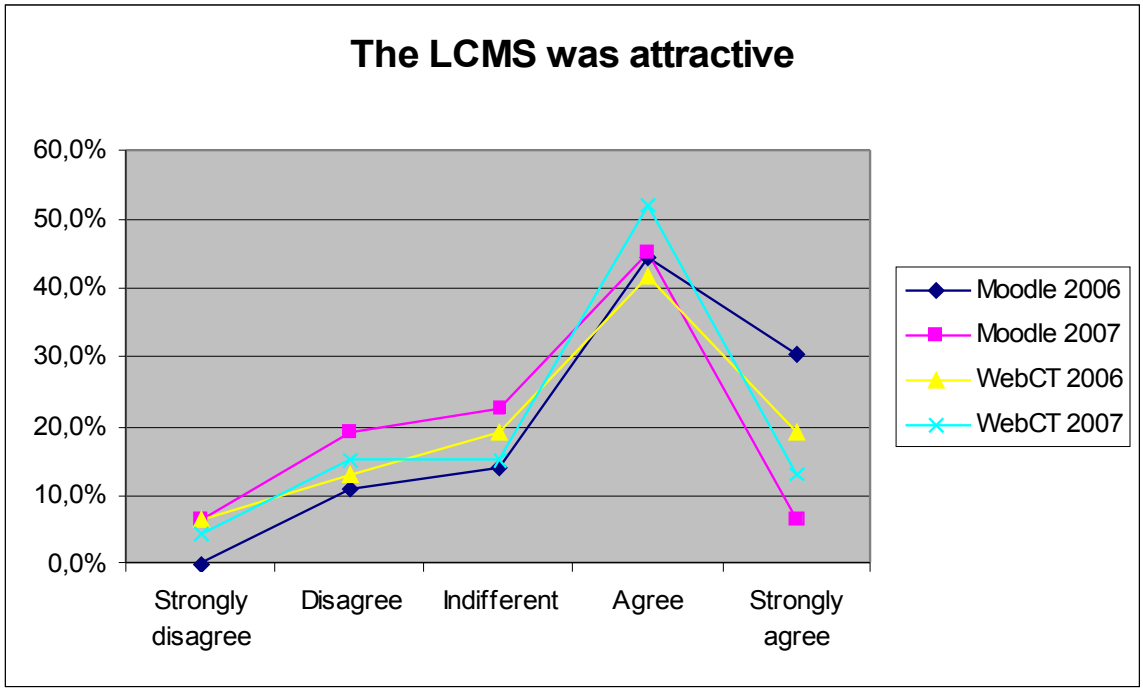

Figure 8: Distribution of responses to statement "The learning environment was attractive"

Majority of students seem to consider their respective system attractive. The percentages of students who answered positively to this question (either “Agree” or “Strongly agree”) range from 51% (Moodle in 2007) to 74% (Moodle in 2006). There is a 23% drop in positive responses in Moodle between 2006 and 2007 while the WebCT responses seem to be more or less the same (61% in 2006, 65% in 2007).

Figure 9 describes responses to the statement “The environment was user-friendly”.

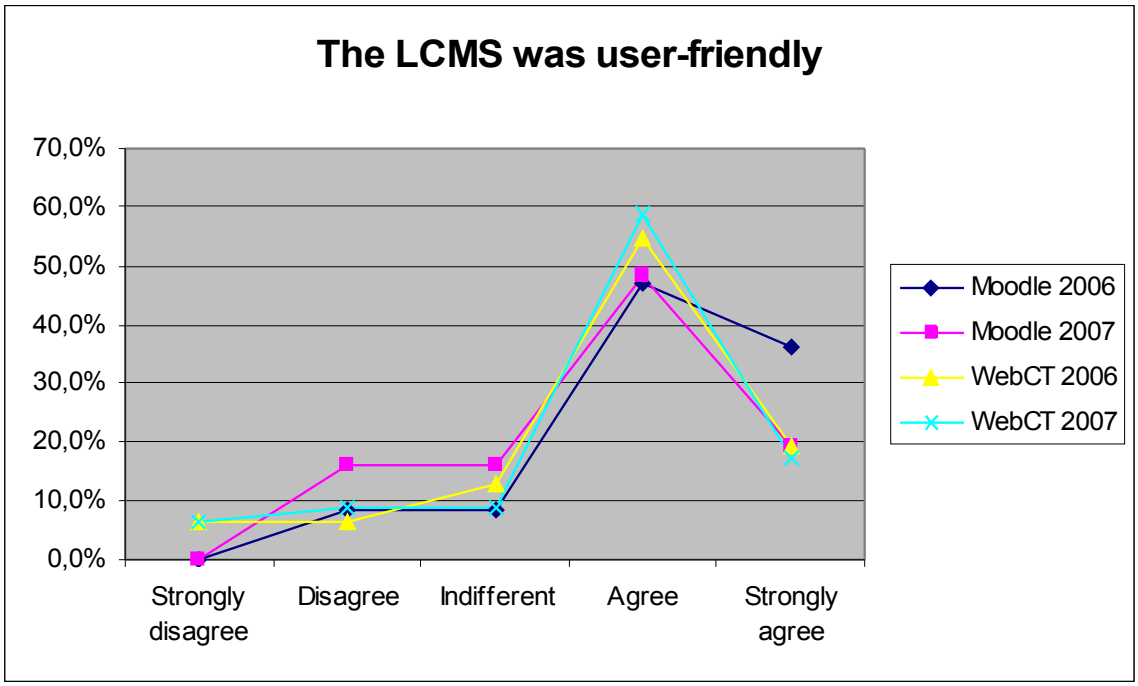

Figure 9: Distribution of responses to the statement "The environment was user-friendly"

The majority of students think that their learning environment is user-friendly. Again, the percent of positive responses (“Agree” and “Strongly agree”) in Moodle drops from 83% in 2006 to 67% in 2007. WebCT percents of positive responses are about the same (74% in 2006, 76% in 2007).

Figure 10 represents the students' responses to the statement “The environment was well-structured”.

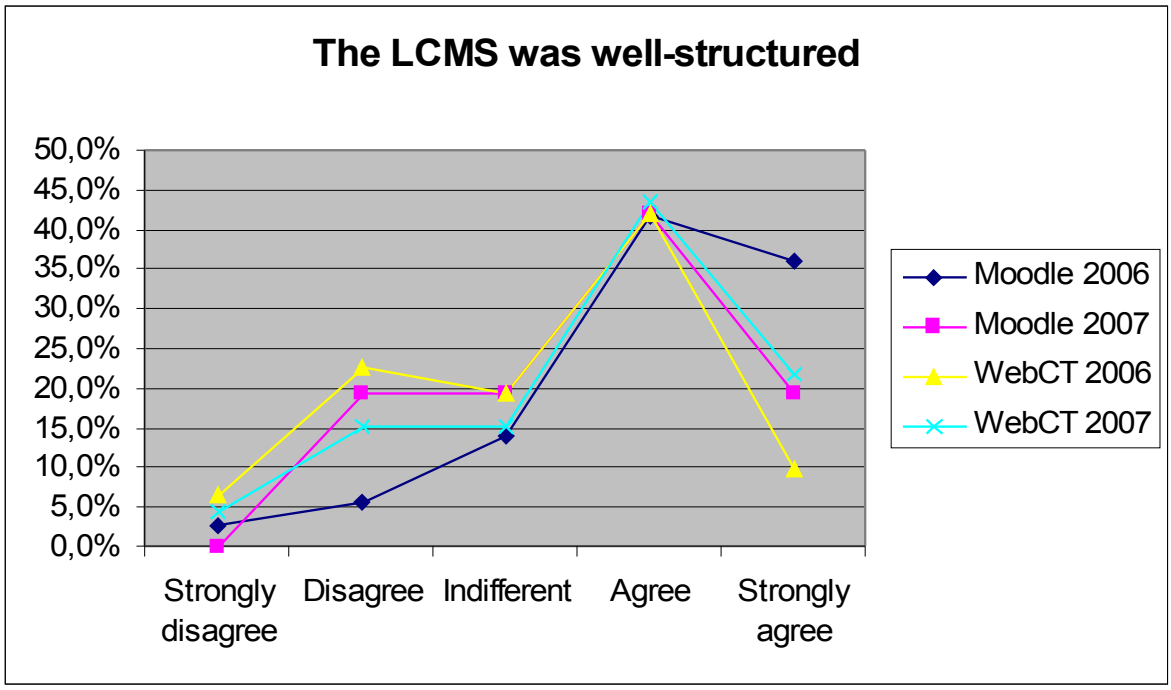

Figure 10: Distribution of responses to the statement "The environment was well-structured"

The drop in Moodle percentages was noticeable (from 78% in 2006 to 61% in 2007). Also, there was a slight rise in WebCT percentages (from 52% in 2006 to 65% in 2007). The students' responses were mostly positive and did not differ greatly between systems.

For the most part, all the charts in those figures (Figures 8-10) seem to have a similar shape. There is a small number of students who either strongly disagrees or disagrees, then about 20% of indifferent students and 40-60% on students who agree. The number of students who strongly agree varies more between systems than in the other answer variants. The chart on Figure 10 is a bit different, since the percent of students, who disagree, is the same or higher than the percent of students, who are indifferent (except for 2006 Moodle students). This was not so in the other two graphs. All in all, the students seemed to consider both learning environments attractive, user-friendly and well-structured.

The students were also asked open-ended questions about those learning environments. In the following table (Table 4) are presented some of the more often occurring responses to those questions about the learning environments. Both groups answered questions about both environments. The number of students who mentioned that particular theme is given in corresponding columns.

Recurring themes	Moodle		WebCT		Total
	2006	2007	2006	2007	
What did you like most about Moodle?					
Wiki	11	5	0	0	16
Simplicity	4	8	1	1	14
Ease of use	4	3	1	1	9
Design	2	1	0	2	5
Pages download fast	1	3	0	0	4
Easy to find things	1	2	0	1	4
Forums	2	0	0	1	3
Interface is in Estonian	1	1	0	0	2
What didn't you like about Moodle?					
Design	3	2	1	1	7
Wiki	4	1	0	0	5
Too crowded	1	1	1	0	3
Structure	0	1	1	1	3
Unfamiliar	2	0	0	0	2
Inconvenient to use	1	0	0	1	2
What did you like most about WebCT?					
Simplicity	4	2	3	5	14
Structure	4	5	3	2	14
User-friendly and easy to use	1	2	2	5	10
New information notifications on the start page	1	2	2	1	6
User interface	1	2	0	2	5
Already familiar	1	0	1	2	4
Materials are together in one place	0	0	2	2	4
Tests	2	0	1	0	3
What didn't you like about WebCT?					
Complex, not easy to use	1	3	0	4	8
Slow	1	5	0	1	7
Is not user-friendly	2	0	0	3	5
Design	2	0	2	1	5
Annoying pop-ups	0	3	1	0	4
Crashes often	1	0	0	3	4
Can't open multiple windows or tabs	1	1	1	1	4
Structured badly	2	0	2	0	4

Recurring themes	Moodle		WebCT		Total
	2006	2007	2006	2007	
Is not in Estonian	0	2	0	1	3

Table 3. Recurring opinions about what the students liked and didn't like about the LCMSs

From students' answers we can see that their opinions are quite diverse and subjective. There are different opinions about ease of use and design of both systems.

One final question concerned the system the students would prefer to use (question 9 in Appendix 1). Only the answers of those students who indicated that they had used the other system, were counted. Figure 11 shows the preferences of the students.

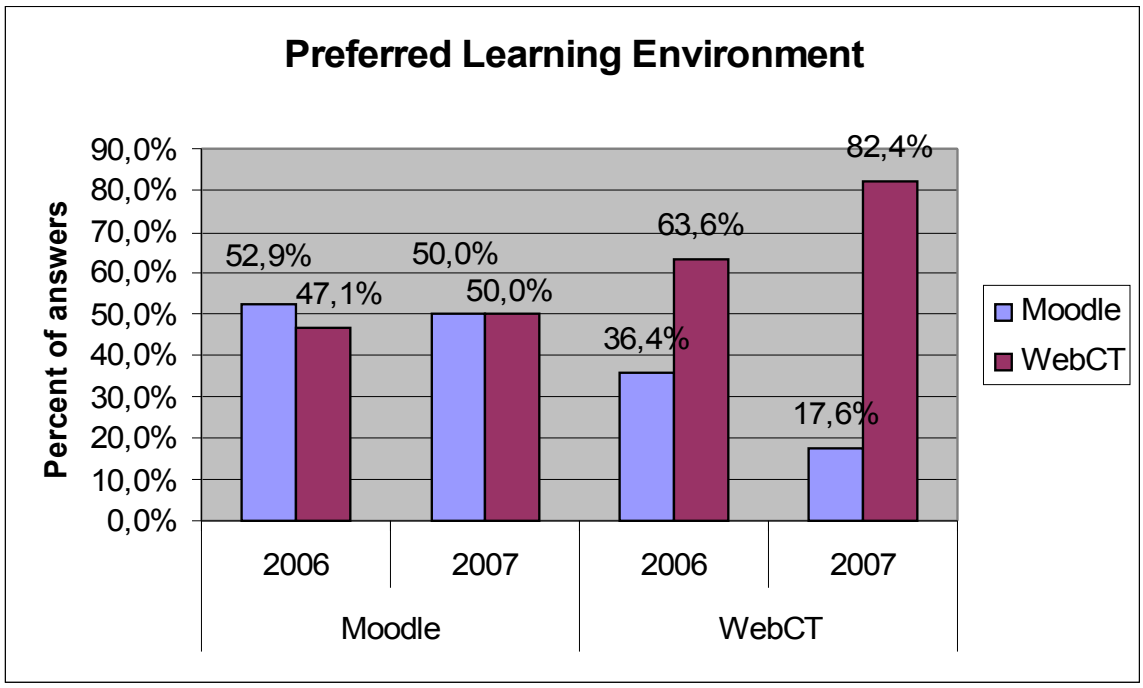

Figure 11: Distribution of answers to question "Which learning environment do you prefer?"

While Moodle students seem to prefer both systems almost equally, then WebCT students show a clear preference for WebCT. The latter is understandable as the WebCT students most probably are not very familiar with Moodle. Only 32 students from WebCT (12 in 2006, 20 in 2007) had visited the course in Moodle, as opposed to 66 (35 and 31, respectively) Moodle students, who indicated that they are familiar with WebCT. Also, the ones from WebCT group, who visited the course in Moodle, used a guest account that didn't allow them access to all Moodle activities (e.g. tests, assignments, etc.). Overall, taking into account that most students were used to using WebCT prior to this course, the response to Moodle was quite positive.

The initial conclusions from this survey can be drawn as follows:

- Students are willing to use e-learning in their studies
- The structure of the course was acceptable for the majority of students
- The students seem to prefer using WebCT, which is understandable, as it is their primary learning platform. Most of WebCT students prefer using WebCT, only a small part of them prefer Moodle. Moodle students' preferences are distributed between systems almost evenly – half of them prefer Moodle, the other half WebCT.
- The course completion rate in both systems was similar; around 80% of the students passed the course in each group.

The results of the survey indicate that in terms of student success it does not matter whether to use WebCT or Moodle. Both systems are suitable for successful teaching/learning process. The way the systems are used is more likely to influence the students' results. Which one to use depends purely on the preference of the course instructor.

Conclusion

The main objectives of this work were to gain a practical experience of content transfer, deal with heterogeneous knowledge of the students and find out the students' attitude towards e-learning and the learning environments used.

The content transfer was carried out between Moodle and different versions of WebCT (4.1 and 6.0). The transfer was done from the viewpoint of the course designer. The content transfer between different versions of WebCT was very smooth and without problems. The transfer between WebCT and Moodle on the other hand, was more troublesome. Even though WebCT was able to export IMS-compliant content packages, Moodle was not able to import them. In the end, the course materials were compressed into an archive in WebCT and unpacked in Moodle. The structure of the materials was restored manually. The tools (forums, tests, etc.) had to be set up separately. Some trouble was caused by the test questions. Moodle was able to import test questions exported from WebCT 4.1, but not from WebCT 6.0, so some of the questions had to be recreated in Moodle and then added to the tests.

The problem of heterogeneous background knowledge of the students was tried to handle by using specific course structure. The materials were presented in two levels, each level consisting of a number of blocks. The first level was compulsory to all; from the second level students had to choose two blocks of material to study. This gave the students the opportunity to choose material that was more interesting for them or that they didn't already know about.

The student attitude survey was carried out in two consecutive years – 2006 and 2007. The survey results indicate the positive attitude of students to e-learning. Many students had used e-learning in some form before, even though only in blended learning form. The answers from students indicate that they liked the opportunity of not attending lectures and dealing with the course at a time and place convenient for them.

The students preferences about their learning environment were quite different across the systems. Most WebCT students preferred using WebCT, although some liked Moodle better. About half of the Moodle students preferred using Moodle to WebCT. Since WebCT was already familiar for most of the students, this is not surprising.

A presentation about the course and results of the 2006 survey was given in LEARN Intensive

Programme 2006 (EUDORA European Summer School). An article (Hendla & Villems, 2006) was written that is accepted for publishing in the summer school publication series.

The course described in this work ("Application Software: Internet") was named as one of the best e-courses of the Estonian E-University Consortium in 2006 (e-University, 2007b). Also, this course was presented at the Estonian e-University Spring conference "E-learning in an E-country: Strategies and technologies" (e-University, 2007c).

E-õpe: uurimus ühest kursusest kahes keskkonnas

Magistritöö

Kadri Hendla

Sisukokkuvõte

Seoses e-õppe üha suureneva populaarsusega on üha enam päevakorda kerkinud ka erinevad e-õppe probleemid. Käesoleva töö põhilisteks uurimisobjektideks olid järgmised e-õppe probleemid:

- Tudengite heterogeensed eelteadmised
- Kursuste ülekandmine ühest e-õppe süsteemist teise
- Tudengite suhtumine e-õppesse ja kasutatavatesse õpikeskkondadesse

Töö esimene pool on valdkonda ja probleeme tutvustav. Töös antakse lühike ülevaade e-õppest ning sellega seotud standarditest. Veel vaadatakse lähemalt kahte Tartu Ülikoolis kasutatavat õpihaldussüsteemi – WebCT'd ja Moodle'it. Õpihaldussüsteemide kasutamisel ilmneb varem või hiljem vajadus kursusi mõnda teise süsteemi ümber kolida. Üks peatükk tööst on pühendatud kursuste ümbertõstmisele ühest süsteemist teise. Töö annab ka lühiülevaate põhilisematest murekohtadest e-õppes, pikemalt peatutakse tudengite heterogeensete eelteadmiste probleemil.

Töö teine pool on praktilisem. Magistritöös kirjeldatakse Tartu Ülikoolis 2006 ja 2007 kevadel aset leidnud eksperimenti, kus väikest, üheainepunktilist kursust peeti paralleelselt kahes õpihalduskeskkonnas samaaegselt. Pooled tudengitest läbisid kursuse WebCT's, teine pool Moodle'is. Kuna kursusel osalejad olid heterogeensete taustteadmistega, siis muudeti kursuse materjalide struktuuri nii, et õpilased saaksid vastavalt oma teadmistele või huvidele valida, mida õppida. Materjalid olid esitatud kahel tasemel ning jaotatud teemade kaupa blokkideks. Esimese taseme materjalid olid kohustuslikud kõigile, teise taseme omade hulgast võisid tudengid valida lähemalt uurimiseks kaks.

Kursuse läbiviimine mitmes keskkonnas andis võimaluse praktiliselt läbi proovida kursuse

ülekandmise keskkondade vahel. Ülekandmise käigus selgus, et kuigi on olemas standardid sisupakenduse jaoks, siis vähemalt WebCT ja Moodle puhul ei ole nendest abi ning kursus tuli üle tõsta suures osas käsitsi. Samuti ilmnes probleeme testiküsimustega. Kuigi WebCT 4.1 formaadis küsimusi oli Moodle suuteline importima, siis WebCT 6.0 omasid mitte ning need tuli käsitsi uuesti luua.

Eksperimendi lõppedes viidi läbi tudengite hulgas küsitlus, milles uuriti nende arvamusi nii e-õppe kohta üldiselt kui ka täpsemalt kursuse ja nende õpikeskkonna kohta.

Küsitluse tulemustest selgub, et õppurid on e-õppe suhtes positiivselt meelestatud. Samuti oldi enamjaolt positiivsed õpikeskkondade suhtes, kuigi tudengid tõid välja ka mitmeid puudujääke nendes keskkondades. Enamik WebCT keskkonda kasutanud tudengitest eelistaks kasutada WebCT'd, kuigi nii mõnelegi neist meeldis Moodle rohkem. Moodle'i kasutajad jagunesid oma eelistustes WebCT ja Moodle vahel umbes pooleks. Tudengite protsent, kes kursuse läbis oli keskkondades enam-vähem sama, seega võib oletada, et kasutatav keskkond iseenesest ei mõjuta oluliselt tudengite õppeedukust.

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Appendices

Appendix 1

Responses to Survey Questions

1. Have you ever participated in a course where e-learning was used?										
	Moodle				**WebCT**				**Total**	
	2006		*2007*		*2006*		*2007*			
No	12	31%	12	39%	24	77%	31	66%	79	53%
Yes	27	69%	19	61%	7	23%	16	34%	69	47%
Total	39	100%	31	100%	31	100%	47	100%	148	100%
2. How did you like 100% e-learning course?										
	Moodle				**WebCT**				**Total**	
	2006		*2007*		*2006*		*2007*			
Dislike very much	0	0%	0	0%	0	0%	0	0%	0	0%
Dislike	1	3%	3	10%	1	3%	3	6%	8	5%
Indifferent	0	0%	2	6%	1	3%	6	13%	9	6%
Like	16	40%	11	35%	17	55%	21	45%	65	44%
Like very much	23	58%	15	48%	12	39%	17	36%	67	45%
Total	40	100%	31	100%	31	100%	47	100%	149	100%
3. If there were lectures in addition to the e-course, would you have attended the lectures?										
	Moodle				**WebCT**				**Total**	
	2006		*2007*		*2006*		*2007*			
Strongly disagree	21	53%	10	32%	14	45%	24	52%	69	47%
Disagree	9	23%	13	42%	10	32%	14	30%	46	31%
Indifferent	5	13%	2	6%	2	6%	3	7%	12	8%
Agree	3	8%	4	13%	4	13%	3	7%	14	9%
Strongly agree	2	5%	2	6%	1	3%	2	4%	7	5%
Total	40	100%	31	100%	31	100%	46	100%	148	100%
4. The structure of the material (compulsory and optional parts) was suitable										
	Moodle				**WebCT**				**Total**	
	2006		*2007*		*2006*		*2007*			
Strongly disagree	0	0%	0	0%	0	0%	0	0%	0	0%
Disagree	1	2%	3	9%	4	13%	6	13%	14	9%
Indifferent	5	12%	3	9%	4	13%	2	4%	14	9%

Agree	23	56%	14	44%	20	63%	31	66%	88	58%
Strongly agree	12	29%	12	38%	4	13%	8	17%	36	24%
Total	41	100%	32	100%	32	100%	47	100%	152	100%

5. For one credit point, the course was...

	Moodle				**WebCT**				**Total**	
	2006		*2007*		*2006*		*2007*			
too small	6	16%	4	13%	4	14%	5	11%	19	13%
just enough	30	79%	18	60%	18	64%	29	64%	95	67%
too large	2	5%	8	27%	6	21%	11	24%	27	19%
Total	38	100%	30	100%	28	100%	45	100%	141	100%

6. The learning environment was attractive

	Moodle				**WebCT**				**Total**	
	2006		*2007*		*2006*		*2007*			
Strongly disagree	0	0%	2	6%	2	6%	2	4%	6	4%
Disagree	4	11%	6	19%	4	13%	7	15%	21	15%
Indifferent	5	14%	7	23%	6	19%	7	15%	25	17%
Agree	16	44%	14	45%	13	42%	24	52%	67	47%
Strongly agree	11	31%	2	6%	6	19%	6	13%	25	17%
Total	36	100%	31	100%	31	100%	46	100%	144	100%

7. The environment was user-friendly

	Moodle				**WebCT**				**Total**	
	2006		*2007*		*2006*		*2007*			
Strongly disagree	0	0%	0	0%	2	6%	3	7%	5	3%
Disagree	3	8%	5	16%	2	6%	4	9%	14	10%
Indifferent	3	8%	5	16%	4	13%	4	9%	16	11%
Agree	17	47%	15	48%	17	55%	27	59%	76	53%
Strongly agree	13	36%	6	19%	6	19%	8	17%	33	23%
Total	36	100%	31	100%	31	100%	46	100%	144	100%

8. The environment was well-structured

	Moodle				**WebCT**				**Total**	
	2006		*2007*		*2006*		*2007*			
Strongly disagree	1	3%	0	0%	2	6%	2	4%	5	3%
Disagree	2	6%	6	19%	7	23%	7	15%	22	15%
Indifferent	5	14%	6	19%	6	19%	7	15%	24	17%
Agree	15	42%	13	42%	13	42%	20	43%	61	42%
Strongly agree	13	36%	6	19%	3	10%	10	22%	32	22%

Total	36	100%	31	100%	31	100%	46	100%	144	100%
9. Which learning environment do you prefer?										
	Moodle				**WebCT**				**Total**	
	2006		*2007*		*2006*		*2007*			
Moodle	18	53%	15	50%	4	36%	3	18%	40	43%
WebCT	16	47%	15	50%	7	64%	14	82%	52	57%
Total	34	100%	30	100%	11	100%	17	100%	92	100%

Glossary

English	Estonian	Definition
blended learning	kombineeritud õpe	A form of e-learning where e-learning is used in addition to classroom learning
content packaging	sisupakendus	The process of packaging content into a single file that can be imported into a content management system. Usually the resulting content package is described by meta-data
content transfer	materjalide ülekandmine	The process of moving content from one content management system to another
ECTS		European Credit Transfer and Accumulation System. A student accreditation system used in Europe that measures the student's academic achievements and allows the transfer of grades between different institutions
learning content	õppesisu	The educational content of the course. This includes the learning materials, tests, descriptions of assignments, study guides etc.
learning content management system (LCMS)	õppesisu haldussüsteem	A system for creating and managing the learning content and delivering it to the users
learning management system (LMS)	õpihaldussüsteem	A system for organizing the learning process and managing learners
learning object	õpiobjekt	A reusable self-contained piece of digital learning material
meta-data	metaandmed	Data about data; additional information about a piece of data