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**THE RESEARCH ON E-LEARNING
INFORMATION TECHNOLOGIES**

**Summary of Doctoral Dissertation
Technological Sciences, Informatics Engineering (07T)**

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VILNIUS GEDIMINAS TECHNICAL UNIVERSITY

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GENERAL DESCRIPTION

Topicality of the problem. Modern Internet technologies have allowed new learning methods to appear for the realisation of which e-learning information technologies are created. While organizing distance learning the problems of selecting and integrating these technologies surface. That has motivated to conduct research on e-learning information technologies.

The newest document “eEurope 2005. An information society for all” stresses that in 2005 Europe must have:

- modern public services with direct access (online):
 - e-government,
 - **services of e-learning,**
 - e-healthcare,
 - dynamic e-business environment;
- universal access to broadband internet at a competitive price;
- safe information infrastructure.

For the new EU members that were admitted into the EU on 1 May 2004 this deadline has been extended for three years. This even now stimulates to intensely conduct scientific research in the field of organizing e-learning, develop e-learning services, create infrastructure and so on. Therefore, this scientific work is timely and relevant today.

The data on the e-courses created and offered in Lithuania, the students who study them, educational programmes and distance learning centres and classrooms provided in “The Report of the LieDM Subprogram for 2004” validates in practice the need for creating a virtual university information system.

Having reviewed the current political situation in the context of distance education, it can be stated that the especially important task today is to create such infrastructure of the Virtual University that enables to merge both various distance learning methods and various learning environments used for creating distance courses as well as to conform to e-learning standards.

Aim and tasks of the work – to examine organisation and management technologies for e-learning as well as the possibilities for their use and to formulate the requirements for the Distance Education Information System (DEIS). Having performed the analysis of e-learning system architectures and information technologies, e-learning information technologies that satisfy the requirements had to be selected, implemented and merged into a unified system.

To realize the formulated goals these tasks are to be solved:

1. Performing the analysis of the influence by information technologies on teaching and learning processes;

2. Performing the analysis of e-learning technologies and classifying them by the chosen criteria;
3. Examining e-learning system architectures and technologies for different e-learning forms taking into account the specifics of learning forms and the requirements for the information technologies and computer hardware used;
4. Based on the analysis performed, creating a conceptual model of an information system for distance education, designing the system, implementing and performing an experimental run of the system.

Scientific novelty. The problems of applying information technologies in distance education have been examined fairly extensively in scientific literature both worldwide and in Lithuania; however, most often only a narrow problem is raised and possible or chosen methods and technologies for solving it are proposed. Moreover, every institution uses different virtual learning media, its own technical and network equipment, which causes many problems trying to create a unified system. This work introduces:

- the formulation of the requirements for the distance education information system;
- the concept of the distance education information system and selected technologies for its implementation have been designed;
- the architecture of two different application servers that enables to use different information technologies in a single information system have been offered. It is scalable, it does not depend on the platform and has a unified identification mechanism;
- the unified system that enables to manage education processes, educational programmes, e-courses created in various virtual learning media and other resources as well as to administer the activities of students and lecturers.

Methodology of research. For the general analysis of distance education systems, methods of bibliographic research and comparative analysis have been used on normative acts, Lithuanian and foreign scientific works published in periodicals and various Internet sources. To analyze virtual learning media, methods of comparative analysis and experimental research have been used. For the research on virtual university concepts, systemic analysis has been used, while the conceptual modelling method has been used to design a virtual university information system. The experimental method has been applied for system testing, and to summarize the results – the evaluative research method.

Practical value. In the published “The National Strategy for Developing the Lithuanian Distance Learning Network” and “The National Study of the Distance Learning in Lithuania” the establishment of the National Virtual

University (NVU) is already planned, the concepts and experience of other virtual universities in the world are analyzed, thereby beginning to create and discuss the concept of the Lithuanian NVU. Therefore, the results of this scientific work could be used in establishing the NVU.

The system created is open, multiplatform and adapted for various information technologies and different application servers, supports various e-learning forms – synchronous and asynchronous; i.e., it is possible to organize blended learning. The implementation of this system enables to manage e-courses created in various VLE, e. learning processes and different resources.

The distance education information system created in this work has been implemented in the information system of VGTU Information Technologies Department and is used in processes of regular and distance education.

CONTENT

The dissertation consists of four chapters, general conclusions, the dictionary of abbreviations and the list of references. The language of the doctoral dissertation is Lithuanian.

In the introduction the topicality of the problems discussed is defined, the goal and the tasks of the research are formulated, and the scientific novelty of the dissertation and the practical value of the work are substantiated.

Chapter 1. The Analysis of the Influence by Information Technologies on Education Process

The analysis of literature and scientific works in the field of organising distance education in the context of creating eEurope and different science branches has been completed.

In this chapter the requirement for applying IT in e-learning raised by the creation of eEurope are examined. The action plan for e-learning by the European Commission proposes ambitious challenges to European education and learning systems namely:

- to stimulate a thorough integration of information and communication technologies (ICT) into education and learning processes;
- to create flexible e-learning infrastructures that are accessible to everyone;
- to prepare programmes for universal computer literacy;
- to nurture life-long learning traditions (culture);

- to develop high-quality European education.

Since distance education is a fairly new field of science covering several fields of science – pedagogy, informatics and communication science – the terms used are not clearly define. In this chapter the terms used are defined, based on the scientific works of different authors, as they are used in this work.

A thorough analysis of pedagogic literature related to the application of new and forward information technologies in teaching/learning processes has been completed. Organising distance education processes fundamentally changes the approach to learning processes; i.e., teaching gets ever more oriented at to student (Fig 1).

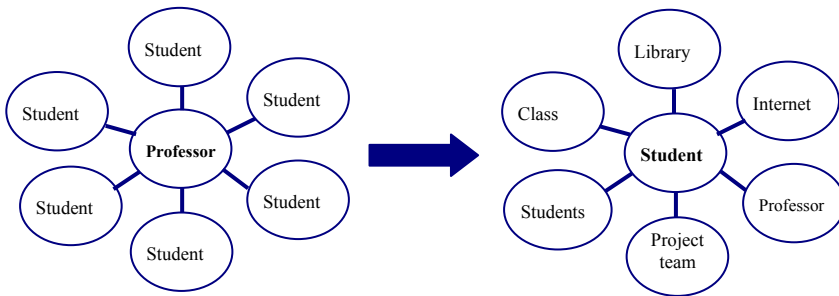


Fig 1. Moving to student centered learning

Main pedagogic problems in applying information technologies in teaching/learning processes are pointed out; i.e., a suitable choice and use of teaching methods as well as raising motivation of students.

Problems of e-learning organisation and management worldwide and in Lithuania in the context of information technologies and computer networks are examined in terms of technologies and standardisation.

Today Learning Management Systems (LMS) are being widely examined. While this is an object of scientific research by many scientists worldwide, these technologies are not being very widely examined in Lithuania. Learning management systems are a revolution in distance education systems for they open more opportunities not only in managing teaching and learning processes but also in creating e-courses and providing them.

The gist of learning management systems is a flexible component architecture conforming to certain e-learning standards (most often SCORM) that enables to realise e-learning functions and to rationally use technical and human resources because learning management systems are usually just internet functional interfaces, and so all user of the system, from the student to the administrator, can be mobile location-wise; i.e., they can work anywhere there

is a computer and an internet browser, not needing any client software. This is a great advantage over those course management systems whose administrators and instructors usually can work only by using a Course Management System (CMS) client.

The creation and recognition of e-learning standards and the conformant virtual learning media have paved the way for the appearance of learning management systems and the ability to import into them e-courses created in various VLE. The standards are created by various scientific organisation, such as AICC, ADL (SCORM), ARIADNE, IEEE LTSA, IMS, PROMETEUS, GESTALT, GEM, ISO/ECJTC1 SC36, CEN-ISSS.

At the ISO organisation the information technologies standards ISO/IEC JTC1 are being created; the group ISO/IEC JTC1 SC36 is designated for standards in Information Technology for Learning, Education and Training. Since the e-learning technology standard group ISO/IEC JTC1 SC36 has been functioning for only a few years (since 2000), there are still no universally certified standards in Information Technology for Learning, Education and Training.

Nowadays, the main and universally used standard is SCORM, covering many standards being created by other organisation, such as AICC, IMS, IEEE LTSA, ARIADNE, etc.

The SCORM standard defines links between various systems of organisations, in order to create a fully universal learning system such as a learning management system; i.e., a typical infrastructure is provided that enables to share learning objects in a distributed learning system. SCORM provides a set of interrelated standards, specification and instruction that guarantees the conformance of a learning management system and learning content to the tough requirements specified for it.

The IEEE LTSA standard is included into SCORM and describes Learning Technology Systems Architecture. This standard specifies the learning, education and training architecture based on high-level information technologies, which describes a high-level system project and the system components.

Accordingly, in summarizing the review of standards, it can be stated that:

- VLE builders most often follow the SCORM standard that inspires a new quality in e- learning;
- Standardised products are easier to provide for a wider audience, they are quicker to work with and cost less;
- Because of globalisation standard writers unite their efforts and works towards one goal.

At the end of the chapter, on the basis of the completed analysis of scientific literature, the research goals are raised.

Chapter 2. Analysis of E-Learning Technologies

Since a variety of e-learning technologies are very wide, it is impossible to analyze them all when choosing one for the use in distance education. The e-learning technologies are most often divided by their functionality. Four large groups are isolated: *learning management systems*, *course management systems*, *virtual classrooms* and *other specialised software*.

The main groups of functional features of e-learning technologies are isolated, and a dependency matrix of functional features of e-learning technologies and software groups is formed (Table 1), using which it is fairly easy to assign a particular e-learning technology to one of the groups. Out of the group of other specialized software the largest and important group in organising distance learning, systems for test creation and management, has been selected.

Table 1. A dependency matrix of functionality of DE systems and software¹

Software groups Features	Course mgmt systems	Learning mgmt systems	Virtual classrooms	Systems for creating and managing tests
Course mgmt	Yes	Yes	No	No
Classroom mgmt	Yes	Yes	Yes	No
Communication tools	Yes	Yes	Yes	No
Student information management	Yes	Yes	Yes	Yes
Course content management	Yes	No	Yes	Yes
Student tools	Yes	Yes	Yes	Yes
Assessment tools	Yes	Yes	No	Yes
Management of educational inst.	No	Yes	No	No

A great variety of e-learning technologies are on offer nowadays. In this chapter three *course management systems* that are most popular worldwide and also used in Lithuania are compared. They are WebCT, LearningSpace,

¹ Yes – applicable, No – not applicable

Moodle, and *virtual classrooms*: Centra and LearningSpace – Virtual Classroom (LS-VC).

From the analysis completed one can draw a conclusion that all asynchronous course management systems analysed (LearningSpace, WebCT and Moodle) are almost equivalent in terms of functionality. On the other hand, virtual classrooms (Centra and LS-VC) differ greatly in terms of functionality. LS –VC is undoubtedly superior.

Chapter 3. Architectures of E-Learning Systems

Distance education is organised in three main forms: *asynchronous*, *synchronous* and *blended*. They differ fundamentally in terms of functionality, so they also naturally differ in terms of technology. Therefore, in this chapter system architectures for each e-learning form are examined.

The architecture of **asynchronous type** is really simple. From a technical standpoint, if there are not many e-courses and students, one server is sufficient with a chosen VLE of asynchronous type installed, in which all required tools of e-learning course creation and provision are integrated. If there are many courses and students, one server might not suffice; in such a case it is recommended to implement a LMS with some system for creating courses.

Hence, it can be stated that the architecture of asynchronous type is simple, not hardware-investment intensive, accessible to many, and thus very popular.

Synchronous learning can be realized in several ways: 1) *video/audio conferences* classified into *point-to-point*, *multipoint* and *classroom – lecture hall*; 2) *workplace videoconferences*.

To organise videoconferences e-learning technologies of synchronous type can be used: Centra Symposium, LearningSpace – Virtual Classroom, ViPS; as well as general purpose technologies for organising virtual meetings: Placeware, WebEx, Interwise, Microsoft NetMeeting, Polycom, CU-SeeMe and the like. Technologies of a more general purpose for organising virtual meetings can be used in learning process, but in this work only e-learning technologies of synchronous type are examined.

E-education/learning technologies of synchronous type should perform these main functions:

- Course builder – provides the framework for building outlines, selecting virtual classroom tools, authoring assessments.
- Course scheduling – allows you to schedule courses.
- Notifications – handles course invitations and reminders.

- Course catalogue – lists all available courses, or the courses in which a learner has enrolled.
- Enrolment manager – administers the enrolment and admission of learners in courses.
- Administrative tools – includes user management, enrolment reports, security settings, and the like.

In Lithuania, the Distance Education Centre of KTU has created and used the ViPS software for broadcasting lectures that enables to organise broadcast of lectures or events from anywhere with a good enough internet connection, to ask the lecturer questions as well as to respond to polls or voting organised by the lecturer. One of the most important system functions is convenient and flexible editing and publishing of video records.

At the Information Technologies Department of VGTU the IBM virtual classroom software LearningSpace-Virtual Classroom, a workplace virtual classroom system, has been implemented and tested.

The capabilities of the LearningSpace Virtual Classroom system are sufficiently wide, and it is difficult to find significant system faults if only it consumes much technical resources.

The blended learning method is:

- a combination of various networked technologies in a single learning package;
- a synthesis of various pedagogic methods that enables to achieve an optimal quality of learning process;
- a combination of various lecturing technologies (video cassettes, compact discs, internet material, etc.) together with direct lecturing by an instructor.

The integration of a virtual classroom into LMS has many advantages:

- An opportunity is presented for provided blended learning;
- All learning activities including both virtual classroom sessions and learning in a virtual classroom can be managed from a single location;
- All learning activities also including virtual classroom sessions can be performed in a single location;
- Information about learning activities is stored in a single location.

The blended learning method is enabled by realising the coupling between virtual classroom and LMS technologies together with course management systems (CMS) Authoring Tool, LearningSpace, WebCT and others conforming to the SCORM standard. The layout of such architecture from a functional standpoint is presented in Fig 2.

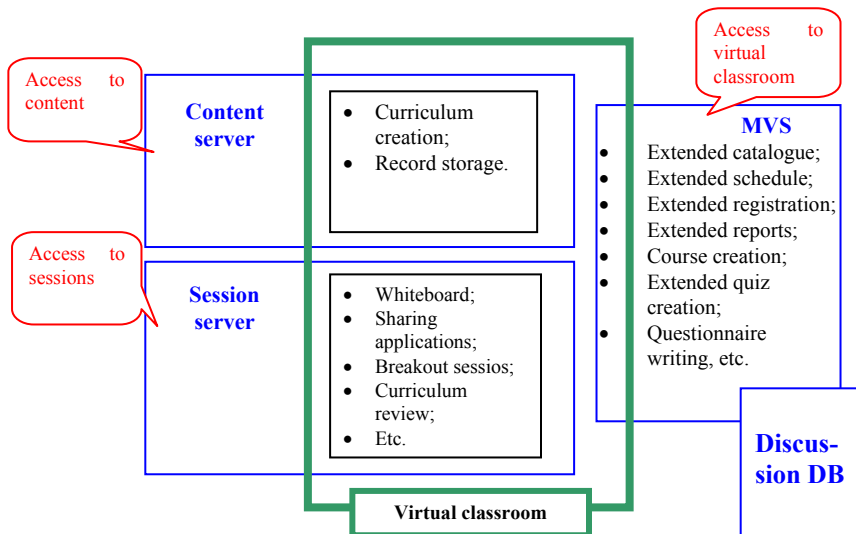


Fig 2. The architecture of blended type from a functional standpoint

Having completed the analysis of e-learning architectures, the architecture of blended type has been chosen for designing the distance education information system because it is the most effective.

Chapter 4. The Architecture of the Virtual University Information System

Based on the completed analysis of e-learning technologies and system architecture, it is recommended to design distance education information system (DEIS) on the basis of blended architecture. Such a system has been implemented and tested for the distance education system at the Information Technologies Department of VGTU, which is examined and presented in this chapter. On the basis of this system the Virtual University System can be created.

Having taken into account the results of analysing e-learning forms, technologies and architectures, these requirements for the distance education information system being created have been formulated:

- the system must realise the blended learning form;
- the system must be flexible; i.e., of component architecture and depending on the number of users the number of servers must be

changeable or scaleable, enabling to use platform and software from different producers;

- the system must conform to standards from TCP/IP, HTML, LDAP to SCORM 1.2;
- the system must be able to integrate into other higher-level information systems.

A simplified conceptual structure of a blended distance education information system has been designed; it is presented in Fig 3. The proposed conceptual structure of a distance education IS can realise all main VUIS functions. Any VLE can serve as a course delivery server as long as it conforms to the SCORM 1.2 e-learning standard. Moreover, it is also planned to implement a knowledge management and search system (Lotus Discovery Server), which would enable users to find required information more quickly and precisely.

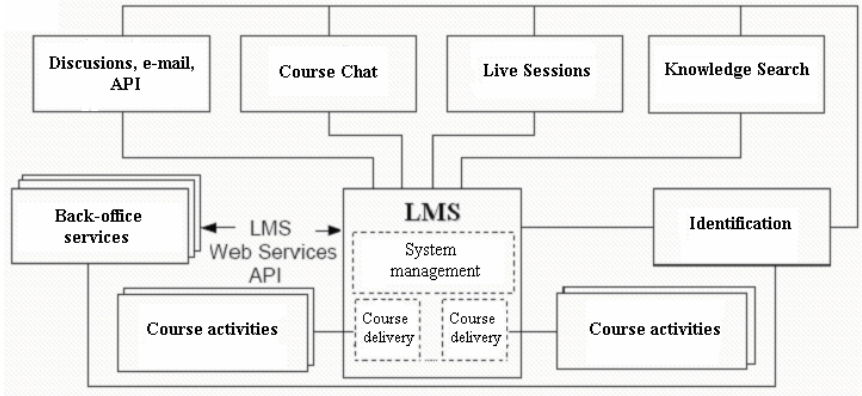


Fig 3. The conceptual structure of a distance education IS

The system designed has been implemented and tested in the departmental information system. Its structure is presented in Fig 4. This system realises the blended e-learning model.

This system has been created using IBM Lotus technologies. Course authors can use the Authoring Tool (AT), an LMS component, or LearningSpace and other course creation tools for creating course content. LMS guarantees the access to the courses created and imported into LMS, administers them, manages learning processes and stores all information related to learning processes. When instructors create course content with the AT, they can connect course content to virtual classroom sessions as one of the activities.

Thereby blended courses can be created that cover video lectures and asynchronous material.

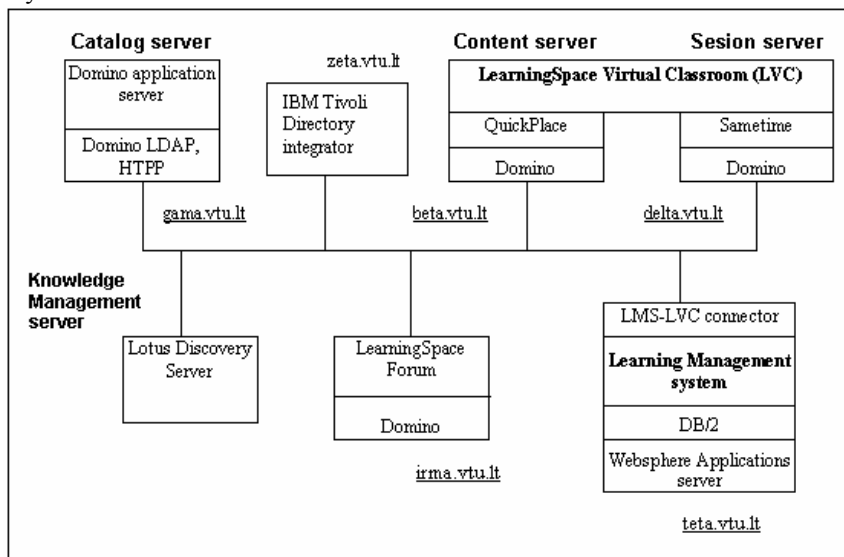


Fig 4. The scheme of the distance learning information system at VGTU

Video lectures are created with the LearningSpace - Virtual Classroom server, course Internet interviews are based on the Sametime technology, and discussions are run on the basis of Domino technology. Also, the Domino server stores various document libraries, such as various departmental organizational documents, theses and organizational documents for bachelor and master students, e-book library, news, schedules, a virtual employment exchange and the like. Content servers store course content files used via the LMS. Course files are connected via URL; application of the WebSphere Application server on the basis of Java, XML, HTTP and other technologies are used. Thereby two different application servers that perform different functions are used in the distance education information system.

Since distance education is one of the services provided by a university, it is evident that the distance education IS must be integrated into the general information system for university administration.

In trying to integrate the distance education IS into the general information system for university education administration three main problems arise:

- Exchanging data on users, so that users, having logged into any system with their identification data, could work in both systems without any additional log-ins.
- Transferring the data on modules, study programmes, student grades from the distance education IS to the general information system for university education administration.
- Combining the distance education IS with the library IS created on the basis of the library information system ALEPH and Oracle DBMS.

The distance education information system created can be easily integrated into the general information system for university education administration.

General Conclusions

1. Using information technologies of learning processes fundamentally changes the approach to organising learning processes; i.e., teaching gets ever more oriented at the student. Thereby, the shift from systemic to individual teaching is in progress.
2. Having completed the analysis of e-learning technologies, it has been proposed to classify them by functionality. Four large groups are isolated: *course management systems*, *learning management systems*, *synchronous learning media (or virtual classrooms)* and *other specialised software*. The main groups of functional features of e-learning technologies are isolated, and a dependency matrix of functional features of e-learning technologies and software groups is formed, using which it is fairly easy to assign a particular e-learning technology to one of the groups.
3. Having completed the analysis of e-learning forms and their architectures, it can be stated that the blended e-learning form combining asynchronous and synchronous learning forms is effective and functional from a pedagogical standpoint, but it is complex from a technological standpoint. Hence, the distance education information system proposed is based on two different application servers so that the system could be easier to scale-up on demand; i.e., the system has become open.
4. Having taken into account the results of analysing e-learning forms, technologies and architectures, the requirements for the distance education information system have been formulated. The conceptual structure of the distance education information system was designed, which realised the blended e-learning form. It meets the functionality requirements being raised. Applications can be written using different tools for creating applications.

5. The conceptual structure of the distance education information system has been realised and tested in the information system at the Information Technologies Department of VGTU. This system flawlessly performs teaching and learning functions, and has additional functions, such as knowledge management and search; various document libraries have been created, such as various departmental organizational documents, theses and organizational documents for bachelor and master students, e-book library, news, schedules, a virtual employment exchange and the like. Such a system can be practically used for organising distance education or for creating a virtual university information system. It has several disadvantages, however; i.e., system implementation and administration are difficult, and the demand for technical resources is high.
6. The distance education information system can technically be easily integrated into the general information system for administering university education thanks to openness of the distance education IS and the possibilities to use various technologies and platforms for writing applications. A unified user identification mechanism has been created thanks to which the user information is stored in a single location; the user has a single login name and password and can access all the required and authorized information throughout the distance education IS.

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E. MOKYMOSI INFORMACINIŲ TECHNOLOGIJŲ TYRIMAS

Mokslo problemos aktualumas. Šiuolaikinės internetinės technologijos leidžia atrasti naujiems mokymo metodams, kurių realizavimui kuriamos e. mokymosi informacinės technologijos. Organizuojant nuotolines studijas, iškyla šių technologijų pasirinkimo ir derinimo problemos. Tai paskatino atlikti e. mokymosi informacinių technologijų tyrimą.

Naujausiame dokumente „e. Europa 2005. Informacinė visuomenė visiems“ (“eEurope 2005. An information society for all”) pabrėžiama, kad 2005 metais Europa privalo turėti:

- modernias tiesiogines kreipties (online) viešąsias paslaugas:
 - e. valdžią,
 - **e. mokymosi paslaugas,**
 - e. sveikatos paslaugas,
 - dinamišką e. verslo aplinką;
- visuotinį plačiajuosčio interneto prieigos už konkurencingą kainą prieinamumą;
- saugią informacinę infrastruktūrą.

Naujoms ES narėms, kurios buvo priimtos į ES 2004 gegužės 1d., šis terminas atidedamas 3 metams. Tai skatina jau dabar intensyviai vykdyti mokslinius tyrimus e. mokymosi organizavimo srityje, vystyti e. mokymosi paslaugas, kurti infrastruktūrą ir t.t. Todėl šis mokslinis darbas yra savalaikis ir atitinka nūdienos aktualijas.

„LieDM paprogramės ataskaitoje už 2004 m.“, pateikti duomenys apie Lietuvoje sukurtus ir teikiamus e. kursus, juos studijuojančius studentus, mokymosi programas ir nuotolinio mokymosi centrus bei klases praktiškai pagrindžia virtualaus universiteto informacinės sistemos kūrimo poreikį.

Apžvelgus šiandieninę politinę situaciją distancinio švietimo kontekste, galima teigti, kad šiandien ypatingai aktualus uždavinys tampa: sukurti tokią Virtualaus universiteto infrastruktūrą, kuri įgalintų apjungti tiek įvairius nuotolinio mokymosi būdus, tiek įvairias virtualias mokymosi terpes, naudojamas nuotoliniams kursams kurti, bei palaikyti e. mokymosi standartus.

Darbo tikslas ir uždaviniai – ištirti e. mokymosi organizavimo ir valdymo technologijas bei jų panaudojimo galimybes ir suformuluoti reikalavimus kuriamai nuotolinių studijų informacinei sistemai (NSIS). Atlikus e. mokymosi sistemų architektūrų ir informacinių technologijų analizę, parinkti e. mokymosi informacines technologijas, tenkinančias keliamus reikalavimus, įdiegti ir apjungti jas į vieningą sistemą.

Siekiant įgyvendinti suformuluotus tikslus, sprendžiami šie uždaviniai:

1. Atlikti informacinių technologijų įtakos į mokymo, bei mokymosi procesus analizę.
2. Atlikti e. mokymosi technologijų analizę ir jas suklasifikuoti pagal parinktus kriterijus.
3. Išnagrinėti e. mokymosi sistemų architektūras ir technologijas, skirtingų e. mokymosi formų atvejais, atsižvelgiant į mokymosi formos specifiką ir keliamus reikalavimus naudojamoms informacinėms technologijoms bei kompiuterinei technikai.
4. Remiantis atlikta analize, sukurti nuotolinių studijų informacinės sistemos koncepcinį modelį, suprojektuoti sistemą, įdiegti ir atlikti sistemos eksperimentinę eksploataciją.

Mokslinis naujumas. Informacinių technologijų taikymo problemos nuotolinėse studijose tiek pasaulio, tiek Lietuvos mokslinėje literatūroje nagrinėjamos gana plačiai, tačiau dažniausiai yra iškeliamas siauro pobūdžio problema ir siūlomi galimi arba parinkti jos sprendimo būdai ir technologijos. Be to, kiekviena institucija naudoja skirtingas virtualias mokymosi terpes, savo techninę bei tinklo įrangą, kas sukelia daug problemų, siekiant sukurti vieningą sistemą. Šiame darbe pristatyti:

- suformuluoti reikalavimai nuotolinių studijų informacinei sistemai;
- suprojektuota nuotolinių studijų informacinės sistemos koncepcija, jos įgyvendinimui parinktos technologijos;
- pasiūlyta dviejų skirtingų aplikacijų serverių architektūra, leidžianti vienoje informacinėje sistemoje naudoti skirtingas informacines technologijas, yra masteliojama (scalability), nepriklauso nuo platformos ir turi unifikuotą identifikavimo mechanizmą;
- sukurta vieninga sistema, kuri leistų valdyti studijų procesą, studijų programas, įvairiose virtualiose mokymosi terpėse parengtus e. kursus, kitus resursus, administruoti studentų bei dėstytojų veiklą.

Tyrimų metodika. Bendrai nuotolinio švietimo sistemos analizei buvo naudojami norminių aktų, Lietuvos ir užsienio šalių mokslininkų darbų, publikuotų periodinėje spaudoje, ir įvairių Internetinių šaltinių, bibliotekinio tyrimo ir lyginamosios analizės metodai. Virtualioms mokymosi terpėms analizuoti buvo naudojami lyginamosios analizės ir eksperimentiniai tyrimo metodai. Virtualių universitetų koncepcijų tyrimui buvo taikoma sisteminė analizė, o virtualaus universiteto informacinei sistemai projektuoti, buvo naudotas koncepcinio modeliavimo metodas. Sistemos testavimui taikytas eksperimentinis metodas, o rezultatams apibendrinti – vertinamasis tyrimo metodas.

Praktinė vertė. „Lietuvos distancinio mokymo tinklo vystymo nacionalinėje strategijoje“ ir “Distancinio švietimo Lietuvoje nacionalinėje studijoje“ jau yra numatomas Nacionalinio Virtualaus universiteto (NVU) kūrimas, analizuojama kitų pasaulio virtualių universitetų koncepcijos ir patirtis, tokiu būdu pradedama kurti ir svarstyti Lietuvos NVU koncepcija. Todėl šiame moksliniame darbe gauti rezultatai gali būti panaudoti kuriant NVU.

Sukurta sistema yra atvira, daugiaplatformė, pritaikyta įvairioms informacinėms technologijoms ir skirtingiems aplikacijų serveriams, palaiko įvairias e. mokymosi formas – sinchroninę ir asinchroninę, t.y. galima organizuoti mišrų mokymą. Šios sistemos įdiegimas leidžia valdyti įvairiose VMT sukurtus e. kursus bei patį mokymo ir mokymosi procesą, įvairius resursus.

Darbe sukurta nuotolinių studijų informacinė sistema įdiegta VGTU Informacinių technologijų katedros informacinėje sistemoje ir naudojama reguliariųjų ir nuotolinių studijų procesuose.

Darbo rezultatų aprobavimas ir publikacijos. Darbo metu atlikto tyrimo ir gautų rezultatų tema buvo skaityti 17 pranešimų įvairiose tarptautinėse ir respublikinėse mokslinėse konferencijose.

Atliktų tyrimų rezultatai pateikti 16 mokslinių publikacijų įvairiuose mokslo leidiniuose.

Išvados

1. Informacinių technologijų naudojimas mokymosi procese ir esmės pakeitė požiūrį į mokymosi proceso organizavimą, t.y. einama link mokymo orientuoto į studentą. Tokiu būdu, vyksta perėjimas nuo sisteminio mokymo – prie individualaus.
2. Atlikus e. mokymosi technologijų analizę, pasiūlyta jas klasifikuoti pagal funkcionalumą. Išskiriamos keturios stambios grupės: *kursų valdymo sistemos, mokymo valdymo sistemos, sinchroninės mokymosi terpės (arba virtualios klasės)* ir *kita specializuota programinė įranga*. Išskirtos

pagrindinės e. mokymosi technologijų funkcinių savybių grupės, ir sudaryta e. mokymosi technologijų funkcinių savybių ir programinės įrangos grupių priklausomybių matrica, pagal kurią galima gana paprastai priskirti konkrečią e. mokymosi technologiją kuriai nors iš grupių.

3. Atlikus e. mokymosi formų ir jų architektūrų analizę, galima teigti, kad mišri e. mokymosi forma, apjungianti asinchroninę ir sinchroninę mokymosi formas, edukologiniu požiūriu yra efektyvi ir funkcionali, tačiau technologiniu požiūriu – sudėtinga. Todėl siūloma nuotolinių studijų informacinė sistema remiasi dviem skirtingais aplikacijų serveriais idant sistema pagal poreikius galėtų būti lengviau praplečiama, t.y. sistema tapo atvira.
4. Atsižvelgus į e. mokymosi formų, technologijų ir architektūrų analizės rezultatus, suformuluoti reikalavimai kuriamai nuotolinių studijų informacinei sistemai. Suprojektuota nuotolinių studijų informacinės sistemos koncepcinė struktūra, kuri realizuoja mišraus e. mokymosi formą, atitinka keliamus funkcionalumo reikalavimus. Aplikacijas galima kurti naudojant skirtingus aplikacijų kūrimo įrankius.
5. Nuotolinių studijų informacinės sistemos koncepcinė struktūra realizuota ir išbandyta VGTU Informacinių technologijų katedros informacinėje sistemoje. Ši sistema puikiai atlieka mišraus mokymo ir mokymosi funkcijas, turi papildomų funkcijų, tokių kaip žinių valdymas ir paieška, sukurtos įvairios dokumentų bibliotekos, tokios kaip, įvairūs katedros organizaciniai dokumentai, bakalaurų, magistrų baigiamieji darbai ir organizaciniai dokumentai, e. knygų biblioteka, naujienos, tvarkaraščiai, virtuali darbo birža ir t.t. Tokia sistema praktiškai gali būti naudojama nuotolinėms studijoms organizuoti arba virtualaus universiteto informacinei sistemai kurti. Tačiau turi ir keletą trūkumų, t.y. sudėtingas sistemos diegimas ir derinimas, aukšti reikalavimai techniniams resursams.
6. Sukurta nuotolinių studijų informacinė sistema techniškai gali būti lengvai integruota į bendrą universitetinę studijų administravimo informacinę sistemą dėka nuotolinių studijų IS atvirumo ir įvairių aplikacijų kūrimo technologijų ir platformų naudojimo galimybių. Sukurtas vieningas vartotojų identifikavimo mechanizmas, dėka kurio informacija apie vartotoją saugoma vienoje vietoje, vartotojas turi vieną prisijungimo vardą ir slaptažodį ir gali prieiti prie visos jam reikalingos ir leistinos informacijos visoje nuotolinių studijų IS.

Trumpos žinios apie autorių

Irma Šileikienė studijas Vilniaus Gedimino technikos universitete Fundamentinių mokslų fakultete pradėjo 1995 metais. 1999 metais ji apgynė informatikos mokslo bakalauro baigiamąjį darbą tema „Virtuali klasė programavimo mokymui“. 2001 m. Irma Šileikienė apgynė informatikos mokslo magistro baigiamąjį darbą tema „VGTU virtualaus universiteto informacinė sistema“ ir tais pačiais metais pradėjo doktorantūros studijas Informacinių technologijų katedroje. Dalyvavo IBM ir LIKS organizuojamame baigiamųjų darbų konkurse ir magistrinių darbų kategorijoje užėmė II-ą vietą.

Studijų metu Irma Šileikienė dalyvavo NorFa Wireless Information Management (WIM) šiaurės šalių doktorantų seminaruose ir ten pristatė savo mokslinių tyrimų rezultatus.

Praktiškai įgytas žinias bei įgūdžius Irma Šileikienė taikė kuriant bendras VGTU ir KTU teikiamas nuotolines „Nuotolinio mokymosi informacinės technologijos“ magistrantūros studijas, nuotolinius kursus „Virtualios mokymo terpės“ ir „ANM infrastruktūra“, dėstė VGTU Inžinerinės informatikos pagrindinių studijų studentams Kompiuterinių mokymo sistemų kursą.

Irma Šileikienė

**THE RESEARCH ON E-LEARNING INFORMATION
TECHNOLOGIES**

**Summary of doctoral dissertation
Technological Sciences, Informatics Engineering (07T)**

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