

Conformity Analysis of E-Learning Systems at Largest Universities in Estonia and Turkey on the Basis of EES Model

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Declaration:

Hereby I declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology has not been submitted for any academic degree.

Fatih Güllü



European Union
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ISSN 1406-4731

ISBN 978-9949-83-134-0 (publication)

ISBN 978-9949-83-135-7 (PDF)

**Eesti ja Türgi suuremate ülikoolide e-õppe
süsteemide võrdlev analüüs
EES-mudeli baasil**

FATİH GÜLLÜ

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LIST OF PUBLICATIONS

This thesis is based on the following papers, referred to in the text by Roman numerals as listed below.

I Güllü, F., Kuusik, R., Demiray, U. and Laanpere, M. (2014). Comparing implementation patterns of e-learning for higher education in Turkey and Estonia. Proceedings of the ECEL-2014. Denmark, Copenhagen, 644-650.

II Güllü, F., Kuusik, R. and Laanpere, M. (2015). Electronic Education System Model-2. Proceedings of the International Conference E-Learning 2015, Las Palmas De Gran Canaria, Spain, July 21-24, pp. 162–166.

III Güllü, F., Kuusik, R., Laanpere, M., Sozcu, O. F. (2015a). Socio-cultural differences of e-learning in Estonia and Turkey. Proceedings of 8th annual International Conference of Education, Research and Innovation (ICERI 2015), Seville, Spain, November 16-18, pp. 6325-6332.

IV Güllü, F., Kuusik, R., Laanpere, M. and Sozcu, O. F. (2015b). Using EES Model-2 for comparison of e-learning activities of Estonian and Turkish biggest universities. Proceedings of 8th annual International Conference of Education, Research and Innovation (ICERI 2015), Seville, Spain, November 16-18, pp. 6333–6342.

V Güllü, F., Kuusik, R., Shogenov, K., Laanpere, M., Oysal, Y., Sozcu, O. F., Parlak, Z. An Analysis and Comparison of Adoption of E-learning Systems in Higher Education by Lecturers at Largest Universities in Estonia and Turkey. Baltic J. Modern Computing, Vol. 4 (2016), No. 3, pp. 428–440.

Author's contribution to the publications

1. The author contributed by comparing the strategic development of technology enhanced learning on the national and institutional levels in Estonia and Turkey, relying on analysis of existing technical and pedagogical basics.
2. The author presented a new idea for a new pilot model for Turkey EES Model-2 extended from EES model for more productive implementation in e-learning systems process design and modelling in higher education.
3. The author studied and compared socio-cultural differences and its' effect on e-learning systems at higher education in Estonia and Turkey using a new pilot model for Turkey EES Model-2.
4. The author studied and compared actions of main Estonian and Turkish universities in the field of e-learning systems in higher education using a new pilot model for Turkey EES Model-2. The author contributed by comparing number of students and e-courses in three main universities in Estonia and in Turkey.
5. The author analysed and compared adoption of e-learning systems by lecturers in three largest universities in Estonia and Turkey. The author found and analysed strong and weak sides of e-learning systems and main barriers, which hinder adoption of e-learning systems in Estonian and Turkish largest universities.

Terms and Abbreviations

AU – Anadolu University
AUZEF – Faculty of Open and Distance Education
BYOD – Bring Your Own Device
CIA – Central Intelligence Agency
EES Model – Electronic Education System model
EES Model-2 – New Electronic Education System developed in this study
EITSA – Estonian IT Foundation
E-learning – Electronic learning
EU – European Union
HITSA – Information Technology Foundation for Education
ICT – Information and Communication Technologies
IVA – Free open source learning environment used in the Estonian e-University and e-Vocational School consortia. The learning environment was created in the Tallinn University (<http://www.htk.tlu.ee/iva>)
IU – Istanbul University
LMS – Learning management systems
MOODLE – free open source web-based learning environment used in the Estonian e-University and e-Vocational School consortia (<http://www.moodle.org>)
SU – Sakarya University
TU – Tallinn University
TUT – Tallinn University of Technology
UT – University of Tartu
ISUZEM – Distance Education Centre at Istanbul University
UZEM – Distance Learning Research and Development Centre at Sakarya University
TAM – Technology Acceptance Model
TAM2 – Extended Technology Acceptance Model
WEBCT – Commercial learning environment used in the Estonian e-University consortium (<http://webct.com>)
TEL – Technology-Enhanced Learning
VLE – Virtual Learning Environments
LCMS – Learning Content Management Systems
PLE – Personal Learning Environments
CSCL – Computer-Supported Collaborative Learning
IEEE – Institute of Electrical and Electronics Engineers
IMS – Global Learning Consortium – Instructional Management System Global Learning Consortium
ADL – Advanced Distributed Learning
SCORM – Shareable Content Object Reference Model
TRA – Theory of Reasoned Action
TPB – Theory of Planned Behaviour
UTAUT – Understanding of factors which influence acceptance of an important new technology
DBR – Design-Based Research

1. Introduction

History of mankind inextricably linked with learning and education. At all times education had survival purpose for the nations: how to build and use tools and weapons for hunting and protection of their lands and population, how cultivate crops and breed animals. The questioning nature of the human mind and trying to find out and know more about what surrounded them, and motivated them to approach learning more systematically (Nooriafshar, 2012). Evolution of learning methods is the most fundamental processes of education adaptation. Educational mechanisms and techniques were always adapted to environments, where these systems were developed and, therefore, have always been presented as useful paradigms of education. Environment or background in this matter is factors related to social, cultural or religious differences, which made each educational system individual. The methods of education evolved from very primitive to advanced technics, based on use of modern electronic and information technologies.

A very important achievement in early education was the devising of the means of recording information so that it could be archived for future reference or transferred to others. Writing was a significant step in the right direction. The earliest form of writing dates back to about 8000 years ago (Nooriafshar, 2012).

It was the beginning of the publicising of learning when this powerful medium (writing), which reflected our thoughts and ideas, was stored in a more organised fashion. The early libraries date back thousands of years. Perhaps the earliest library in the world was in Babylonia in the 21st Century BC and it contained clay tablets (The Concise Columbia Encyclopedia, 1992). Although papermaking can be traced back to ancient China, it was probably introduced to Europe around and after the Middle Ages. Until then, books were made out of parchment and they were bound in an exquisite manner. Therefore, they had reasonably high price tags on them. The invention of printing by Johannes Gutenberg in the early 15th Century had a significant impact on the costs of books. One of the notable ancient libraries was the Alexandria Library. It was built about 2300 years ago (in the fourth century BC). It became the world's first university. Scholars such as Euclid, Erastosthenes, Heron and Archimedes were associated with the Library and its colleges. It had a catalogue of around 700,000 listed and classified manuscripts (Nooriafshar, 2012).

According to our days, the phenomenon of 21st century education is distance education using the latest developments in the field of Information Technology (IT). These technologies present a new tool for modern education systems- electronic educational learning or e-learning.

E-learning or Technology-Enhanced Learning (TEL) is a new approach to education, teaching, and learning. This movement started in higher education more than 15 years ago and in the beginning it was a hobby for a small number of innovators among the university staff (Cross, 2004, Ehlers and Pawlowski, 2006, Sangrà et al. (2012). However, distance education origins have a 150 years history (Usun, 2004).

But distance education, that can make use of of e-learning systems, is not the only context for using such systems today, as e-learning has been integrated to all forms and modes of education.

The term “e-learning” was coined in 1998 by Jay Cross (Cross, 2004). Soon it was picked up by policymakers and researchers. Yet, even today a multitude of definitions of e-learning exists. Sangrà et al. (2012) provide an overview of alternative definitions of e-learning in four categories:

- technology-driven definitions: e-learning as the use of various technological tools for learning
- delivery system oriented definitions: e-learning as a means of accessing knowledge (or learning resources)
- communication-oriented definitions: e-learning as a set of methods of communication, interaction, and collaboration through digital channels
- educational paradigm oriented definitions: e-learning as a radically changed way of learning or as an improvement on existing teaching and learning methods.

Herewith, we define e-learning or technology-enhanced learning in line with European Commission (2001), Alonso et al. (2005), Ehlers and Pawlowski (2006) as *“the use of new multimedia technologies and internet to improve the quality of learning by facilitating access to resources and services, as well as remote exchange and collaboration”*. This definition implies that systemic management of e-learning innovation cannot focus merely on upgrading and making available new digital tools, it should also involve introduction of new teaching methods, learning habits, assessment practices, cultural norms for internet behaviour, as well as legal frameworks and business models for digital educational contents production and delivery (Ehlers and Pawlowski, 2006).

E-learning systems are herewith defined as socio-technical systems that include infrastructure, services and process support for maintaining and enhancing e-learning on the organisational level. The main objective of e-learning systems in the context of higher education is to increase of quality of learning as a process and efficiency of learning. E-learning systems are aimed on redesigning and updating of current learning and teaching methods according to new possibilities and technologies.

During last 15 years e-learning systems phenomenon matured and became integral part of educational program in any modern university around the world. With development of technologies this phenomenon was significantly improved and evaluated into different systems. Its importance for users (students and lecturers) increasing every day.

According to modern trend in technology development and its integration in our everyday life, I suppose that e-learning systems are the next step in evolution of educational system and will completely exchange standard format of study in nearest future. That’s why it is no longer enough to consider e-learning systems as technical tool and software to provide information for students. E-learning systems, as multitasking formation, must take into account every part of human social life (age, religion, socio-cultural factors, language, etc.), if we want to implement it successfully

at all social levels of population, in all countries around the world. Today, development and implementation of e-learning systems is still often seen as merely technological process, without considering different social factors that affect wider impact of e-learning. This concern become one of the main motivations for selecting a topic for this thesis. Socio-cultural barriers might have huge influence on using ICTs and thus need to be studied well to improve tools for effective learning. Considering socio-cultural factors in the design and implementation of e-learning systems is also essential for more diverse global solutions. Customized and localized solutions might be more suitable to overcome the identified barriers quickly and effectively than international or universal solutions (Marcus and Gould, 2000). It was summarised in Kohn et al. (2010), that is important to consider also religious concerns in e-learning systems by redesigning the content according to religious rules and to avoid interaction formats that might be perceived offensive by some teachers or learners.

This thesis is based on the analysis of the state-of-the-art in research on e-learning systems. Laanpere (2013) in his work describes genesis of e-learning systems in very appropriate way. There exist a large variety of e-learning systems (or Technology-Enhanced Learning or TEL systems), e.g. Virtual Learning Environments, educational multimedia, virtual classrooms, interactive learning environments, e-learning platform, educational software (Laanpere, 2013). The TEL systems are defined as computer software systems built and/or used for facilitating the learning process. Laanpere (2013) divides TEL systems to offline or online learning systems. Offline learning systems (e.g. desktop software used for learning and teaching, drill programs, multimedia textbooks on CD-s) were the dominant type in the first generation of TEL systems. The second generation of TEL systems (Virtual Learning Environments, VLE) appeared with the emergence of WWW and online learning systems. Virtual Learning Environment is defined as *“a server software system that combines a number of different tools that are used to systematically deliver content online and facilitate the learning experience around that content”* (Weller, 2007). There are many free online actively used Learning Management Systems or LMS (e.g. Edmodo, Moodle, BlackBoard, etc.) in the world today (Burn, 2006; Falvo and Johnson, 2007; Coopman, 2009). Many universities also using their own, in-house developed LMS. However, the benefit of well-known open-source systems is common electronic environment for all students and lecturers and possibility to ensure interoperability between university information systems within university consortia.

One of the software architecture models that can be used for developing or evaluating e-learning systems is Electronic Education System (EES) model. The aim of this model is to assist the designers of different e-learning software architecture settings to plan and implement a specific learning situation, with the focus on the individual requirements and milieu of the learning group (Cloete, 2001). EES model permits a full range of services in the construction of a specific learning situation. Procedures are defined within each of these tiers, facilitating the design of, and suggesting a subsequent workflow structure for, a specific learning situation (Drlik and Skalka, 2011).

1.1 Motivation

Every year electronic information systems (incl. e-learning systems) are going to be implemented in higher education more and more actively around the world. E-learning is phenomenon based on electronically mediated collaboration of students and lecturers, facilitating of access to educational resources and services, enhancing of learning quality, upgrading of teaching methods and habits using new multimedia technologies and internet. Today, most of the universities have already implemented institutional e-learning platforms and enhancing the learning with the help of web technologies is becoming a norm. Fast development of this technology is obliged to general level of technological progress of information technologies (IT). However, balanced adoption and integration of e-learning systems in higher educational institutions by main users of the systems, lecturers and students, is controversial. Number of barriers limiting productive implementation and utilization of e-learning systems in universities' everyday routine is still exists: economic, political, technical, pedagogical, absence of strategic plan and consortia between universities.

I had an experience of higher education using e-learning system in universities in different countries (Turkey, Russia and Estonia). I was a teacher at school in Russia. In that school, educational system was connected to universities. All of those universities have implemented e-learning management systems in different manners and had to overcome different barriers and problems in this process.

The main developers and deliverers of e-learning systems for students are lecturers, which are in most cases accustomed to use old educational system. Therefore, there is a high importance of understanding of how lecturers perceive and react to elements of e-learning systems along with how to most effectively apply an e-learning systems approach to enhance learning. It is necessary to conduct research that provides personal information from lecturers about their perception of attitude towards and intention to use e-learning systems.

Essential number of models and guidelines were developed for enhancing and assuring quality in e-learning systems. Studies are trying to compare and to model evolution of e-learning systems at higher education in their countries with examples in advanced countries using different factors and barriers, such as, technical, pedagogical and economical. In many of the e-quality models, there is a tendency to focus on single aspects, thus failing to capture the holistic nature of problems and their solutions in virtual institutions. In this thesis, I tried to develop such reference model that will cover wide range of aspects that have to be taken into account while solving both general and local problems related to adaptation or evaluation of e-learning systems on the organisational scale in higher education.

1.2 Problem statement

Estonia, or “silicon valley of Europe” (Cassidy, 2014; Shapoval, 2016), is one of the most developed countries in the field of Information and Communication Technologies in the world. Estonia has gained significant results in the field of implementation of modern type of education methodology, electronic education or e-learning systems and

other internet based services. Today this small country is an example for almost every country in the world in e-learning systems. The strongest point of Estonian e-learning system in higher education is unity between all participants of e-learning educational system from all the studied universities. At the same time Estonian e-learning system at higher education still has some barriers in pedagogical and adaptation aspects that need to be studied and solved.

From other side large country Turkey with huge population is still on the low level of development. Turkey has a long experience with distance education but, at the same time, difficulties to adopt this experience to modern technologies and methods. The stagnation in the evolution of the learning methods needs good example and input of fresh ideas for the progress in this field. The most serious barriers which stop development and adaptation of e-learning systems at higher education in Turkey is that universities in Turkey have its own interaction platforms without links and possibility to cooperate between users from different institutions.

As stated in Reis and Gulsecen (2014), as a developing country, Turkey has experienced problems in the national higher education system. The fact that the country has had a population increase relatively very high as compared to the European Union, which Turkey aspires to integrate, and a young population, led to serious problems in education, but the development of higher education has been one of the most significant objectives of the state.

Therefore, Estonia was selected for this study as the best example of practice of e-learning system in higher education to improve higher education system in developing Turkey.

The author defines the overall research problem as: “How to improve Turkish e-learning systems in higher education using Electronic Educational System model (EES model) and successful implementations in Estonian universities?”

EES model was selected as one of the most appropriate. At the same time, an important aspect of the research problem was stated and needed to be solved as well: “Is the current version of EES model suitable to solve my research problem or should it be modified to be successfully adopted in the context of my research”?

1.3 Aim and research question

This thesis is aimed at identifying barriers in development and adaptation of e-learning systems at higher education in Turkey and ways to improve existing situation by comparison of activities and structure, and quality issues of e-learning systems, covering policy, technical, pedagogical and socio-cultural aspects in two countries: Turkey and Estonia.

Three largest Estonian universities, University of Tartu (UT), Tallinn University of Technology (TUT) and Tallinn University (TU), were selected as objects of study in this thesis to be an example for modelling the e-learning system for Turkish higher education. On the other side, three largest Turkish mega-universities Anadolu University (AU), Istanbul University (IU) and Sakarya University (SU), were studied to demonstrate current state of development of e-learning systems in higher education in Turkey. Previously, Lepkova et al. (2012) presented comparative study, which is a questionnaire-based analysis of the results of distance learning applications at Vilnius

Gediminas Technical University (Lithuania) and Istanbul University (Turkey). A sample of lecturers of UT, TUT, TU, AU, IU and SU (professors, associate professors, assistant professors and other lecturers), as main beneficiaries as well as blockers of e-learning system, were selected as respondents in this study.

Several research questions were established to solve the research problem:

- What are the main differences between Estonian and Turkish universities regarding adoption of e-learning systems?
- How much and what kind of adaptation needs EES model to suit the needs of this two-country comparative study?
- Which suggestions for Turkish universities could be made to improve current situation in development and adoption of e-learning systems?

To answer the research questions, I developed and implemented a cyclic iterative research-based design process consisting of three iterations. A new pilot model for Turkey - EES Model-2 extended from EES model was presented for more productive implementation in e-learning system process design and modelling in higher education. The pilot EES Model-2 was used for comparative analyses of e-learning system and to study components of socio-cultural factor in Estonian and Turkish higher education e-learning systems.

To study current situation in e-learning systems, I developed a questionnaire based on the new EES Model-2 and extended technology acceptance model (TAM2) and sent to lecturers from the studied universities. Answers were collected and studied to reach aims of the study.

Results of this research are important to understand barriers that slowing down the progress of development and adaptation of e-learning system in higher education in Turkey, as well as in other countries with similar obstacles. These results have a **practical value or contribution** for further investigations, aimed to solve problems, increase quality and support development and adaptation of e-learning systems in higher education.

The results of this research can help e-learning systems administrators and developers to create more effective learning environment to adopt and better integrate e-learning systems for lecturers in higher education.

1.4 Contribution of the thesis

The author contributed by comparing the strategic development of technology enhanced learning on the national and institutional levels in Estonia and Turkey, relying on analysis of existing technical and pedagogical basics.

In this thesis the iterative research-based design process, consisting of three iterations (Fig. 4.3), was developed due to needs of this research. Theoretical framework (theories and models of e-learning systems, adoption and implementation of e-learning systems, e-learning systems status in Estonia and Turkey) was analysed and requirements for the electronic educational model needed to be implemented in Turkish higher education were established and model was selected.

The author explained in details each layer of EES model and presented new concept of pilot model for Turkey: EES Model-2 (Fig. 4.2) extended from the EES

model for more productive implementation in e-learning system process design and modelling in higher education of Turkey. In the new e-learning educational architecture design model author suggested to take into account: (1) human and (2) social factor, (3) students' age groups, (4) cultural diversity, (5) language and (6) religion. The author strongly recommended application of this updated pilot EES Model-2 in Turkey to support high educational standards of higher education and provide rights of students with different needs and abilities.

E-learning system status in Estonia and Turkey was studied, analysed and compared using EES model and developed pilot EES Model-2. Socio-cultural differences and its' effect on e-learning system at higher education in Estonia and Turkey were studied and compared using EES Model-2.

The author studied and compared actions of main Estonian (University of Tartu, Tallinn Technical University and Tallinn University) and Turkish universities (Anadolu University, Sakarya University and Istanbul University) in a field of e-learning systems in higher education using pilot EES Model-2. Elements of Physical layer of the EES Model-2 of Turkish and Estonian e-learning system were compared and analysed for the first time.

To analyse and compare adoption of e-learning systems by lecturers in three largest universities in Estonia and Turkey, covering policy, technical and pedagogical aspects, the questionnaire based on the extended Technology Acceptance Model (TAM2) was proposed. The author analysed and compared adoption of e-learning systems by lecturers in three largest universities in Estonia and Turkey. TAM2 model was used to analyse results of acceptance and usage of e-learning systems. The author found and analysed strong and weak sides of e-learning systems and main barriers, which hinder adoption of e-learning systems in Estonian and Turkish largest universities. Immediate measures to support development and improvement of e-learning system at higher education in these universities were suggested.

1.5 Outline of the thesis

Chapter 1

Chapter 1 gives historical overview of education and the thesis. Here I will speak about e-learning, e-learning systems and the motivation for this study, problem statement, and aim and research questions. At the end of the chapter, contribution of the thesis and outline of the thesis are presented.

Chapter 2

The aim of this chapter is a short overview of historical background of e-learning, main theories, models and adoption of e-learning systems developed in this area which are important in this research. Also the context of this research will be described in the end of the chapter.

Chapter 3

In this chapter I will review methodological patterns used in the study and present description of methodology for research design.

Chapter 4

In this chapter, detailed analysis of EES Model and new EES Model-2 was presented. Layers, and evaluation plane are being described. There is an implementation example and a summary of the model. Research design developed and implemented in the thesis was described in the last sub-chapter.

Chapter 5

Sample subjects used in the questionnaire were presented in chapter 5.1. The statistical procedure implemented in the questionnaire were presented in 5.2. Questionnaire analysis are being described in 5.3. Conformity of questionnaire results with EES Model-2 is discussed in 5.4. Analysis and comparison of adoption of e-learning systems between two countries are being discussed in 5.5. Summary of results is presented in 5.6.

Chapter 6

In chapter 6.1 conclusions, in 6.2 recommendations for Turkey and Estonia and future plans in 6.3.

2. Theoretical framework

The aim of this chapter is short overview of historical background of e-learning and main theories and models of e-learning systems developed in this area which are important in this research. Also the Estonian and Turkish context will be described in the end of the chapter.

2.1 Historical overview

Due to e-learning is linked with distance education, but not necessarily included into the distance education and vice versa, the historical overview of e-learning will be started from history of distance education.

Distance education started with the rise of industrial era in the form of correspondence study by the end of 19th century. It was based on using of printed course materials and the postal services and depended on adult literacy, the printing press, a publishing industry, mass-produced, low cost pens (Hamilton, 1990), cheap and reliable postal service, an efficient transportation system and, in some countries like Canada and Australia, large, sparsely populated areas (Sumner, 2000).

In 1840, in England, Isaac Pitman offered the first recognised correspondence courses in shorthand (Verduin and Clark, 1991), to aid in business administration. In 1873, Anna Eliot Ticknor, an early pioneer of American correspondence education, founded the Society to Encourage Study at Home, with a mostly female clientele (Holmberg, 1986), in step with an era that slowly began to support women's education. By the end of the 19th century, a number of Canadian, American and European universities offered distance education courses. In the early part of the 20th century, 'correspondence study was flourishing with universities and private schools providing instruction to elementary, secondary, higher education, and vocationally-oriented learners' (Willis, 1994, p. 9). Portman (1978) describes how, in the United States alone, 48 institutions were offering doctorates by correspondence (Sumner, 2000).

The British model of correspondence study was spread around the globe by colonialism and adapted to local needs. For example, in Australia, the introduction of mandatory childhood education created the need for more teachers, many of whom were educated by correspondence courses (Sumner, 2000).

In 1882, in the United States, the Chautauqua movement pioneered correspondence instruction that influenced the development of distance education throughout North America. In Canada, citizenship education took on special importance, especially during World War II (Selman, 1983). The Soviet Union used correspondence study to widen educational opportunities and combine study with productive work (Young et al., 1980). In turn, East European countries adopted the Soviet prototype of adult schooling, including correspondence courses (Kulich, 1985). Linked to the student's work, these courses involved independent study and, often, consultation sessions, which were criticised as being more lecture than real consultation (Eklund et al., 1993). In addition to massive technological development, the two World Wars promoted the

growth of distance education. The armed services demanded correspondence education for soldiers during World War I (Holmberg, 1986), and soldiers returning from World War II looked to education, including correspondence study, as a way to change society after the horrors of the two World Wars and the Depression (Sumner, 2000).

With development of new technologies the term “correspondence study” transformed into “distance education”. It was a start of second generation of this type of education based on integration of print materials with broadcast media, cassettes, and to some degree computers. However, the problem of communication between learners and lecturers still has not been solved (Nipper, 1989).

In 1969 the Open University of the United Kingdom was established. Holmberg (1986) called this establishment as “the beginning of a more prestigious era in the history of distance education”. The early multimedia course model of the Open University involved the use of one-way technologies—radio and television broadcasts, and audio and video cassettes. In addition, it has preponderantly specialised in print-based correspondence courses (Sumner, 2000). In spite of the accelerating development of new educational technologies, the vast majority of distance education throughout the world at the end of the 1980s was still primarily print-based (Bates, 1993).

Therefore, although the second generation of distance education carries the potential for communicative action because of its two-way communication possibilities (e.g. teleconferencing), it wastes this potential by concentrating on one-way communication, expert knowledge, mass marketing and student independence (Sumner, 2000).

The 21st century brought our industrialized society to the new era – era of high technologies or “information and knowledge age”, where information availability became the main phenomenon. The major inhibitor of development process was an invention of Internet and the World Wide Web. Rapid development of different types of media from floppy disks, CD-ROMs and portable flash drives with huge amount of storage space to new growing “Cloud” service (when you don’t even need any storage media, but only computer or smartphone) incorporated with becoming more and more available internet connection, made spreading and storage of educational data incredibly easy. Described technologies brought to the distance learners indispensable one-way learning mechanisms. But, at the same time, these technologies opened a new possibilities for conferencing and two-way study: video chat services and other learning platforms developed for online conferences.

Modern era of education used computer-based learning tools was very well chronologically described by Leinonen (2010). He split the development into five phases:

(1) In the late 1970s and early 1980s the computers used in schools were often running MS Basic, an operating system that had only a shell user interface. At the time there was generally very little software available and many school classes with computers focused on teaching programming with such tools as the Logo environment (Papert, 1997). Later on, educational software in schools was often written or created by teachers themselves and shared among colleagues (O’Shea and Self, 1984, pp. 219-

220). In the mid-1970s the Learning Research Group in the laboratory at Xerox Palo Alto Research Center designed a Dynabook - a notebook-sized computer device that could be used by anyone, including children (Kay and Goldberg, 1977).

(2) The late 1980s and early 1990s is the time of arrival of multimedia computers with advanced graphics, sound, and audio, as well as a graphical user interface. New expectations raised among educators of the usefulness of computer tools in teaching and learning (Barron and Kysilka, 1993; Sims, 1988). In the creation of markets for more powerful multimedia PCs and CD-ROMs, the educational and student markets played an important role. Educational CD-ROMs were introduced and marketed as motivating and efficient ways to study (Rassuli and Tippins, 1997).

(3) Early 1990s is a period of Internet-based training (IBT). The World Wide Web made a dramatic change to the situation in PC markets and the use of PCs in teaching and learning. At this point computer-based training was brought to the Internet, but as yet without multimedia. Especially in the business world, internet-based training was widely marketed as a new cost-efficient method for human resource development (Harris, 1999).

(4) Internet-based training matured in the late 1990s and early 2000s and was now renamed e-learning. In practice, e-learning courses were actually not so different from the older internet-based training courses, except that now there were specific products designed to deliver courses and stronger attempts to build infrastructure for e-learning business, the exchange of courses, and transactions (Moore, 2002; Seufert, 2002). The specific products were called Learning Management Systems (LMS) (e.g. Blackboard and Moodle), and the e-learning infrastructure builders got involved in defining standards in specific industry working groups (for instance, the IMS Global Learning Consortium).

(5) The late 2000s meant a breakthrough for the phenomena of social software and free and open content in educational technology. The vast popularity of blogs and wikis has brought the Web back to its initial ideas and ideals, to a system that is a combination of a collaborative working environment and an efficient publishing platform for the free sharing of information (Berners-Lee, 1992, 2006; Berners-Lee et al., 1994; Berners-Lee and Hendler, 2001; Alexander, 2006). The considerable success of such peer and open content production projects as Wikipedia, founded in 2001 and Open Courseware, founded in 2002, demonstrated that free and open content does not necessarily have to exclude high quality in information production. Especially in the case of Wikipedia and other Wikimedia projects, the model of production, adapted from the Open Source1 software, has proven that small contributions by independent people can become very important when they are part of a bigger system (Tuomi, 2002).

2.2 Theories about e-learning

Different educational theories were studied to understand better the problem of adaptation of e-learning systems at higher education (Mayes and de Freitas, 2004). Brief description of the theories which I used in modelling is given further.

2.2.1 Behavioural theory

Early computer learning systems were designed based on a behaviourist approach to learning. The behaviourist school of thought, influenced by Thorndike (1913), Pavlov (1927), and Skinner (1974), postulates that learning is a change in observable behaviour caused by external stimuli in the environment (Skinner, 1974). Behaviourists claim that it is the observable behaviour that indicates whether or not the learner has learned something, and not what is going on in the learner's head. In response, some educators claimed that not all learning is observable and that there is more to learning than a change in behaviour. As a result, there was a shift away from behaviourist to cognitive learning theories.

Cognitive psychology claims that learning involves the use of memory, motivation, and thinking, and that reflection plays an important part in learning. They see learning as an internal process, and contend that the amount learned depends on the processing capacity of the learner, the amount of effort expended during the learning process, the depth of the processing (Craik and Lockhart, 1972; Craik and Tulving, 1975), and the learner's existing knowledge structure (Ausubel, 1974).

Recently, there has been a move to constructivism. Constructivist theorists claim that learners interpret information and the world according to their personal reality, and that they learn by observation, processing, and interpretation, and then personalize the information into personal knowledge (Cooper, 1993; Wilson, 1997). Learners learn best when they can contextualize what they learn for immediate application and to acquire personal meaning.

When the behaviourist, cognitivist, and constructivist schools of thought are analysed closely, many overlaps in the ideas and principles become apparent. The design of online learning materials can include principles from all three. According to Ertmer and Newby (1993), the three schools of thought can in fact be used as a taxonomy for learning. Behaviourists' strategies can be used to teach the "what" (facts), cognitive strategies can be used to teach the "how" (processes and principles), and constructivist strategies can be used to teach the "why" (higher level thinking that promotes personal meaning and situated and contextual learning). Janicki and Liegle (2001) analysed different instructional design models to identify the components that support quality design of Web-based instruction. Components were identified from each of the behaviourist, cognitivist, and constructivist schools of learning (Ally, 2008).

According to Dron and Anderson (2014), the dominant form of teaching in nearest future will become instructivist approach or method. However, recent studies shows that constructivist method is more feasible in engaging the students in innovative and creative activities (e.g. Khalid and Azeem, 2012). Constructivist teaching was proposed as more effective in terms of academic achievement of students and students have some preference for a constructivist teaching classroom environment (Kim, 2005). At the same time, Kim (2005) found that constructivist teaching is not effective in terms of student self-concept enhancement and student learning strategy changes in general, but have some effect upon motivation to learn academic tasks, causing anxiety in the academic learning process and self-monitoring in terms of learning for tests.

Pogue (2009) noted that first year, traditional college students tend to prefer the passive learning style that instructivist methods engender. However, non-traditional, adult students are more proactive-possibly because these learners have discovered that they are in charge of their own learning. They tend to seek out learning opportunities needed to enhance performance in their jobs and hobbies. By incorporating constructivist activities, instructors and course developers can improve student learning. Due to importance of these two approaches I will explain further both methods in more details.

2.2.1.1 Instructivist method

Apprenticeship models, while explicitly acknowledging that there are masters from whom to learn, are essentially conversational. Learning outside schoolrooms has almost always been a two-way flow of information. The “teacher” (whether a parent, peer, or formal pedagogue) imparts knowledge through telling and showing, but equally must pay attention to how and whether a learner is learning (Dron and Anderson, 2014). In the instructivist learning theory, knowledge exists independently of the learner, and is transferred to the student by the teacher. As a teacher-centred model, the instructivist view is exhibited by the dispensing of information to the student through the lecture format. This theory requires the student to passively accept information and knowledge as presented by the instructor. While this method has been the basis of education for centuries, it does have drawbacks, especially in the online class (Pogue, 2009).

2.2.1.2 Constructivist method

In the constructivist learning theory, the learner constructs new knowledge through a process of analysing new information and comparing it to previous knowledge. Student-centred, rather than teacher-centred, the constructivist theory is best exemplified by instructors who provide guidance, rather than spoon feeding knowledge to the student in the lecture hall. The student is control of whether or not he or she learns, not the instructor. Constructivism helps students comprehend how they understand or know a topic. Interactions with a learning environment provide the stimulus for learning through cognitive conflict as learners continually compare new knowledge with old knowledge and make a determination concerning which is more valuable. Building a model, designing a chart, and completing a project are all examples constructivist learning activities (Pogue, 2009).

From a social-constructivist perspective, knowledge and knowledge creation is a fundamentally social phenomenon. Not only are meanings negotiated and formed in a social context, the process of education is one where learners move from one zone of proximal development to the next, mediated by others who have already reached beyond where the learner wishes to go. In distance learning, social constructivist approaches were prohibitively expensive until the advent of affordable communications technologies (Dron and Anderson, 2014).

2.2.2 Information processing theories

Cognitivists see learning as an internal process that involves memory, thinking, reflection, abstraction, motivation, and meta-cognition. Cognitive psychology looks at learning from an information processing point of view, where the learner uses different types of memory during learning. Sensations are received through the senses into the sensory store before processing occurs. The information persists in the sensory store for less than one second (Kalat, 2002); if it is not transferred to working memory immediately, it is lost (Ally, 2008).

2.2.3 Socio-cultural learning theories

Socio-cultural factors might have big influence on development and adoption of e-learning systems. Reis and Gulsecen (2014) identified cultural factors as a crucial influence on the success or failure of adoption of ICTs in general. Gunawardena et al. (2001) and Salvatore (2002) mentioned that culture is emerging as an important variable in the investigation of the adoption of e-learning in general. One of the most famous theories of socio-cultural learning was introduced by Lev Vygotski (1978). This important theorist underscored the dynamic interdependence between the social and individual processes in learning (Vygotsky, 1978; John-Steiner and Mahn, 1996). In his theory of mind, Vygotsky proposes three forms of mediation: tools, signs and symbols (semiosis), and social interaction. Most Vygotskian sociocultural research has focused on the semiotic form of mediation to address cognitive challenges in education. Whereas semiotic mediation relies on social interaction, and social interaction has often comprised the “unit of analysis”, the mediation of social interaction itself largely remains to be unpacked. Even though some studies have investigated the processes of cooperation or collaboration in learning, the dynamics of those processes as social relations have not received extensive examination in Vygotskian research. The mediation of social relations - the dynamics of power, position, social location in the social interaction of learning - is of profound significance in education. Nowhere is the importance of social relations in learning more evident than in the dynamics of social class in schooling (Panofsky, 2003). Vygotsky viewed learning as a developmental or genetic process. This general genetic law of cultural development emphasized the importance of concentrating on the process by which higher functioning is established (Vygotsky, 1978; John-Steiner and Mahn, 1996). Socio-cultural approaches to education either related to tradition of “Post-Vygotskian Activity Theories”, like Luria, Leont’ev, Davydov, etc. (Luria, 1928; Davydov, 1975a, b, 1983; Leont’ev, 1981).

Other important theories describing socio-cultural aspects in learning are Bandura's social cognitive theory (Bandura, 1993) and participation model of cultural development (Lave and Wenger, 1991; Rogoff, 1990). Bandura (1993) postulates that perceived self-efficacy affects an individual in all aspects of life, including educational experiences. Beliefs about one's competence to successfully perform a task can affect motivation, interest, and achievement. The higher the perceived efficacy, the higher the

goal aspirations people adopt and the firmer their commitment to achieving those goals (Bandura et al., 1996; Peer and McClendon, 2002).

The participation model of cultural development (Lave and Wenger, 1991; Rogoff, 1990), is considered useful to overcoming dualisms, such as the society and the individual. The participation model represents development as the transformation of individual participation in sociocultural activity. Transformation (rather than internalization) occurs as participants in the activity assume increasing responsibility for the activity; in essence, redefining membership in a community of practice, and, in fact, changing the sociocultural practice itself (Scott and Palincsar, 2009).

2.2.4 Knowledge Building theory

Knowledge Building, or knowledge creation, as a theoretical, pedagogical, and technological innovation focuses on the 21st century need to work creatively with knowledge (Scardamalia and Bereiter, 2010). Knowledge Building, represents an attempt to refashion education in a fundamental way, so that it becomes a coherent effort to initiate students into a knowledge creating culture. Accordingly, it involves students not only developing knowledge-building competencies but also coming to see themselves and their work as part of the civilization-wide effort to advance knowledge frontiers. In this context, the Internet becomes more than a desktop library and a rapid mail-delivery system. It becomes the first realistic means for students to connect with civilization-wide knowledge building and to make their classroom work a part of it (Scardamalia and Bereiter, 2006).

A core principle of knowledge building (see Scardamalia and Bereiter, 2010) is “Real ideas, authentic problems”. Real ideas are ideas that originate from the participants in knowledge building, not copied ideas; and authentic problems are problems whose solution makes a contribution to community knowledge, not problems whose only value is in the learning that ensues.

2.2.5 Trialogical learning approach

Computer-Supported Collaborative Learning (CSCL) is an emerging research field which is clearly connected to novel ways of understanding fundamental epistemological, methodological, and also ontological questions concerning human cognition and activity. CSCL is married to basic conceptions of the socially, materially, culturally, and technologically distributed nature of human cognition. Yet there are different interpretations how these challenges and possibilities are interpreted, and which broader research traditions provide as a background for CSCL research (e.g., neo-Piagetian framework, a socio-cultural approach, situated cognition, knowledge building) (Paavola and Hakkarainen, 2009).

To highlight the core issues that relate to the needs for reframing the conceptions of learning, Paavola and Hakkarainen (2005) introduced the concept of *trialogical approach on learning*, or to CSCL, to differentiate it from those models of learning which emphasize individual knowledge acquisition or processes within the human

mind (“monological”), and from those approaches emphasizing just social practices or participation (“dialogical”). The trialogical approach aims at developing pedagogical models and tools for organizing learners’ activities around shared objects of activity (like texts, conceptual artefacts or practices) that are created for some meaningful purpose or reason. Within the trialogical approach, also individually performed activities and social interaction serve the sustained processes of developing some concrete, shared objects collaboratively for some subsequent use (Lakkala et al., 2012). The trialogical approach is discussed in more detail in Paavola and Hakkarainen (2009).

2.2.6 Summary of selected theories

The design of e-learning system can be and should be influenced by relevant pedagogical principles, theories and models. Described learning theories (Behavioural, Information processing, Socio-cultural learning, Knowledge Building, Trialogical learning approach) have a potential to inform e-learning system development and help in analysing the problems with adoption of such systems. These theories make possible to update old models according to modern tasks and barriers (e.c. EES model was updated into EES Model-2 in this study). For example, Instructivist approach is not useful for contemporary e-learning systems in most of the developed countries due to enforcing passive role of students, reducing creative, collaborative and self-regulated learning. From other side, constructivist approach, where students are active players in educational systems is completely compatible with e-learning principles. Using Information processing theories it is possible to understand ability of each student for learning using: memory, thinking, reflection, abstraction, motivation, and meta-cognition. Also, these theories describe how it is more comfortable for student to learn using different types of memory. The socio-cultural learning theory explains relations between students and impact of social factors on their ability to study. Using this theory it is possible to enhance the effectiveness of learning process within e-learning. Trialogical learning approach aimed at developing of pedagogical models, tools for organizing learners’ activities and social interactions within e-learning. Knowledge Building theory is the main part of e-learning development, due to it represents an attempt to refashion education in a fundamental way, so that it becomes a coherent effort to initiate students into a knowledge creating culture. With intensive development of different technologies, including of educational technologies and methods, with highly increased of needs of education and requirements for education and study level, in the nearest future we must to review approach to evaluate educational theories. The main value of the modern learning theory or model is its ability to explain and analyse complex needs, interests, requirements and limitations of the students. The new learning theory must be very flexible, adaptive and universal for any time, country, society and any other type of context. At the same time, it should be simple and understandable to be easily adopted and implemented in any environment and by users with any level of pedagogical experience – including the software engineers who develop the e-learning systems.

2.3 Models of e-learning systems

Clark and Mayer (2002) classified e-learning activities according to their time dependence, as: (1) synchronous and (2) asynchronous. (1) Synchronous e-learning, where teachers and students are involved in learning activities at the same time. They have to synchronize their activities. Examples include video conferencing, chats, and real-time video lectures. (2) Asynchronous e-learning, in which teachers and students are involved in learning activities at different times. They “do not” have to synchronize their activities. Examples include content delivery, cooperation through a forum, a blog, or a wiki, as well as e-mail communication and file sharing. New asynchronous e-learning applications are emerging, based on archived podcasting and webcasting content.

The more common approach is asynchronous e-learning. Its main benefit is its freedom from time and space requirements, thus supporting an “anytime” dimension of e-learning. On the other hand, synchronous activities give e-learning more appeal, involving people interacting directly with each other in real-time activities. A typical e-learning scenario might involve components of both (Salomoni et al., 2007).

From a technological point of view, today’s e-learning is rooted primarily in Web-based delivery of educational multimedia content, coupled with synchronous and asynchronous communication features that allow students and teachers to interact (Sloman, 2002). There are several types of systems that assist with e-learning activities. Perhaps, the most common type of e-learning application, the so called Learning Management System (LMS), is devoted to managing learning activities and, more specifically, to keeping track of what learners do and learn, following both their activities within the system, and their progress mastering learning materials. A second category of applications, called a Learning Content Management Systems (LCMS), aim primarily at managing the delivery of course content, but such systems are frequently extended to include communication tools and user management features often found in an LMS (Jacobsen, 2002).

Often used interchangeably with LMS (and often with LCMS) is the Virtual Learning Environment (VLE), with its focus on the “virtuality” of the learning space and on the idea of a platform that supports the whole range of learning activities as a stand-alone integrated “virtual environment”. A very different role is played by “e-learning content repositories”, applications that are used to store, distribute, and share learning content. Often content repositories are linked into an LMS so instructors, and often students, can search and retrieve learning materials, export content from the repository in a standard format, import or link that content into an LMS as part of a course lesson, and often transfer content from an LMS into the repository to be shared with others.

The nature of e-learning content allows it to be reused in many contexts, and to be redistributed as standardized packaged educational materials (Horton and Horton, 2003). Pieces of learning material in a “Content Package” are often referred to as “Learning Objects” (LO). A content package is a collection of learning objects assembled together with a document, generally XML based, that defines association

and sequencing rules used to organize the content within an e-learning system (Salomoni et al., 2007).

Cloete (2001) developed a layered model for second-generation e-learning systems: Electronic Education System Model (EES). The EES model was selected for this research due to its flexibility and other advantages that will be described in details in chapter 4.1. However, EES model also has number of disadvantages needed to be updated according to needs of our study. These updates and new model EES Model-2 was presented in chapter 4.2.

2.3.1 E-learning standards

A standard description of content structure is needed to make content interoperable across different e-learning platforms. Several interoperability specifications have been developed by international organizations such as:

- The Institute of Electrical and Electronics Engineers (IEEE), with a specific working group, the Learning Technology Standards Committee that is working on e-learning standardization (IEEE, 2006).

- The Instructional Management System Global Learning Consortium (IMS Global Learning Consortium), a collaboration of government organizations that are defining specifications to ensure interoperability across e-learning systems (IMS Global Learning Consortium, 2006).

The goal of such standards is to define metadata, data structures, and communication protocols that will make learning content work across platforms, providing guidelines for designing, developing, and delivering electronic learning content.

Another similar project is the Advanced Distributed Learning (ADL) initiative, leads by the U.S. Department of Defence. It has developed the Shareable Content Object Reference Model (SCORM) standard, one of the more widely used e-learning specifications. ADL has based its work on that of IEEE and IMS, and has created a more encompassing interoperability standard that takes into consideration recommendations from those and other standards (ADL, 2004). The collected standards can be applied to learning content and to learning platforms (e.g. LMS, LCMS, VLE) with an aim to fully support the reuse of content across systems and standardize the delivery e-learning content. SCORM includes a de-facto standard for defining a Sharable Content Object (SCO). A SCO is a learning resource that can be presented in any SCORM compliant system, displaying and sequencing content, and tracking student progress. Each SCO is made up of one or more assets or resources, which are generally electronic media (e.g. text, images, sound and video), web pages, or other types of data. SCOs can be described with metadata, and often retrieved from online content repositories by searching for terms in the metadata, thereby encouraging their re-use.

Metadata and structural information about a unit of learning content is usually contained within a “manifest”, an XML file that describes the learning content in a standard manner. A SCORM manifest generally contains the content’s semantic

description (metadata), together with its navigation or structural description (organizations), and the locations of each of the contained assets (resources). The SCORM main specifications are (ADL, 2004):

- The Content Aggregation Model (CAM) that defines the structure or arrangement of learning materials, and describes the content or topics it contains with metadata (based on the IMS Content Packaging specification).

- The Run-time Environment (RTE), a JavaScript Application Programming Interface (API) that delivers to a LMS or LCMS real time information about user actions within a SCO, including exercise solving and tracking through resources.

- The Sequencing and Navigation (SN) specification describes rule-based definitions of possible paths through learning content (Salomoni et al., 2007).

IMS (www.imsglobal.org) is an industry/academia consortium that develops specifications based on the needs identified by its supporting members. It was started in 1997 by the National Learning Infrastructure Initiative (NLII) (www.educause.edu/nlII) which is an organization sponsored by EduCause (www.educause.edu). IMS is now an independent, non-profit corporation owned by its participating members. IMS produces specifications and also offers workshops, developer support, and executive briefings. IMS is in the process of creating a conformance and testing program intended to be licensed by industry and national consortia and organizations. Main IMS's initiatives are:

- Learning Object Metadata (LOM) - IMS Metadata specification is a primary source of input to the IEEE LOM standardization process, and has also been adopted by ADL as part of SCORM. IMS produced this specification in late 1999.
- Content Packaging - The IMS Content Packaging specification creates standardized packages of learning objects, files referenced by the objects, and instructions for a learning management system to organize the learning objects in the package. This specification has been adopted by the ADL as part of SCORM and commercialized by Microsoft under the name LRN. IMS produced this specification in early 2000.
- Question and Test Interoperability (QTI) - The IMS QTI specifies an XML format for encoding online questions, tests, and test banks. This enables the transport of such objects between learning systems. IMS produced this specification in mid-2000. Assessment engines are moving toward adoption of this specification, and it is likely to become part of SCORM in the future.
- Learner Information Packaging (LIP) - The IMS Learner Information Package specification defines XML structures for the exchange of comprehensive learner information among cooperating systems. Some vendors and product development consortia have looked at adopting the LIP. This specification was produced in mid-2001.
- Enterprise Interoperability - The IMS Enterprise specification defines XML packages for the exchange of class scheduling and learner registration information between systems. The first release, produced in early 2000, was primarily targeted at supporting the interaction between Learning & Course Management Systems and enterprise Student Administration and Human Resource systems. This specification has been implemented by a number of vendors of these systems. The Enterprise

specification is in the process of being revised to extend registration interoperability support to other types of learning systems, and to specify messaging workflow architecture.

- Simple Sequencing - The IMS Simple Sequencing working group is in the process of creating a specification that describes the way learning objects should be sequenced by a learning system.
- Learning Design - The IMS Learning Design working group is looking at ways to describe and codify the learning methodologies embodied in a learning offering.
- Digital Repositories - This IMS working group is in the process of creating specifications and recommendations for interoperation among digital repositories.
- Competencies - The IMS (and IEEE) working groups are in the process of creating a standardized way of labelling the various components that go into defining “competencies” (also known as proficiencies, outcomes, etc.).
- Accessibility - The IMS Accessibility working group is promoting accessible learning content through recommendations, guidelines and modifications to other specifications. Accessible technology refers to technology that can be used without having full access to one or more input or output channels, usually visual, auditory or motor (Collier and Robson, 2002).
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2.3.2 Summary of selected e-learning standards

The main standards of e-learning systems, IEEE, IMS Global Learning Consortium, ADL and SCORM, must be applied to e-learning content and to e-learning platforms with an aim to fully support the reuse of content across systems and standardize the delivery e-learning content. Implementation of standards of e-learning is significant to be implemented in e-learning models to unify the process of adaptation and integration of e-learning with available sources. An ideal e-learning model in my opinion is united standardized model that can be easily implemented in any institution around the world. At the same time it is intelligent structure that can be modernize its self, using its own experience and flexible to accept new ideas and delete ineffective patterns.

According to needs of Turkish e-learning system the EES model was selected for this study. One of the software architecture models for e-learning systems EES model is more flexible than other models, makes available implementation of standardization of e-learning systems to unify the process of adaptation and integration of e-learning system with available sources.

2.4 Adoption of e-learning and implementation of e-learning systems

To understand and illustrate how technological innovation moves from localized invention to widespread use the Rogers’ theory could be used. This theory describes the Innovation Decision Process (IDP) as a process that occurs over time and that can be structured in five specific stages: knowledge, persuasion, decision, implementation and confirmation (Rogers, 2003; Gonçalves and Pedro, 2012). The attributes of an

innovation influence its rate of adoption. Rogers identified five characteristics of an innovation that need to be considered: relative advantage, compatibility, complexity, trialability, and observability (Sahin and Thompson, 2006). Innovations that are perceived as having greater relative advantage, compatibility, trialability, observability, and less complexity will be more rapidly adopted (Rogers, 2003). Considering LMS integration in higher education institutions, Rogers' theory highlights the fact that the ability of faculty motivation to go the extra mile in the acquisition of technology integration skills is largely determined by their perceptions of their attitudes, perceptions, previous beliefs and values considering technology-integration in today's teaching, as well as its identified advantages, level of complexity and required effort (Gonçalves and Pedro, 2012).

Considering the different pattern of response to innovation or level of innovativeness, Rogers identified five categories of adopters which can be applied to LMS adoption by faculties: (1) the innovators, (2) the early adopters, (3) the early majority, (4) the late majority, and (5) the laggards. These categories follow a standard deviation curve, very little innovators adopt the innovation in the beginning (2,5%), early adopters making up for 13,5% a short time later, the early majority 34%, the late majority 34% and after some time finally the laggards make up for 16%. Rogers' theory also reveals three important ways in which the adoption of interactive communications differs from that of previous innovations: (i) a critical mass of adopters is needed to convince the "mainstream" professors of the technology's effectiveness, (ii) regular and frequent use is necessary to ensure success of the diffusion effort and (iii) technology is a tool that can be applied in different ways and for different purposes and is part of a dynamic process that may involve change, modification and reinvention of individuals' practices and beliefs (Rogers, 2003). Rogers' theory also evidences that innovation adoption is not only defined at an individual level, but it is also a collective, organizational process. Individuals' decisions always rely upon the subjective evaluation of how an innovation was conveyed to other individuals. This dependence on peers' previous experiences puts the diffusion process core in a modelling. The diffusion theory argues that, since opinion leaders directly affect the tipping of an innovation, a powerful way to promote the diffusion of an innovation is to favourably affect the attitudes of opinion leaders. Therefore, interpersonal communication channels, even in wide organizations, are the more effective mechanism for diffusion of an innovation in this case. Many studies have used Rogers' diffusion model as a theoretical basis for assessing ICT integration in faculty teaching practices (Car, 2001; Finley and Hartman, 2004; Sahin and Thompson, 2006). Overall, research findings showed that faculty members would get involved in technology integration if (i) they feel it is consistent with their beliefs and teaching style, (ii) they feel they are knowledgeable and competently skilled to use it, (iii) they are supported and rewarded for doing so, and (iv) they can see how it is pedagogically useful (Gonçalves and Pedro, 2012).

2.4.1 Technology adoption models

It is not enough to build a good e-learning system if the development is not accompanied by the relevant support to university-wide implementation and adoption of the system. Technology adoption is defined as acceptance and taking-into-use of a new technology by its users (Agarwal, 2000). Various models were developed to understand users' adoption of new technologies: the Technology Acceptance Model or TAM (Davis, 1989; Park, 2009), Unified Theory of Acceptance and Use of Technology or UTAUT (Venkatesh et al., 2003), Matching Persons and Technology model (MPT), hedonic-motivation system adoption model (HMSAM). Each of these models has sought to identify the factors which influence a citizen's intention or actual use of information technology (Alzahrani and Goodwin, 2012).

2.4.1.1 Technology Acceptance Model (TAM/TAM2)

TAM is a theoretical model that helps to explain and predict user behaviour of information technology (Legris et al., 2003) and IS systems by assuming that two main constructs - perceived usefulness (PU) and perceived ease of use (PEOU) - are the key determinants of information technology and information systems acceptance behaviour (Alzahrani and Goodwin, 2012). According to TAM, one's actual use of a technology system is influenced directly or indirectly by the user's behavioural intentions, attitude, perceived usefulness of the system, and perceived ease of the system. TAM also proposes that external factors affect intention and actual use through mediated effects on perceived usefulness and perceived ease of use (Davis, 1989; Park, 2009). Davis (1989) defines perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance", while ease of use is "the degree to which a person believes that using a particular system would be free of effort". Fishbein and Ajzen (1975) define behavioural intention as "the strength of one's intention to perform a specified behaviour". Under the TAM, both ease of use and usefulness have a significant impact on attitudes towards the use of a system either positively or negatively. To summarize, TAM specifies that PEOU and PU affect behavioural intention to use a system, which then determines actual use. TAM is criticized for ignoring the social influence on technology adoption (Mathieson, 1991; Fu et al., 2006) social and human factors. Venkatesh and Davis (2000) extended TAM by integrating social and cognitive variables such as experience, job relevance, image, and voluntariness. This extended model is referred to as TAM2. TAM2 appears to be able to account for 60 percent of user adoption (Venkatesh and Davis, 2000). As suggested in TAM2, subjective norm, one of the social influence variables, refers to the perceived social pressure to perform or not to perform the behaviour (Ajzen, 1991). It seems important to determine how social influences affect the commitment of the user toward use of the information system for understanding, explaining, and predicting system usage and acceptance behaviour (Malhotra and Galletta, 1999; Park, 2009).

In general, variables related to the behavioural intention to use information technology or to the actual use of information technology could be grouped into four

categories: individual context, system context, social context, and organizational context. While social context means social influence on personal acceptance of information technology use, organizational context emphasizes any organization's influence or support on one's information technology use. Thong et al., (2002) identified relevance, system visibility, and system accessibility as organizational context variables. They reported that the organizational context affects both perceived usefulness and perceived ease of use of a digital library. Lin and Lu (2000) similarly reported that higher information accessibility brings about higher use of information and higher perception of ease of use. In this study, e-learning accessibility refers to the degree of ease with which a university student can access and use a campus e-learning system as an organizational factor (Park, 2009).

Overall, because of its simplicity and more practical theory, TAM has been tested broadly and commonly accepted (Gupta et al., 2008). At the same time several researchers have added their extensions to the model or integrated factors from other models. Hence, it cannot be said to be an all-encompassing model that can be used for all studies. Modifications may have to be made as and when necessary depending upon the subject, the size of the research or the duration of the study (Alzahrani and Goodwin, 2012).

2.4.1.2 Theory of Reasoned Action (TRA)

TAM is based on Theory of Reasoned Action or TRA (Fishbein and Ajzen, 1975; Ajzen et al., 1980; Venkatesh, 1999; Chen et al., 2002) that is well-accepted model already applied successfully to explain behaviour across a wide variety of settings (Davis et al., 1989; Chau, 1996). Under TRA, the behaviour of a given is best predicted through their behavioural intentions that, in turn, is determined by the person's attitudes and subjective norm (social influence) (Fishbein and Ajzen, 1975). Behavioural intention is a reference to the strength of a person's intention to adopt certain behaviour (Davis et al., 1989). Subjective norm is defined as beliefs about what others will think about the behaviour (Fishbein and Ajzen, 1975). That is, if someone believes those who are significant to him perceive the outcome of performing the behaviour as positive, they will be more likely to perform the behaviour. The main shortcoming of the TRA is that it assumes individual behaviour is controlled volitionally (Ajzen, 1991) which is not always the case. Some people have little control or think they have little control of their behaviours (Alzahrani and Goodwin, 2012).

2.4.1.3 Theory of Planned Behaviour (TPB)

TPB goes beyond TRA and incorporates a further construction, specifically perceived behaviour control (PBC); this accounts for those situations where control over the target behaviour is not fully volitional (Ajzen, 1985). TPB is considered as to be among the more influential of the theories in predicting and explaining behaviour (Sheppard et al., 1988). Various studies showed the applicability of TPB to various

domains, and verified the ability of this theory in providing a valuable framework to explain and predict the accepting of new information technology (Hung et al., 2006). The new construct PBC was defined as the “perception of ease or difficulty of performing the behaviour of interest” (Ajzen, 1991). Under TPB, the explanation of a person’s behaviour lies in their behavioural intention; this is influenced by perceived behavioural control, attitude and subjective norms. Perceived behavioural control describes the perceptions an individual has regarding the absence or presence of the resources required or requisite opportunities to perform the target behaviour. Attitude refers to the negative or positive way the individual evaluates the performance effect of a given behaviour. The subjective norms are an individual’s perceptions of how others will view their performance of a given behaviour (Alzahrani and Goodwin, 2012).

2.4.1.4 Advantages of Unified Theory of Acceptance and Use of Technology (UTAUT) model

The UTAUT model informs understanding of factors which influence acceptance of an important new technology. Even though the UTAUT model is quite new, it is quickly growing in popularity. Additionally its viability, validity and stability in technology adoption research studies within several contexts have already been confirmed, example (Anderson et al., 2004, 2006; AlAwadhi and Morris, 2008; Zhou et al., 2010) studies in TRA, TPB, and TAM developed substantial efforts in order to improve understanding of the area of IT adoption theories and they produced a significant basis for discussions and arguments. Nevertheless, difficulties remain amongst those theories. First, despite the fact that every model utilizes various terminologies within their phraseology of acceptance elements, they are basically similar aspects. Next, as a result of the nature of behaviour research and the limitations on the researchers, we lack an individual theory which addresses most (or a majority) of the factors. Basically, every theory and model has its own restrictions and does not enhance the other (Min et al., 2008). Moreover, the UTAUT model explains 70% of technology acceptance behaviour intention whereas other models explain just over 40% of acceptance (Venkatesh et al., 2003). Therefore, the UTAUT includes more factors affecting the intention of the behaviour. It comes to fill the deficiencies of the other models and theories and combines them. Yet, UTAUT is the most all-encompassing IT adoption theory (Alzahrani and Goodwin, 2012).

2.4.2 Summary of technology adoption models

Various models were developed to understand users’ adoption of new technologies: TAM, MPT, HMSAM, and UTAUT. Each of these models has sought to identify the factors which influence a citizen’s intention or actual use of information technology. TAM is a theoretical model that helps to explain and predict user behaviour of information technology. TRA is a well-accepted model already that has been applied successfully to explain behaviour across a wide variety of settings. TPB goes beyond TRA and incorporates a further construction, specifically perceived

behaviour control. This accounts for those situations where control over the target behaviour is not fully volitional. UTAUT model informs understanding of factors which influence acceptance of an important new technology. TAM2 appears to be able to account for 60 percent of user adoption. TAM2 extended theoretical model was implemented and adopted for this study to develop questionnaire that answers to the needs of this research. TAM2 model was estimated as appropriate to study how e-learning and e-learning systems were adopted by main users-lecturers. As suggested in TAM2, subjective norm, one of the social influence variables, refers to the perceived social pressure to perform or not to perform the behaviour (Ajzen, 1991). It seems important to determine how social influences affect the commitment of the user toward use of the information system for understanding, explaining, and predicting system usage and acceptance behaviour (Malhotra and Galletta, 1999; Park, 2009).

2.5 The context of my research

To analyse situation in Estonia and Turkey in the field of e-learning systems, the data of operating web-based courses and programs, and number of attending students in three main universities of Estonia and Turkey were collected by studying databases of the universities and private collaboration with heads of national e-learning centres. Socio-cultural issue data were collected by reviewing available literature, according personal experience and discussion with Estonian and Turkish students and other representatives of scientific communities from both countries.

2.5.1 Estonia

Estonia is a small country (45,226 km²) with population of 1,315,819 persons (Population and Social Statistics Department of Estonia). As one of European Union countries, Estonia is presented by a perfectly organized e-University consortium, founded in 2003 by eight largest Estonian public and private universities and the Ministry of Education and Research. The consortium has done a great work in this context, having the development of e-learning as a key element of the Estonian Research, Development and Innovation Strategy (Kalvet, 2007).

In May 2013 the Estonian Information Foundation, Tiger Leap Foundation merged with the Estonian Education and Research Network (EENet) to become the Information Technology Foundation for Education (HITSA). HITSA is a partner to the Estonian Ministry of Education and Research, educational institutions and Estonia's ICT sector in providing competitive ICT education that meets modern needs.

E-learning system has grown rapidly in different Estonian universities, which are shown clearly in Figures 2.1 and 2.2. The main users of e-learning at higher education and its developers and inspires in Estonia are three largest universities: UT, TUT and TU.

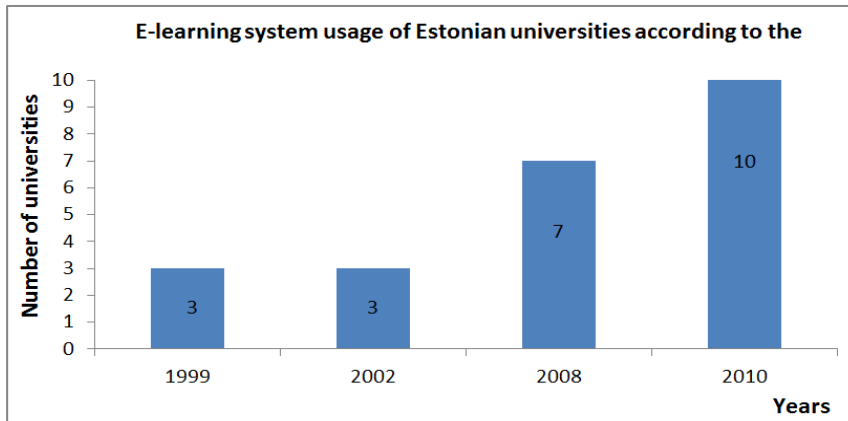


Figure 2.1. Usage of e-learning system in Estonian Universities.

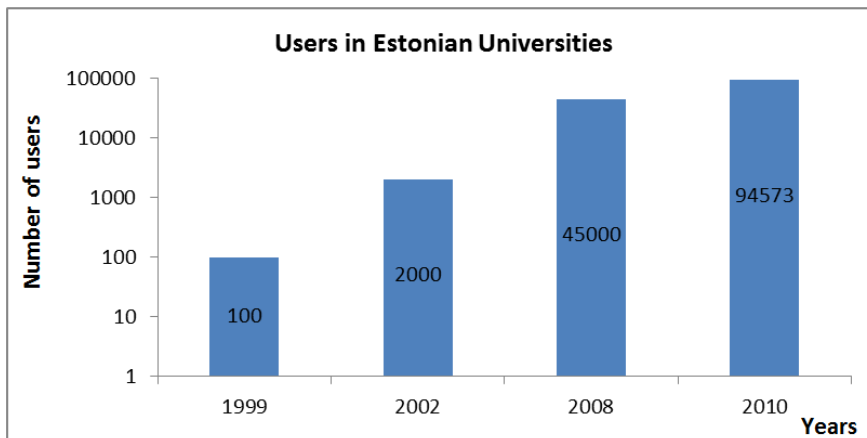


Figure 2.2. Number of users in Estonian Universities (Dremljuga-Telk et al., 2011).

2.5.1.1 University of Tartu

The first activities in e-learning at UT, the oldest university in Estonia established in 1632 (Times Higher Education World University Rankings 2013-14), were started from 1995 at the Faculty of Mathematics by delivering for the students an e-mail based course. However, the first web-based course in the WebCT environment was developed and delivered at the UT after three years in 1998. Later, in 2000 e-learning at UT was granted the highest priority by the University Council and the Distance Education Centre, as a structural unit with the responsibility for developing e-learning at UT, was established. In 2002 the portal of the E-University of the UT was opened. This portal provides learning opportunities and technical and methodological support to learners and academic staff (creating ICT-based courses, copyright problems, etc.). From 2003 the UT is a one of the member universities of just established consortium of Estonian e-University. In 2009 the UT started to use “Moodle” web-based learning

environment (Moodle web-based learning environment). In same year Adobe Connect Pro (Adobe Connect Pro), a web conferencing platform for web meetings, e-learning, and webinars, became available for teachers at the UT. The video portal (Television of the University of Tartu UTTV) was launched one year later, in 2010. In 2011 the Moodle environment was connected with Study Information System (SIS). By the year 2014 the UT has approximately 2937 operating web-based courses and a lot of courses are being designed. Total number of registered students for these courses in 2014 was about 54000 (University of Tartu, University of Tartu e-learning portal).

2.5.1.2 Tallinn University of Technology

TUT was founded in 1918. According to number of students it is a second in Estonia after UT. Very important role in development of e-learning at TUT plays cooperation with other institutions. Crucial place in this interplay has HITSA Innovation Centre, which coordinate and support e-learning process at TUT. The main learning management system at TUT is Moodle. During 2013-2014 academic year, Moodle was used in 869 e-courses from 1083 available at TUT with 39614 students registered.

2.5.1.3 Tallinn University

E-learning Centre of TU, third largest public university in Estonia, established in 2005, provides a number of technical solutions for e-learning (ICT infrastructure, videoconference services, etc.) and support of academic staff on e-learning activities. The TU reported about 1582 e-courses in 2014 and 52469 students registered. While previously TU was using in-house developed LMS called IVA, currently the university has switched to using Moodle, eDidaktikum.ee, Open Learning Environments (blogs, wikis) for creating e-courses and for education.

The largest Estonian universities are participating very actively in development of e-learning in higher education in Estonia, organizing and conducting different e-learning courses for university staff. Taking into account the population of the country and average number of students in higher education in Estonia, this country reached a significant result in development of e-learning, blended learning and distance education. Thus, Estonia not only achieved the aims of the EC to be an example for other European Member states, but even exceeded any expectations. E-learning in higher education and other e-services in Estonia are represented worthy and widely recognized at a global level and Estonian example of progress in these areas is playing a very important role for a worldwide ICT development.

Political attention on the problem and productive initiatives of all Estonian universities and strong cooperation with stakeholders and Estonian Government made these impressive results realistic. However, there are number of problems are still existing in Estonian R&D area (Kalvet, 2010).

2.5.1.4 Factors influencing e-learning in Estonia

Official language in Estonia is Estonian and minority languages are Russian, Ukrainian, Belorussian and others (Fig. 2.3). In 1989, just before Estonia got independence, 36% of the entire population of Estonia was foreign-born (Kemppainen et al., 2008) with the majority of this group being composed of immigrants from Russian or other Soviet republics. This politically privileged Russophone minority used Russian in both public and private spheres, leading to a de facto state of asymmetrical bilingualism wherein Estonians were required to learn Russian for socio-economic and political survival but Russians frequently saw little use in learning Estonian (Hogan-Brun, 2007; Kemppainen et al., 2008). Indeed, by 1991, 34.8% of the total population identified Russian as their first language or mother tongue (Hogan-Brun, 2007). It should be noted that while Estonian was not actively persecuted from 1940-91, the lack of a policy supporting its importance and its use in public spheres meant that socially and psychologically Estonian became a de-privileged language, even among Estonians (Della Chiesa et al., 2012).

Specific of Estonian educational system, according to study of Worden from Harvard University (Della Chiesa et al., 2012), is that education remains the only sphere in Estonia where both Estonian and Russian are afforded equal status as official languages of instruction, at the basic level. Higher education is taught solely in Estonian, although University rectors do retain some decision-making power in language choices. As of 2007, the Russophone community in Estonia accounted for approximately 28% of the overall population (Hogan-Brun, 2007) at which time about 70% of these children attended Russian language schools (Kemppainen et al., 2008), where they have been required to study Estonian as a non-native language (Hogan-Brun, 2007).

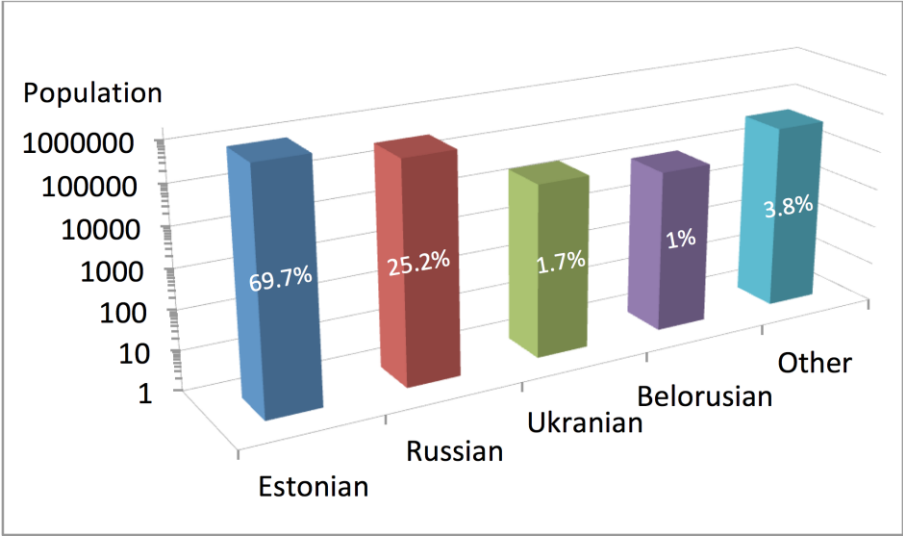


Figure 2.3. Languages in Estonia (<http://www.stat.ee/34278/>).

Within the last two decades the Estonian skills of the non-native speakers of Estonian have improved considerably. Nevertheless, the results of secondary school graduation exams show that language skills acquired by the end of secondary education are often not sufficient for managing in the Estonian society, education and work. The implementation of the language reform in education for Russian medium schools has been slow in Estonia, both for political and practical reasons. It was completed in the school year of 2011/2012. The elementary schools may decide whether and how they teach subjects in Estonian. The national curriculum determines that on the upper secondary level all pupils have to study in total of 60% of their subjects in Estonian (Koržel, 2013; Metslang et al., 2015).

The Central Intelligence Agency (CIA) published following population age distribution in Estonia: ages 0–14: 15.6%, ages 15–24: 11.2%, ages 25–54: 41.5%, ages 55–64: 13.2% and 65 years and over: 18.5% by 2014 (www.cia.gov).

Estonia is a country in transition in regard to the value system with wide diversity and complexity in value systems (Lin and Fu, 1990; Wang and Tamis-LeMonda, 2003; Tulviste et al., 2012). For instance, mothers from Estonia have been found to value some values of self-direction (independence, imagination) for their children as highly as parents in the U.S., Russia, and South Korea (Tudge et al., 1999), parents from Finland (Tudge et al., 1999), and mothers from Sweden (Tulviste et al., 2007). At the same time, they emphasize self-confidence less, and upkeep traditional values (Tulviste, 2013).

According to study of Tulviste (2013), Estonian parents were most likely to choose between important qualities that children should be encouraged to learn at home first of all, trustworthy, respect others, hard-working, and independence. They have never chosen obedience, religion, unselfishness, sporty and good looking. Parental educational level appeared to be associated with the extent to which the parents value self-directive behaviour over conformity and traditional values. University-educated mothers were less likely to choose qualities related to traditional values (e.g. trustworthy, polite, good manners, and obedient), and more likely to choose those related to self-direction (e.g. imagination, self-confidence, healthy lifestyle, determination, and smartness) among the five most important qualities to develop in children than less-educated mothers. The fathers with university education valued imagination, and healthy lifestyle more highly, and good manners, and hard work less highly than those fathers whose educational level was lower (Tulviste, 2013).

Technical infrastructure in Estonian e-learning system in higher education is on a high level, where some few problems can't influence to the quality of this system. One of the most important inhibitor of the e-learning development in Estonia is consortia between all universities. Significant financial support from EU budget opens opportunities for project applicants and gives more chances for success. Low number of students together with high number of available courses also makes progress in e-learning area very fast and work very productive. There are many factors making Estonia successful in development and implementation of e-learning systems in higher education. However, there are still some barriers in the field, mostly related to pedagogical factor. For example, it was found that there is a need in pedagogical training of academic staff in Estonian universities.

2.5.2 Turkey

Turkey, as a country with significant population of 74 million (Statistical Yearbook for Asia and the Pacific, 2013) and a large territory of 783,562 km² (UN Demographic Yearbook 2009-2010, 2011) has a strong experience in a distance education, which a long history begins from early 1956.

In 1995, John Daniels describes Turkey as having one of the best known distance education programs and one of the 10 largest distance education institutions in the World (Usun, 2004).

Usually, the most motivated users of e-learning are part-time students. But in Turkey the part-timers is null or negligible (Demiray, 2010). The schooling ratio at higher education level is 43% in average at the European countries, while that in Turkey is 29%. In 1999, the ratio of total education expenditure to Gross National Product is 5% in average in the European countries, 6% in average in Organization for Economic Co-operation and Development (OECD) countries and 3.9% in Turkey. Under these circumstances, the quality of Turkish education, its international validity and acceptability is questionable. The e-learning system at higher education could not be settled up due to unstable situation in government: policies changing from one government to another and the continuity of education policies could not be ensured. These practices also caused to a great loss of resources. Changing governments have muddled the system (Demiray, 2010). These serious problems exist, while every year in Turkey more than 1.3 million of students apply for higher education (Cakmakcı, 2009; Demiray, 2010). To simplify testing procedure of such huge number of students, a central test based on multi-choice questions was developed and successfully applied by Student Selection and Placement Centre (OSYM). In this term Turkey could be a good example for many countries of the world.

The main players in the use of e-learning systems at higher education and its development in Turkey are three largest Turkish mega-universities: AU, IU and SU.

2.5.2.1 Anadolu University

AU is number one in Turkey and one of the largest universities in the world. It was established in 1981 from an older institution, the EAECs, founded in 1958. In accordance with the Higher Education Act of 1981, the AU, that had a sufficient infrastructure, was also authorized to provide distance education in Turkey on a national scale. Later, in 1982, when EAECs was transformed into OEF, solid distance education system was created (Demiray, 2010).

The AU is an institution, promoting universal higher education values and blazing trails in the Turkish higher education with its three distance education faculties. Successful launch of the distance education system, as well as Lifelong Learning system, focusing on expanding educational opportunities for all Turkish citizens through distance and life, ranks at the top of innovative initiatives of the AU.

Today, the number of students attending 156 e-learning in three faculties at AU is 1,365,802 (www.anadolu.edu.tr, Anadolu University distance education). Anadolu

University Open and Distance Education Model is the first institution in Turkey that offers higher education through contemporary education model.

AU uses WebCT (Blackboard), Moodle and Adobe Connect (Adobe Breeze) for e-learning system.

2.5.2.2 Istanbul University

The number two institution in Turkey, taking into account the capacity of students and application of e-learning system in their education system, is IU.

In 2009–2010 the Distance Education Centre at IU (ISUZEM) was established and has started its activities. Forty-seven e-learning programs under the supervision of ISUZEM are presented at IU. In the 2010–2011 education years, approximately 3,500 students were enrolled in ISUZEM (Reis and Gulsecen, 2014).

In 2010 the Faculty of Open and Distance Education (AUZEF) was founded at IU. From this year IU started to use Electronic Document Management System (EDMS) to decrease bureaucratic processes. On basis of distance education system 18 new programs were opened at AUZEF. It provided a revolution in university education organizing different republic examinations. They gave a great chance for millions of people who did not have opportunity to apply for higher education before. The AUZEF Solution and Support Centre insuring information support about e-learning system. A total 450 lecturers were involved in studying of 28,000 students during 5230 of hours of live lessons.

The AUZEF learning management system developed at IU is used for e-learning system (<http://websis.auzefim.com>).

2.5.2.3 Sakarya University

SU became a state university in 1992. Its history starts from 1970, when SU was opened as the School (later State Academy) of Engineering and Architecture. In 2005, the Department of Informatics established the Distance Learning Research and Development Centre (UZEM) (www.uzem.sakarya.edu.tr).

Course and courseware development follows the Analysis–Design–Development–Implementation and–Evaluation (ADDIE) model. The UZEM is also responsible for the provision of technical and learner support, marketing the e-learning programs, and training and supporting academic staff in instructional design and online teaching and learning.

SAUPORT Platform and Academic LMS (ALMS, SAUPORT) are used as LMS at SU (<http://www.uzem.sakarya.edu.tr/Makaleler.aspx?Makaleid=18>).

One recent research project, the SU-Advancity Academic LMS Project, enabled the University's faculties, graduate schools, and vocational schools to engage more cost-effectively in e-learning delivery, tracking, and evaluation. This work grew out of the UZEM's earlier SAUIDO Server Optimization and Exam Module Project for the State Planning Organization, which investigated the infrastructure, operations,

performance, and effects of LMSs, and the Server University Project in which the SU acted as a server university for other Turkish universities.

Today, about 8,000 students are taking part in 31 e-learning programs at the SU (Reis and Gulsecen, 2014, www.uzem.sakarya.edu.tr).

In Figures 2.4 and 2.5 is shown the evolution of e-learning system in Turkish universities (Yamamoto et al., 2010).

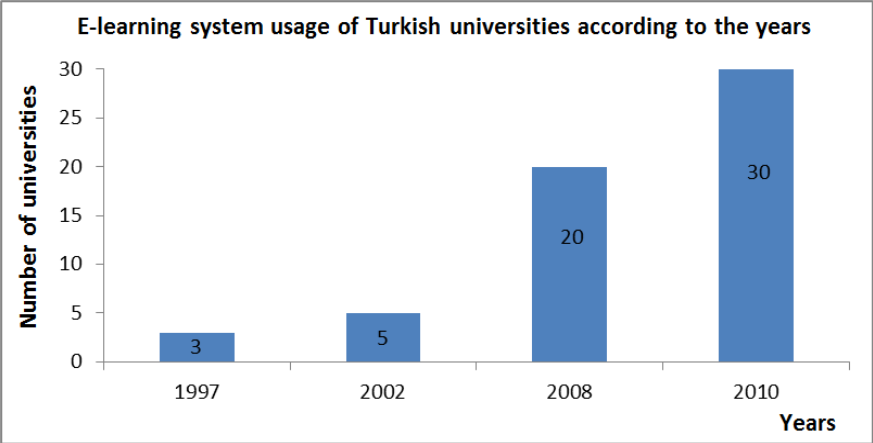


Figure 2.4. Usage of e-learning system in Turkish Universities (Yamamoto et al., 2010).

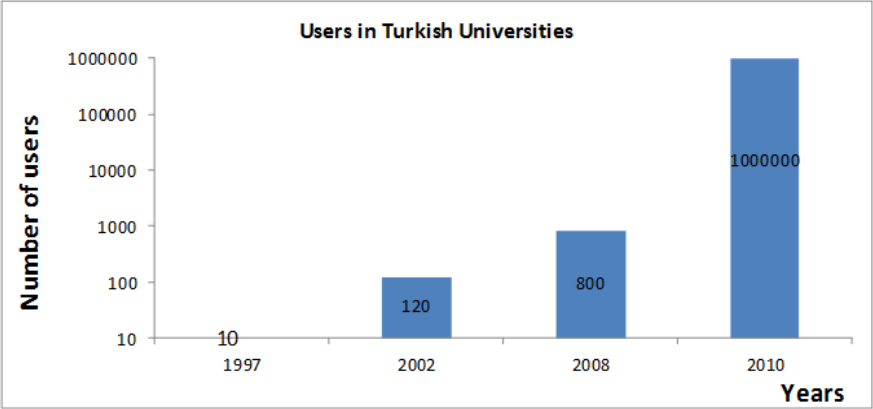


Figure 2.5. Number of the users in Turkish Universities (Yamamoto et al., 2010).

2.5.2.4 Factors influencing e-learning in Turkey

Total population in 2014 was recorded at 77.32 million people (www.statista.com). The official language is Turkish and minority languages are Kurdish, Arabic, Circassian and others (Fig. 2.6).

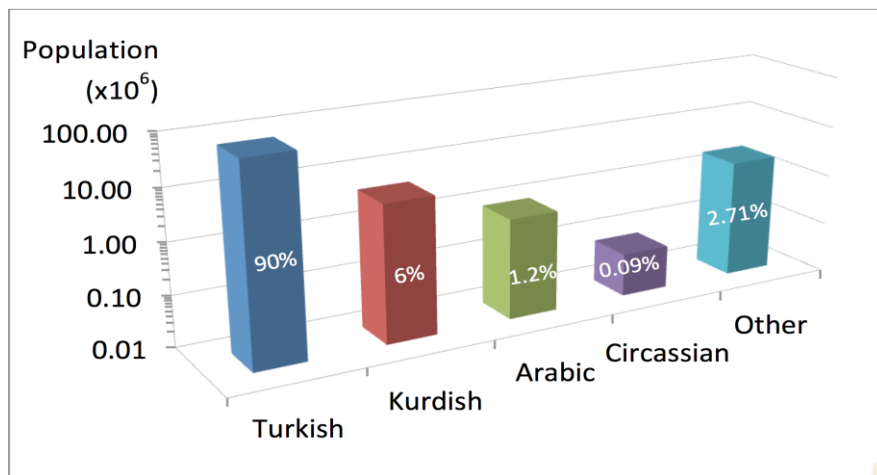


Figure 2.6. Languages in Turkey (www.statista.com)

In 1923, with the aim of establishing a secular, Westernized Turkey, Mustafa Kemal Atatürk began to implement his modernization policy in which he desired to create a new regime based upon concepts of cultural unity, rationalism, secularism and a liberal economy. In this respect, all former Ottoman subjects living in Anatolia were accepted as members of the new Turkish nation. However, this policy of cultural unity pursued by the Kemalists gave rise to the emergence of Kurdish uprisings against the central government ever since 1925. Until the 1990s, the Turkish government rejected the Kurdish identity as well as the Kurdish issue (Efegil, 2011).

Turkey is officially a secular country. Islam is the largest religion of Turkey with around 81% percent of the population being a Muslims. Christians (Oriental Orthodoxy, Greek Orthodox and Armenian Apostolic) and Jews (Sephardi), who comprise the non-Muslim population, make up 0.7% of the total (Reis and Gulsecen, 2014). Due to almost all children in Turkey involved into learning of basic rules of Islamic religion this factor and motivation points derived from Islam are becoming important in the pupils future attitudes for a higher education and for e-learning in particular. Islam strongly motivates its followers for study and increasing of knowledge in all life aspects. As evidence, the development of a science in the Middle Ages, called “Islamic Golden Age”, by Muslim scholars after spreading of Islam. The Muslim scientists, fathers of modern science, developed a scientific method, and established a basement for all scientific units, as mathematics, chemistry, physics, astronomy, medicine, etc. (Durant, 1980; Saliba, 1994; Jacquart, 2008). The world's oldest degree-granting university the University of Al-Karaouine, founded in 859, is related to this time period (The Guinness book of records, 1998).

Turkish society is strongly separated by social status that could be related to a negative side. Main factors affect the separation are wealth and education. Number of poor people in Turkey has reached 20 million in 2003. About 23% of families and 37.8% of pre-school children live under poverty line (Acar et al., 2006). The basic categories include the wealthy urban educated class, the urban middle class, the urban lower class, the large rural landowner class, and the general rural population. A university education is the minimum qualification for entry into the urban educated class, in which there are numerous substrata.

However, there are number of positive sides in Turkish culture, which could have influence on e-learning. Very strong following traditions, culture and respect of ethical values is an integral feature of Turkish people. One of the important and specific Turkish customs, usual for eastern and Caucasian nations and unfamiliar for European and Western world, came from the past and based on a full trust to the teacher. Children were giving by parents to a teacher for a long study. The teacher was becoming the next person after parents. A strict upbringing of children and respect of parents and older people are another basic customs in Turkey. Usually the word of parents is a law as well for small children, as for adults. Turkish traditions, customs and ethical values are identical with almost all the minority nations living in Turkey.

According to the CIA, Turkey had following population age distribution in 2014: ages 0–14: 25.5%, ages 15–24: 16.8%, ages 25–54: 42.9%, ages 55–64: 8.1% and 65 years and over: 6.7% (www.cia.gov). Approximately half of the population of Turkey is younger than 28 years old (Reis and Gulsecen, 2014).

E-learning system in higher education in Turkey has poorly developed technical infrastructure and lack of consortia between universities. New projects could not be supported due to financial mechanisms for e-learning development are absent in Turkey. Significant specific barriers are huge number of students and very low number of resources (lecturers, courses, and infrastructure). There are many barriers, which brake down progress of e-learning in higher education in Turkey. However, there is a huge potential for elaboration and need of assistance to evolve this area.

2.5.3 Summary of factors Estonia and Turkey

In contradiction with Estonia, Turkey is a big country with large population, where the problems in e-learning systems in higher education occurred from technical and pedagogical barriers. Consortium between universities of Turkey doesn't exist in the largest universities, when consortium between universities of Estonia has worked very well. Estonian users has united e-learning platform for collaboration, but there is no such unity in Turkey. Financial mechanisms in EU, including Estonia, to support e-learning projects are well developed. At the same time, there is no such regulation in Turkish policy. Low number of students together with high number of e-learning system courses available in Estonia e-learning in higher education. This study shows huge number of students and insignificant number of lecturers and available e-learning system courses in Turkey.

2.6 The context analysis

In the next chapters I will analyse e-learning systems status in Estonia and Turkey. Comparison of e-learning systems and activities in the field of study in both countries will be provided.

2.6.1 E-learning status in Estonia

Nowadays, e-learning system in higher education of Estonia has most of the barriers in pedagogical way, than in technical way. Technical infrastructure in e-learning system is on a high level, where some few problems can't influence to the quality of this system. In the process of e-learning system, as pedagogical barriers, some issues have been identified, which are listed as follows (Dremljuga-Telk et al. 2011):

- Some of the lecturers want to give lessons face to face and for this reason they can't except to use e-learning system
- Content to be transferred onto the internet in a monotonous way
- Excessive or inadequate presentation of information
- No transparency in results of examinations time
- Appropriate and timely feedback cannot be given.

Based on the sources mentioned above, the strategic implementation of e-learning development was carried out in Estonia during the first phase (1997–2005), but after the establishment of Estonian IT Foundation and its E-learning Development Centre, the centralised coordination started to play more important. Centrally funded and hosted e-learning services (LMS, repositories of learning objects) boosted experimentation with new instructional designs by growing number of university staff. This was supported by centralised staff training opportunities provided by Estonian IT Foundation (EITSA), which had impact on disseminating the new e-paradigm (collaborative blended learning). Within the period of 2004–2012, more than 4,800 fully or partly online courses were created and taught in centralised Moodle LMS and additional 4,200 courses were made available through locally developed IVA LMS platform (Laanpere, 2013). In the universities that belonged to Estonian E-university consortium, more than 40% of all courses included e-learning component by 2013.

2.6.2 E-learning status in Turkey

As we suspected, in general the e-learning system aren't widely used and implemented in many universities in Turkey. Exceptionally, there are small universities, which have established or successfully applied these systems in the past. Most of the problems in the e-learning systems came from the largest universities like AU, IU, SU or Ankara University (Nart and Altunisik, 2013). Almost in the AU, where capacity of students is around 2 million, we have seen that problems came from technical and pedagogical barriers (Yamamoto et al., 2010, 2011). There are three important explanations that can describe the e-learning system in relation of

technology infrastructure and their barriers, including hardware and software, which are shown below:

- Technological infrastructure is the foundation of e-learning system that has to be taken firstly into consideration. The accurate and purposeful e-learning infrastructure planned facilities cannot be used without technology innovation, content excellence, trainers and learners qualifications, intended to achieve the goals
- E-learning necessary hardware for computers, servers (web server, email server, video server, voice server, chat server, etc.), modems, network appliances, wireless devices, printers, scanners, cameras, microphones, backup and storage devices consist of e-learning software size, the word processor, e-mail packages, presentation programs, support software (plug-ins), data bases, learning management systems (LMS), learning content management systems (LCMS), authoring tools
- E-learning system in the design of bandwidth, connection speed, the quality of materials used, such as multi-media considerations appear to be advantages on the one hand, the wrong choice of technology or technology barriers can arise as impossibilities. An e-learning application speed internet connection, voice and video communication will enable the necessary software and hardware with a learner for an enjoyable e-learning experience gives an impression of slow, limited internet connectivity, with the necessary technological hardware and software lacks another learning a serious emerges as a barrier.

There are technical barriers in e-learning system of the largest universities of Turkey (Yamamoto et al., 2011):

- Lack of or insufficient speed of internet access
- Lack of the equipment required
- The absence of a computer program or programs
- Available computer program or programs not being up to date
- Costs of the related software needed, authoring tools or systems
- The software needed, authoring tools or nature and quality of systems
- Personal and corporate security concerns
- Unsafe technology infrastructure and inconsistencies in access to e-learning environment
- The quality of multimedia materials used, the suitability and design
- Interface and visual design
- Technical limitations
- Technical infrastructure, authoring tools or systems, such as excessive expectations regarding the capacity of the technological elements
- Read program design and limitations on the use of multimedia material
- Absence or lack of technological infrastructure

In the process of e-learning system, as pedagogical barriers, we have identified some additional issues, which are listed as follows (Yamamoto et al., 2011):

- E-learning content did not match the expectations of learners
- Content to attract the attention of students

- E-learning programs and quality concerns related to the conformity of inconsistency of content, logical errors, lack of clear improper design, improper content, wrong methods, techniques and strategy selection
- To appeal to different learning styles, one being flat and boring
- Allowing applications to interact failure, ineffectiveness
- Content to be transferred onto the internet in a monotonous way
- Lack of instructional design
- Excessive or inadequate presentation of information
- Multimedia materials timely and appropriately used in improper system of educational content, authoring tool or work placement programs
- Appropriate and timely feedback cannot be given

The main Turkish universities, e.g. Anadolu, Ankara and Sakarya, independently have well designed systems for e-learning and distance education for high level education: (1) Anadolu University Open Education System, (2) Ankara University's Distance Education Centre (ANKUZEM), (3) Distance Learning Research and Development Centre, respectively. During last decade this systems and programs of e-learning already showed progress and significant results (Latchem et al., 2006; Mutlu, 2004). In 2007, more than 550,000 students logged in the portal of Anadolu University Open Education System more than 11.7 million times and used the e-learning services (Anadolu University, 2008). ANKUZEM currently serves 1,190 distance education students, 940 at undergraduate level and 250 at certificate level. In 2009, in the Distance Learning Research and Development Centre at SU were registered 50 students for the four-year degree programs, 460 postgraduate students, 41 in master's program. At the same time, there is a lack of cooperation between these institutions. Due to different approaches of the systems, users of different universities don't have possibility to collaborate, exchange knowledge and experience.

2.6.3 Comparisons of e-learning systems in higher education between Estonia and Turkey

In the area of higher education, e-learning system is playing an important role in both countries, such as Estonia and Turkey. Estonia is a small country, in comparison with Turkey. High level e-learning systems were implemented in Estonia. However, there are some problems due to pedagogical barriers. From other side we have Turkey with large population, where the problems occurred from technical and pedagogical barriers. There are different reasons to understand that e-learning systems have these kinds of barriers, which are:

- Consortium between universities of Turkey doesn't exist in the largest university, such as AU, SU, IU, Ankara and Middle East Technical University. In some universities we have important problems to collaborate the faculties with each other's
- Consortium between universities of Estonia has worked very well, where 10 universities are collaborating together for increasing the quality of e-learning system

- There is no unique e-learning platform in Turkey. Each university uses their own system.
- United e-learning environment (Moodle) supports productive cooperation between all participants of e-learning at higher education in Estonian universities.
- The budget in the largest universities of Turkey weren't enough for minimizing these important barriers that we mentioned above
- The probability is very low to participate and to get different projects from European Union (EU) because the capacity of these largest universities is too high
- In case of Estonia, the probability is too high for getting different projects from EU because the capacity of largest universities is fifty times lower than Turkish universities and they have all the facilities for implementation their projects successfully.
-

2.6.4 Comparisons of e-learning activities

The activities in the field of e-learning systems in the three largest Estonian and Turkish universities (UT, TUT, TU and AU, IU, SU, respectively) were studied and compared for the first time.

Within the period of 2004–2012, more than 4,800 fully or partly online courses were created and taught in centralized Moodle LMS and additional 4,200 courses were made available through locally developed IVA LMS platform in Estonian universities (Laanpere, 2013). In the universities that belonged to Estonian E-university consortium, more than 40% of all courses included e-learning component by 2013 (Güllü et al., 2014). According to this study in 2013–2014 academic years in total 146,067 students were attending 5,388 web-based or e-learning courses in three largest Estonian universities UT, TUT, TU (Fig. 2.7). Total number of students in 2013 at UT (16,000; www.studyinestonia.ee), TUT (13,050; www.ttu.ee) and TU (10,209; www.tlu.ee) was 39,259 that is 65% of total students in higher education in Estonia (59,998; www.ttu.ee; Fig. 2.7). Total number of an academic staff in 2013 at UT (1,800; www.studyinestonia.ee), TUT (1,731; www.ttu.ee) and TU (460; www.tlu.ee) was 3,991 (Güllü et al., 2016; Fig. 2.8).

Total number of students in Turkish largest universities in 2013 was 1,194,735: >1 mln. in AU (www.anadolu.edu.tr), 109,901 in IU (www.istanbul.edu.tr) and 84,834 in SU (about.sakarya.edu.tr). It is 24% of total number of students in higher education in Turkey (4.9 mln; www.studyinturkey.com; Fig. 2.7; Güllü et al., 2016).

Total number of an academic staff in 2013 at AU (2,000; www.anadolu.edu.tr), IU (5,100; www.istanbul.edu.tr) and SU (1,976; about.sakarya.edu.tr) was 9,076 (Fig. 2.8; Güllü et al., 2016). Big difference in total number of e-courses and attending students was determined in the studied universities of two countries. The Estonian institutions

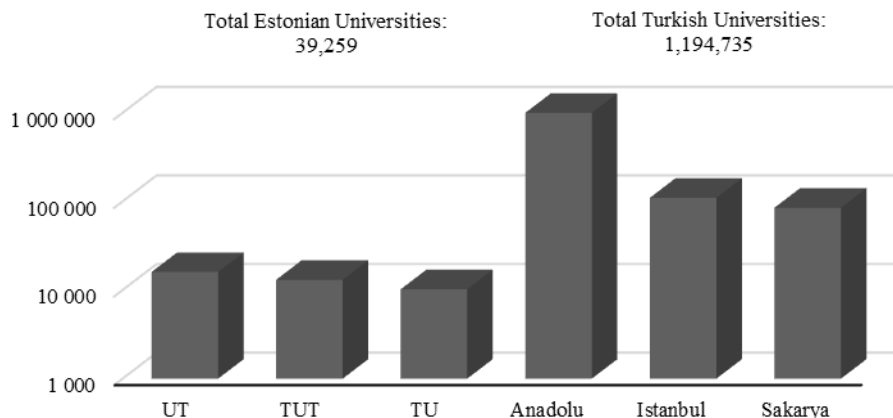


Figure 2.7. Number of students in largest universities of Estonia and Turkey

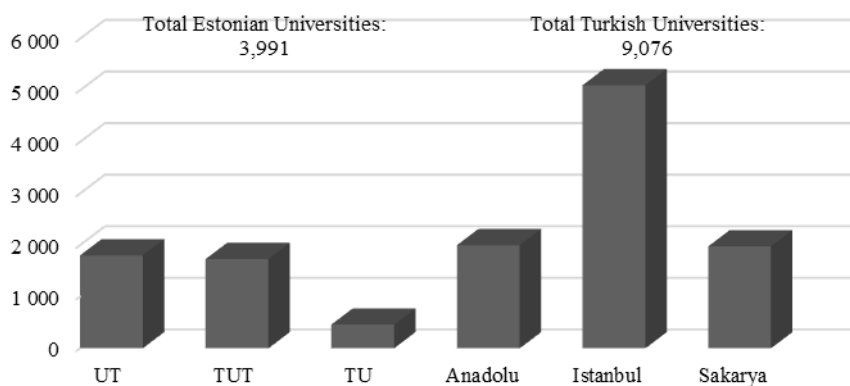


Figure 2.8. Number of academic staff in largest universities of Estonia and Turkey

were presented by high number of available e-courses (5,388) and more than ten times less, in comparison with Turkish universities, number of students (146,067).

At the same time quality of e-courses and educational programs were significantly higher (Güllü et al., 2015b), as well as opportunities for new projects proposals for Estonian universities was wider. Small number of available e-programs (234) at studied universities in Turkey, that is 25 times less than in Estonian site, have shown incredible capacity (1,194,735 students). However, number of technical, economical and pedagogical barriers was an obstructing factor for productive development of the studied area in Turkish higher education. We found that Turkish students were less equipped technically in comparison with Estonian students. Almost all students in Estonia had laptops and/tablets and therefore are ready for productive e-learning study. Also Estonian universities were better supplied with technologies. They had high level

computer classes and laboratories, one of the fastest in the world Wi-Fi internet connection available in all area of universities, widespread free Wi-Fi spots around the country, unique educational platform that make e-learning study in higher education more easy and friendly for Estonian students. From another site Turkish students had problems with access to gadgets, as well as to a reliable and free internet connection. Also, there was no united platform between all studied universities for e-learning study at higher education.

2.7 Summary

Model of e-learning systems in higher education in Turkey was analyzed and found that there is no united e-learning system in Turkey. The most of universities are using their own platforms and there is no standardization requirements in Turkish higher e-learning systems. Consortium between universities of Turkey doesn't exist in the largest universities, when consortium between universities of Estonia has worked very well. Estonian users has united e-learning platform for collaboration, but there is no such unity in Turkey. Financial mechanisms in EU, including Estonia, to support e-learning projects are well developed. At the same time, there is no such regulation in Turkish policy.

Different theories, models of e-learning systems, adoption models were studied (chapter 2.3). The requirements for the electronic educational model needed to be implemented in Turkish higher education were established. The model should take into account differences between groups of students with different age, instructivist and constructivist approaches, cultural diversities, to understand ability of each student for learning, relations between students and social factors (socio-cultural factors: language, education language, population age, customs and traditions, religious, ethical values), specification of technology (chapter 2.2).

Implementation of standards of e-learning system is significant to be implemented in e-learning model to unify the process of adaptation and integration of e-learning system with available sources (chapter 2.3.1). The model should explain and predict user behaviour of information technology. The model should be united standardized model that can be easily implemented in any institution around the world. At the same time it is intelligent structure that can be modernize its self, using its own experience and flexible to accept new ideas and delete ineffective patterns.

The main point of the modern progressive model is an ability of the model to include complex needs, interests, requirements and limitations of the students. The new progressive model must be very flexible, adaptive and universal for any time, country, society and any other type of context. At the same time it should be simple and understandable to be easily adopted and implemented in any environment and by users with any level of experience.

According to needs of my study and requirements established for model needed to be implemented in Turkish higher education the Cloetes' EES model was selected for this study. EES model is flexible, due to top-down and a bottom-up algorithm, takes into account instructivist and constructivist approaches, makes available implementation of standardization of e-learning systems to unify the process of adaptation and integration of e-learning systems with available sources (chapter 2.2.1). Some of disadvantages needed to be updated are: no possibilities for more flexible scheduling, no specification of technology that could be used for e-learning system and absence of socio-cultural objects.

3. RESEARCH DESIGN AND METHODOLOGY

In this chapter I will review methodological patterns used in the study, present description of methodology for research design.

3.1 Methodological considerations

In recent years, several researchers succeeded in bringing design research into the information systems research community, successfully making the case for the validity and value of design science as an information systems research paradigm (Walls et al., 1992; March and Smith, 1995; Hevner et al., 2004) and actually integrating design as a major component of research (Nunamaker et al., 1990). In spite of these successful efforts to define design science as a legitimate research paradigm, design science research has been slow to diffuse into the mainstream of information systems research in the past 15 years (Walls et al., 2004) and much of it has been published in engineering journals (Peffer et al., 2008).

Design science research in information systems may still be evolving. It involves a rigorous process to design artefacts to solve observed problems, to make research contributions, to evaluate the designs, and to communicate the results to appropriate audiences (Hevner et al., 2004; Peffer et al., 2008). The definition of design science research includes any designed object with an embedded solution to an understood research problem (Peffer et al., 2008).

The design science research methodology (DSRM) presented by Peffer et al. (2008) incorporates principles, practices, and procedures required to carry out such research and meets three objectives: it is consistent with prior literature, it provides a nominal *process model* for doing design science research, and it provides a *mental model* for presenting and evaluating design science research in information systems.

Peffer et al. (2008) mentioned last developments in process modelling design (Archer, 1984; Nunamaker et al., 1990; Eekels and Roozenburg, 1991; Rossi and Sein, 2003; Adams and Courtney, 2004; Cole et al., 2005), however, remarked that there is still lack of complete model for design science research in information systems.

The final objective of a DSRM process by Peffer et al. (2008) is to provide a mental model for the characteristics of research outputs. Details on a mental model can be found in studies of March and Smith (1995), Johnson-Laird and Byrne (2000) and Hevner et al. (2004). A mental model can help researchers to serve the design science research effectively (Peffer et al., 2008).

Number of e-learning research approaches based on researcher's intervention to the study process, involvement of teachers and learners in designing this intervention, multivocal combination of various data collection and analysis methods were mentioned by Laanpere (2013). Such approaches are, for instance, participatory action research (Whyte, 1991), design experiments (Brown, 1992), developmental research (van den Akker, 1999) and design-based research (Design-Based Research Collective, 2003).

In this thesis I used the most suitable methodological framework - Design-Based Research (DBR). DBR was defined by Wang and Hannafin (2005) as “a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories”. Just as design experiments and action research, DBR improves chances for creating synergies between research, pedagogical design and engineering of new software tools (Brown, 1992). DBR was born within the community of educational researchers, on the other hand the approach is similar to one used in other design-oriented sciences, e.g. human-computer interaction (Laanpere, 2013).

This study was based on Leinonen’s (2010) adaptation of DBR, labelled as research-based design, where software development is brought to the foreground and participatory design-based research activities provide input to design decisions. Leinonen’s model is iterative, consisting of four phases (ibid.):

- Contextual inquiry – studying trends, benchmarking, ethnographic studies, which result with defining the context and preliminary design challenges
- Participatory design – engaging users in designing scenarios, conceptual models, which result with defining the key concepts and their relations
- Product design – creating user stories, use cases, throwaway prototypes, which define basic interactions
- Production of software as hypothesis – from developing and pilot-testing early prototypes towards feature-rich and fully functional software.

3.2 Research design

Educational technology is an applied design science in which the foremost goal is to improve educational practice. The essential way the field of educational technology can improve educational practice is through design of innovative interventions to resolve educational problems and produce design knowledge (Reeves, 2006). In design research, design also functions as both a type of knowledge and a strategy. Design knowledge derived from the literature guides the design research process, and enacted design grounded in the real world provides a basis for developing and refining multiple theories such as design frameworks and design methodologies (Edelson, 2002). Design researchers constantly engage in design and redesign, striving to maximize the possibility of designing better solutions to the problems of practitioners while seeking opportunities to better understand the implication of design theory and principles (Oh and Reeves, 2010).

Design research has more pragmatic goals than traditional educational research. Design research aims to solve problems in educational practice by designing innovative interventions and enacting and refining theories and design principles (Wang and Hannafin, 2005; van den Akker et al., 2006). Design research is theory-driven (van den Akker et al., 2006; Reinking and Bradley, 2008). It begins with problem definition arrived at in concert with practitioners and integrated with in-depth

investigation and analysis of the current literature to enact conjectured initial theories. These enacted theories are continuously elaborated throughout the intertwined processes of design and research, and they also function as a design framework for interventions throughout the process (van den Akker et al., 2006). Since the purpose of design research is improvement of educational practice, all these processes are embedded in naturalistic settings where complex variables associated with real problems and complicated dynamics of multiple stakeholders exist (Wang and Hannafin, 2005; Reinking and Bradley, 2008). Design research requires intensive interactive collaboration among researchers and practitioners (Reeves, 2006). Design research involves the continuous iterative cycle of “design, enactment, implementation, analysis, and redesign” (DBRC, 2003). Design researchers develop and implement their interventions constructed on theory based conjectures. These “embodied conjectures” (Sandoval, 2004) are refined through the process of implementation and analysis along with reflection (Cobb et al., 2003) to support the revision of design. This prospective and reflective nature also makes design research flexible. At the same time that enacted designs are implemented, data continuously collected, and initial conjectures tested with designs. Design and research plans can be modified flexibly based upon changing needs and conditions. Design research is integrative since researchers utilize multiple research methods and approaches from multiple sources to enhance the “objectivity, validity, and applicability of the ongoing research” (Wang and Hannafin, 2005). Compared to other methodologies, which utilize certain dominant methods to collect and analyse data, any approach can be appropriate, depending on the design researcher’s needs and justification (Reinking and Bradley, 2008). That is, design researchers may use different methods and approaches at different stages to address emerging needs and issues as the focus of research is adjusted. Instructional designers also collect data from multiple sources and use multiple methods. Design research is contextual because “research results need to be connected with both the design process through which results are generated and the setting where research is conducted” (Wang and Hannafin, 2005). Design research is conducted in naturalistic settings in which the designed intervention is implemented and researched in an environment in which complex dynamics, interactions and variables exist. Design researchers co-design interventions and learning environments with practitioners, study them deeply throughout implementation of interventions, experience the learning contexts, and gain insights into how better to employ, revise and adopt interventions in new settings (Kelly et al., 2008; Oh and Reeves, 2010).

4. Analysis and development of EES model

In this chapter I will introduce in details EES model and EES model-2, analyses of e-learning activities using a new pilot model for Turkey EES model-2 and research based design model.

4.1 EES model

Because enabling technologies present many opportunities as well as challenges in the realizing of e-learning, it is imperative that educators and institutions planning to embark on the development of e-learning systems, have a clear and accurate understanding of the capabilities, limitations and influences of these technologies (Cloete, 2000). Creative approaches and competent strategies to manage these limitations at the instructional design, the user levels as well as integration to other systems, need to be established and understood in order to ensure a degree of quality comparable to that of traditional learning. Without the integration of well-established methods and techniques, many of the e-learning efforts may be futile, leaving frustrated facilitators and badly educated students in their wake (Cloete, 1999, 2001).

The creation of an e-learning system needs to have a model. The first generation of e-learning system was to manage and measure the learning process, display some kind of learning objects but they didn't deal with reusability and organization. These were the Learning Management System. The second generation of e-learning systems, based on Ismail (2002), has to be able to manage searchable, reusable and platform-independent learning objects. Cloete (2001) has improved the system and developed a layered model for second-generation e-learning systems: Electronic Education System Model (EES).

There are number of different architecture models available in the field. According to needs of our study and advices from specialist in the field, the EES model was selected for this research due to its flexibility and compatibility with TAM2 model, used in this study.

The aim of the model was to assist the designers of different e-learning system settings to plan and implement a specific learning situation, with the focus on the individual requirements and milieu of the learning group. The multilevel EES model contains four layers (Fig. 4.1, Cloete, 2001).

These layers are strictly separated in their functions and each layer uses the services of the lower level layers (Dulai et al., 2013). The strategic development of e-learning can be carried out either on top-down or bottom-up manner, or as combination of both (Güllü et al., 2014). Their target is application of the potential of e-learning to enhance teaching and learning. In addition, staff training is seen as essential to successful e-learning but flexible support structures and mechanisms are seen as even more important (Mac Keogh and Fox, 2009; Drlik and Skalka, 2011).

However, need to update existing EES model raised from the modern issues influenced on educational process in our society. We explored that diversities of age, religion, language, culture are making significant influence on educational process of

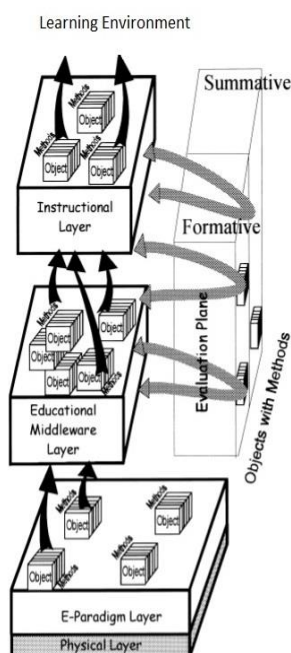


Figure 4.1. Four-tier model for Electronic Education System (Cloete, 2001).

current generation of students.

According to number of studies based on personal interviews and detailed research we found that current students can be older, more religious and with strongly marked commitments to language, culture and nationality (e.g. Stolzenberg et al., 1995; Myers, 1996; Sherkat, 1998; Sherkat, 2007; Terry and Irving, 2010; Cavazos, 2015).

I explored that weak side of EES model is absence of socio-cultural factors as age, religion, language and culture. These factors are making significant influence on educational process of current generation of students. According to number of studies based on personal interviews and detailed research I found that current students can be older, more religious and with strong preferences for language, culture and nationality. Today, it is very important option for nowadays educations system to understand socio-cultural differences for different nationalities. Absence of socio-cultural object is a gap of EES model.

The most important components of socio-cultural factor with higher influence on e-learning at higher education are in Estonia: language, education language, population age and customs and traditions. The language, religious, customs, traditions and ethical values and population age are components play significant role in e-learning at higher education in Turkey. The language is the main component in the both countries. However, in Estonia this component is strengthened by education language component, that absent in Turkish case. The next component, according to its' importance for e-learning at higher education in Estonia is population age. The same component in Turkey is the last one according to its importance. Three other

components having higher influence for e-learning in Turkey are religion, customs and traditions and ethical values. Customs and traditions components in Estonian case have minor impact to e-learning.

Various models were analysed for understanding users' adoption of new technologies: TAM, TRA, TPB, and UTAUT. Each of these models has sought to identify the factors which influence a citizen's intention or actual use of information technology. TAM is a theoretical model that helps to explain and predict user behaviour of information technology. The best appropriate model for the EES Model-2 was selected TAM2 model. TAM2 appears to be able to account for 60 percent of user adoption. TAM2 model was selected to study how e-learning systems were adopted by main users-lecturers. TAM2 extended the original TAM model to explain perceived usefulness and usage intentions including social influence (subjective norm, voluntariness, and image), cognitive instrumental processes (job relevance, output quality, and result demonstrability) and experience (Park, 2009).

Next I describe EES Model in detail.

4.1.1 Instructional layer (uppermost)

The purpose of the instructional layer is to serve as a window between the learning process and the underlying strategies necessary to establish the learning environment. The instructional layer is composed of various objects, each containing one or more methods (Fig. 4.1, Cloete, 2001).

4.1.1.1 Analysis of instructional layer

I analysed EES model on the basis of e-learning theories: Behavioural, Information processing, Socio-cultural learning, Knowledge Building, Trialogical learning approach and found gaps and strong sides. Trialogical learning approach aimed at developing of pedagogical models, tools for organizing learners' activities and social interactions within e-learning.

The need to update existing EES model raised from the recent issues influenced on educational process in our society. Instructional layer of EES model provides course communication objects when designing a specific learning situation. Course designers may decide to include only e-mail for course communication or provide their courses with wider communication environment by including telephone, discussion groups, and chat facilities as the means of course communication. It is very important option for communication between student and teacher. The gap of the communication object is lack of individual and specific approaches can be implemented for different persons during the courses.

Instructional layer of EES model describes also the pedagogic paradigm objects. The pedagogic paradigm object of EES model provides ways to get course content by students and to gain skills, such as critical thinking, deeper understanding, problem solving, writing, construction, etc. Some of the methods that may be included in this

object are (1) learn-by-reading, (2) learn-by-discovery, (3) learn-by-doing, (4) cooperative learning, etc.

4.1.2 Educational layer (middleware)

The educational middleware layer provides services for a reliable and effective learning environment. It accomplishes this task by supplying a set of tools to support educational programmes such as managing access for retrieval of courseware, authorising data entries to the server, providing a central repository structure for course material, with efficient storage mechanisms optimised for different media types with indexing and retrieval facilities. Three other major functions on this level include the provision of an integrated user interface, with the objective to buffer the student from the technology behind the content, the establishment of enabling technologies for electronic submissions of assignments for automatic assessment and grading, and the integration of the learning environment with other institutional systems (Cloete, 2001).

4.1.2.1 Analysis of educational middleware layer

Elements of the educational middleware layer were identified as (1) user authentication, (2) assignment, (3) course enrolments and (4) testing services. Implementation of standardization of e-learning systems is important in e-learning models and platforms to unify the process of adaptation and integration of e-learning with available sources. Educational middleware layer is a strong side of EES model. The main standards of e-learning systems, IEEE, IMS Global Learning Consortium, ADL and SCORM, must be applied to e-learning content and to e-learning platforms with an aim to fully support the reuse of content across systems and standardize the delivery e-learning content. For example, in Turkey all universities use their own e-learning systems and don't follow standards for unification of systems.

4.1.3 E-paradigm layer

The objective of the e-paradigm layer is to provide an electronic learning paradigm composed of technological strategies possible in electronic learning. The objects found on this layer form the basis of the specific learning situation. They often prescribe which objects from upper layers may be suitable for selection (Cloete, 2001). The E-paradigm layer represented by "Possible technological strategies" (synchronous, asynchronous). The synchronous and asynchronous objects are commonly identified on the e-paradigm layer. In synchronous learning environments geographically dispersed, students and lecturers share a virtual classroom within the same physical time frame. Examples include remote lecture rooms with video conferencing, or students attending real-time lecture from home. The asynchronous object is characterised by its being independent of location, time, and learning speed of the learner. A typical example is that of the learner who prefers to study at his/her own place and time. The number of methods for objects on this layer is limited, and is realised on other levels. For example, selection of the asynchronous object will have a direct influence on the methods of the course distribution object found on the educational

middleware layer. Methods may be through web downloads or precompiled CDs while in the synchronous environment, e-books and on-line material may be more relevant (Cloete, 2001).

4.1.3.1 Analysis of e-paradigm layer

The objective of the E-paradigm layer is to provide an electronic learning paradigm composed of technological strategies possible in electronic learning. There are two options in EES model which students have to choose: (1) Synchronous and (2) Asynchronous objects, or possible technological strategies. It is not enough for nowadays requirements for e-learning education. Today it is very important for student and teacher to have more flexible scheduling. It is weak side of EES model. Object “combination” that explains by combination of synchronous and asynchronous objects was added into the E-paradigm layer of a new pilot model for Turkey EES Model-2.

4.1.4 Physical layer (bottom)

The physical layer provides for the transparent transmission of messages (which may be course communication, course material or course directives) between students and lecturers tied together in an e-learning scenario. The physical layer includes the specification of hardware and software technology objects necessary to accomplish e-learning. The number of methods included in these objects is usually limited to one but may sometimes extend to two. For example, an object on this layer may be an Internet connection. The methods of the Internet connection object describe the prerequisite hardware and software strategies necessary to accomplish an Internet connection.

4.1.4.1 Analysis of physical layer

The Physical layer of the EES model includes the specification of hardware and software technology objects necessary to accomplish e-learning. Weak side of EES model is that there is no specification of technology that could be used for e-learning. To make an effective e-learning model we should propose specific learning environment options. Using Physical layer I have made analyses of situation in e-learning systems in higher education in Turkey. I have found that e-learning system in higher education in Turkey has poorly developed the technical infrastructure and lack of consortia between universities exists. Elements of Physical layer give opportunity to focus on such specific but important for e-learning education moments such as available devices for students. A new pilot model for Turkey EES Model-2 includes options – Government purchased devices, when student receive necessary devices from government (e.g. laptops, tablets, etc.), using own devices – Bring Your Own Devices (BYOD) and using Computer laboratories on the basis of institutions. Element of the physical layer BYOD has two options – single and multiplatform. Single platform approach set a frames for technical parameters of needed gadgets for education (explaining a strict parameters: technical options, type of gadget: laptop or tablet, PC or Macintosh, etc.). The Multiplatform approach gives wider opportunities

for gadgets parameters making implementation of this model and especially this layer more flexible in the future, when technologies will be changed. I have found lack of computer laboratories in Turkish universities. That's why element "Computer laboratories" was implemented in the model.

4.1.5 Evaluation plane

An evaluation plane stretches across the top two layers. This plane performs evaluation functions related to these two layers as a whole. The purpose of the evaluation layer is to determine whether or not the methods selected from the instructional layer and from the educational middleware layer are accomplishing the established goals and objectives. The evaluation plane is divided into a summative evaluation sub-plane and a formative evaluation sub-plane. Formative evaluation is typically conducted during the lifetime of a process, whereas summative evaluation is conducted at the end, or after the lifetime of a process (Wills, 1995; Cloete, 2001). In an e-learning system, one may for example choose to do both types of evaluation and must then include objects from both sub-planes, or one can include only one type of evaluation, analysing one's learning situation through various methods (from selected objects) as found in that particular sub-plane. More detailed description of evaluation plane can be found in Cloete (2001).

4.1.5.1 Analysis of evaluation plane

Evaluation plane, performing evaluation functions of Instructional and Educational middleware layers is very strong side for EES model. The purpose of the evaluation layer is to determine whether or not the methods selected from the Instructional layer and from the Educational middleware layer are accomplishing the established goals and objectives. Formative evaluation is typically conducted during the lifetime of a process, whereas summative evaluation is conducted at the end, or after the lifetime of a process.

4.1.6 Algorithms of modelling

A top-down algorithm and a bottom-up algorithm are two natural approaches to the design of a strategic model for a particular e-learning situation. The top-down approach is preferable where the options available on the physical layer are not restricted. For example, where all students have full-time access to the Internet, there is no restriction and any e-paradigm object may be selected, because the underlying services are available. The bottom-up approach is suitable where limitations exist on the physical layer, such as restricted Internet access. In the next two sections we describe the progression in each of these two approaches (Cloete, 2001).

4.1.6.1 Top-down approach

In the top-down approach, planners, schedulers and facilitators initiate the mapping of the EES model onto the specific learning situation by first selecting objects from the instructional layer to be incorporated into their design plan. The services necessary to realise the chosen objects are then selected from the educational middleware layer. Other objects on the educational middleware layer which may not be of direct service to the objects from the top layer can also be identified. The objective of these additional objects will be to enhance and enrich the infrastructure of the learning environment. However, the methods of objects on the educational middleware layer are often labour-intensive and require a well-established base of support. If embarking on an innovative e-learning effort without the backing of a support group, one should be very careful not to select sophisticated methods within objects from this layer. The target group of students and the objects chosen from the top layers will often suggest the objects and the methods to be selected on the e-paradigm and the physical layers. For example, selection of a video-conferencing method (from the course communication object on the instructional layer), and a specialised virtual classroom software method (from the interface object on the educational middleware layer), suggest the selection of a synchronous paradigm object from the e-paradigm layer, with a permanent connection object from the physical layer (Cloete, 2001).

4.1.6.2 Bottom-up approach

In the bottom-up approach, the course designers are often limited in their course design by restrictions on the physical layer such as restricted Internet access. It, therefore, makes sense to take these restrictions into account and select objects and methods from the bottom layer, before considering the specific e-paradigm of the target group. Once suitable objects and methods from the e-paradigm layer are selected, one can eliminate certain (obvious) objects from the educational middleware layer that might only be suitable for courses in unrestricted environments, or move straight on to the next step where designers consider the desired instructional environment for the planned course. Objects and methods matching the desired goals and pedagogy of the course can subsequently be selected from the instructional layer. The services necessary to realize the chosen objects from the instruction layer are then selected from the educational middleware layer. In both approaches, the final steps include the selection of such evaluation objects and methods as the designers and facilitators wish to implement. Although evaluation is often neglected, we wish to stress the importance of including objects from the evaluation plane. Identification of strengths and successes and also of gaps and weaknesses in the instructional process is equally important to ensure effective and quality learning. Only by analyzing the results of evaluation data that were gathered by a method included in the design of the course, can these goals be achieved (Cloete, 2001).

4.1.6.3 Analysis of top-down approach

A top-down and a bottom-up algorithm are two natural approaches to the design of a strategic model for a particular e-learning situation. This option makes design of e-learning systems flexible and characterised as strong side of Cloets' EES model.

The importance of advanced electronic technologies, such as the Internet, to education has increased significantly during the past few years. In order for electronic learning systems making use of these technologies to be successful, effective and of a quality comparable to some of the traditional educational learning systems, the electronic learning systems must be designed and constructed with care, using a scientific approach embracing well-designed procedures and techniques.

4.2 EES Model-2

Uptake of e-learning in one country does not depend only on the choice or design of tools and platforms, it is equally important to take into account the sociocultural factors while implementing e-learning innovations. Collins and Halverson (2009) argues that there is a need to rethink education in the age of technology. By applying the sociotechnical paradigm, new ways of teaching and learning in a networked world might be prepared. Typical sociotechnical systems are, for example, groupware systems, knowledge-management systems and applications for social networking. The challenge of such sociotechnical systems is to design the interaction between social and technical parts (Jahnke, 2016). The EES Model was selected as a technical part for this study to add social constituent.

In this thesis the pilot model for Turkey - EES Model-2 was developed. The most changes were subjected to update of E-paradigm and Physical layers of EES model with new elements and the new uppermost layer - Socio-Cultural factor layer was added. The Socio-Cultural part was implemented using example of TAM2 model that explains social influence (Park, 2009).

In new EES Model-2 the new Socio-Cultural factor layer consists of intermediate elements, Learning process and Learning environment strategies, and main objects: social influence elements (subjective norm, voluntariness, and image), cognitive instrumental processes (job relevance) and experience (Fig. 4.2).

The Learning process was adopted for young and old people. Religion was added into the methods of Socio-Cultural factor layer as an important object. Object "combination" that explains by combination of synchronous and asynchronous objects was added into the E-paradigm layer of the EES Model-2. The Physical layer was extended to "Government purchased devices", "BYOD" (Bring Your Own Device, multiplatform, single platform), "computer laboratories". EES Model-2 was developed based on the analysis of EES Model (Wills, 1995; Cloete, 2001).

I found that several factors, such as student's age, differences of students by social-cultural and human factors, language differences and religion were not included into EES model. According to many studies in the field (e.g. Sherkat, 2007; Kohn et al., 2010; Terry and Irving, 2010; Dhiya Al-Jumeily and Abir Jaafar Hussain, 2014; Cavazos, 2015) nowadays these issues are very actuals in modern society and have

significant influence to education and higher education in particular. Thus, were added into the EES Model-2. These updates are important for further studies related to modelling of e-learning process.

The updates were related to the new uppermost Socio-Cultural factor layer. First of all, learning processes object of the layer was updated, taking into account interests of students of the different age groups. For example, older people are more conservative in implementation of new technologies into their life and need more time for adaptation to the new environment.

Other important objects of the uppermost layer are cultural diversity and language differences. Cultural preferences must be taking into account during e-learning process design. In Turkey customs are very important part of life of young people and can be used to design more productive educational process. For example, respect of old people and teachers is still common in this country.

It was found that language differences factor is very important and sensitive for young and old students in both countries, Turkey and Estonia, which are very different. Thus, we highly recommend to apply this object in e-learning system design.

Next updates were related to communication object of the Socio-Cultural factor layer, extracted from TAM2 model. Human and social factors were added to be implemented in e-learning modelling in the part of communication specifications. Human factor contains individual specific needs of every student. Efficiency of the e-learning systems can be increased by taking into account this factor. For example, some students can be more familiar with some objects of study, other need more time for explanation. Or some students are very flexible for changing of software environment and other needs more time to adopt. The social factor is important element in Turkey. Turkish people are very sensitive for social status of different persons. It is not a rule in Turkey, but, for example, very often young people grouping into clusters by social status and access to these groups for people from lower social class is not allowed, as people came from villages or from families with low income. In described situation, virtual classes of e-learning systems will solve this problem and offer more effective education for such students.

These results have high significance for increase of quality of e-learning system in higher education in specific cases. Application of updated a new pilot model for Turkey EES Model-2 is strongly recommended to support high educational standards of higher education and provide rights of students and, in some cases, lecturers with different needs and abilities.

Learning environment

EES Model-2

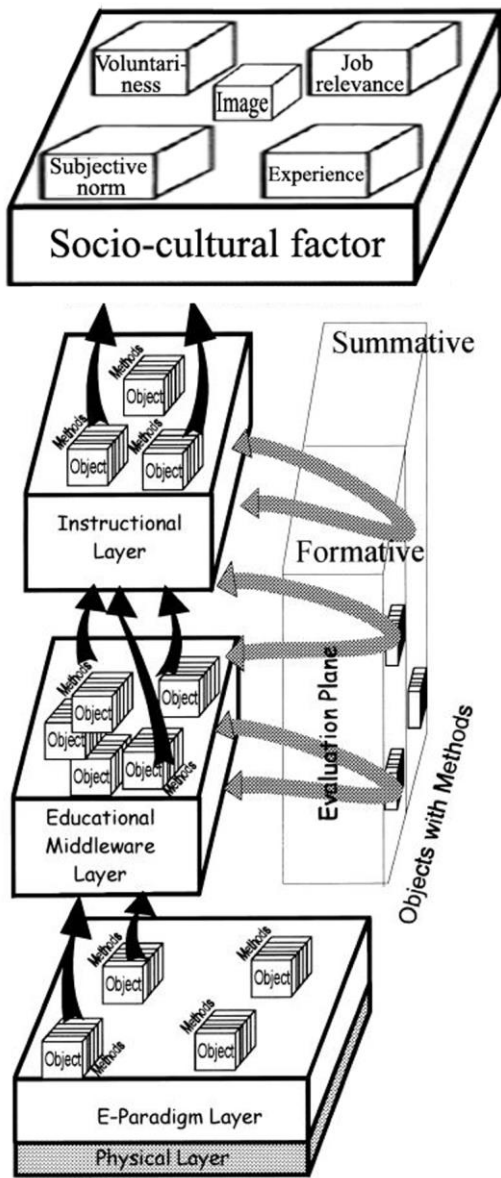


Figure 4.2. Updated Electronic Education System Model

4.2.1 Analysis of Socio-Cultural factor in Turkey based on pilot EES Model-2

Reis and Gulsecen (2014) identified cultural factors as a crucial influence on the success or failure of adoption of ICTs in general. Gunawardena et al. (2001) and Salvatore (2002) mentioned that culture is emerging as an important variable in the investigation of the adoption of e-learning in general. It was found that social factor is important element in Turkey. Kohn et al. (2010) mentioned that in Islamic countries (like Turkey) exists religious barriers in were barely found in ICT. Barriers have huge influences on using ICTs and thus need to be studied well to improve tools for effective learning. Considering culture in the design is essential for more diverse global solutions. Customized and localized solutions might be more suitable to overcome the identified barriers quickly and effectively than international or universal solutions (Marcus and Gould, 2000). It was summarized in Kohn et al. (2010), that is important to consider religious concerns in e-learning systems by redesign content according to religious rules and to avoid interaction formats that offend role constraints.

However, this factor was not presented in the Cloets` EES Model. Due to high importance of social factor for Turkey, the new pilot EES Model-2 was updated with Socio-cultural factor layer.

4.2.2 Socio-Cultural factor layer (uppermost)

The new Socio-Cultural factor layer added to EES consists of intermediate elements extracted from TAM model (Learning process and Learning environment strategies) and main objects: social influence elements (subjective norm, voluntariness, and image), cognitive instrumental processes (job relevance) and experience (Fig. 4.2). National culture (incl. religion) was the main aspect of 'Subjective norm' and language (mono- or multilingualism) was considered as the main aspect of 'Experience' in this study The Learning process can be adopted for young and old people, who have different needs and ways for study. The main objects are containing different methods of study (by watching, reading, discovering, observing, listening, doing and cooperative learning).

The main object element contains of communication objects and objects of content. The communication objects describe differences of students by social and human factors. Human factor means that every person is individual and specific approaches can be implemented for different persons. We found that social factor is important element in Turkey. Turkish people are very sensitive for social status of different persons and respective environment must be applied in such cases.

Objects of content describes cultural and language differences. We analysed cultural and linguistic situations in Estonia and Turkey and found that these elements have high importance for e-learning systems. Implementation of cultural element and language preferences of different groups of students into the e-learning environment will increase interest for education and motivate students of different cultural and linguistic societies for study. Environment of E-learning systems in higher education could be designed with opportunity to choose different languages, to be friendly for users (Kurdish/Turkish/English in Turkey and Estonian/Russian/English in Estonia). At the same time learning materials could be in the main languages of the country (English,

Estonia or Turkish). Religious factor for Turkey could be implemented in a form of special environment of e-learning systems for religious students: welcome screen in Arabic, local prayer times calculator and reminder, reminder of the important Friday prayer and its importance, every day reminders from Islamic religious books about importance of education, etc. For old age people e-learning environment could be designed with special tools for people with special needs, like zooming, "voice-over" tools, automatic translator of modern terminology, etc. Cultural factor could be implemented in the e-learning environment as design with implementation of special tools, signs and symbols related to the specific culture (e.c. flags, patterns for Turkey).

4.2.2.1 Analysis of socio-cultural factors in Estonia and Turkey

This analysis is an important step in this work in order to see and understand the socio-cultural differences in higher-education, and their impacts on new updated pilot model for Turkey EES Model -2.

The most important components of socio-cultural factor with higher influence on e-learning systems at higher education in Estonia (a post-Soviet Union country) were estimated: (1) language, (2) nationality, (3) history, (4) education language, (5) age (6) gender (7) art and literature, (8) customs and traditions and (9) social status (Güllü et al., 2015a). The most important factors (1, 4, 5 and 8) with higher influence on e-learning were chosen for the study.

Main components of socio-cultural factor in Turkey as transcontinental country are (1) language, (2) religion, (3) art and literature, (4) history, (5) customs and traditions, (6) gender, (7) age, (8) education condition, (9) average life duration and (10) ethical values (Eren, 1990). Most important components (1, 2, 5, 7 and 10) with higher influence on e-learning were chosen for the study. Components 5 and 10 were merged in this study (Güllü et al., 2015a).

The language is the main component in the both countries. However, in Estonia this component is strengthened by education language component, that absent in Turkish case. The next component, according to its' importance for e-learning at higher education in Estonia is population age. The same component in Turkey is the last one according to its importance. Three other components having higher influence for e-learning system in Turkey are religion, customs and traditions and ethical values (Güllü et al., 2015a). The customs and traditions components in Estonian case have minor impact to e-learning system.

4.2.2.2 Language aspect of socio-cultural factor

Component of language of socio-cultural factor was estimated as main in two countries. Big difference between spreading of main republic language in Estonia (69.7%) and Turkey (90%) was found. However, this factor is crucial in both cases. Due to post-Soviet Union history there is a new generation of citizens in Estonia, whose parents were immigrants from Russia and others Commonwealth of Independent States countries (CIS). Problems in linguistic integration of Russian-speaking population into

the Estonian community, including the education area were found. That's why "education language" of socio-cultural factor was selected as second important component for e-learning systems in Estonia. At the same time, Turkey, transcontinental, multi-national country, with big number of other nationalities living on its' territory, having more tough position in understanding of integration, anyway has a problematic moments in this field. As stated by (Efegil, 2011), for many years Kurds and other groups were forced to absorb Turkish values and culture instead of developing their own local identities. Anyway, 100% of Turkish students speak Turkish language fluently.

Thereby, the "language" and "education language" in Estonian case have the highest impact on e-learning systems development and could significantly decrease effectiveness of implementation of e-learning systems at higher education due to problems with integration of part of students whose mother language is different from country native one. Students very often meet difficulties owing national language of the country they live and, therefore, may have difficulties in relationship between classmates. These problems were found in Estonia, when Russian speaking students have problems with integration into the local environment, and in Turkey, with Turkish-Kurdish integration. Estonian and Turkish e-learning systems must take into account needs of Russian- and Kurdish-speaking students, respectively, to support effective cooperation between students and lecturers, not only in educational environments but in a private communication. Application of these components should enhance or slow down development of e-learning systems at higher education in Estonia and Turkey and should be implemented in further e-learning system modelling (Güllü et al., 2015a).

4.2.2.3 Religion aspect of socio-cultural factor

The "religion", the second important component in Turkey, was not presented in Estonia with high impact on education. Estonia is one of the least religious country in Europe with highest population (about 71%) considering them self as unbelievers (Ringvee, 2011). Meanwhile, over 81% of the total Turkish population considered themselves as adherents of Islam, the main religion of the country (Reis and Gulsecen, 2014). According to results of Gallup poll (Gallup Survey), when people were asked in 42 countries the question "Does religion occupy an important place in your life?", Estonia and Turkey gained opposite locations in the table with 84% and 9%, respectively answering "no". This factor should make a positive input into e-learning system at higher education in Turkish case in general due to motivation points derived from Islam for study and increasing of knowledge in all life aspects.

It was found that religion, as a component of socio-cultural factor can significantly motivate Turkish students for productive study according to Islamic tradition. At the same time, according to political regime and new laws, followers of Islamic religion can meet problems to support their religion duties during visits of Turkish Universities (e.g. wearing Islamic traditional headwear, hijab, for woman). In comparison with Turkey, the religious questions in Estonia in most cases don not play significant role, but according to situation in the world it becomes more actual and should be taking into

account in e-learning modelling (Güllü et al., 2015a). Due to actual political situation related to escalation of situation in Islamic world by media and problems in migration policies, which obliged EU countries to accept migrants from Islamic countries, population in Estonia more and more feels dislike and scares of followers of Islamic religion even if they are Estonians.

4.2.2.4 Age Component

The component “age” was estimated as third in Estonia and fourth in Turkey. Older people are unwilling to adopt for new technologies and methods as e-learning system is. As a consequence, this component influences on e-learning system accessibility for older lecturers and students, eventually losing of number of lecturers and students involved into e-learning. It was found that Turkish population is younger than Estonian one. According to that, it was supposed that Estonian education system could meet more problems related to integration of e-learning system between older lecturers and students than Turkish one (Güllü et al., 2015a).

4.2.2.5 Customs, Traditions and Ethical Values Component

Components “customs and traditions” and “ethical values” are very specific, delicate and individual components in the list of influences on e-learning systems at higher education that may vary significantly from person to person. It may significantly stimulate development, as well as slow down effectiveness of e-learning system at higher education. “Customs and traditions” is fourth component of socio-cultural factor, with lower impact on e-learning system at higher education in Estonia, was estimated as the last one. Estonian families traditionally raise in children respect others, hard-working, independence and self-direction. These personal qualities could be significantly helpful factors in e-learning study at higher education, e.g. helping to reach the highest goals, working independently, what is very important in e-learning environment. However, such important component for productive education as obedience is not common in Estonian society. Not following the prescriptions of lecture may consequently decrease effectiveness of e-learning study.

The same component in Turkey has third position and was merged with “ethical values” component. This component is more important for Turkish side due to Turkish society is historically more predisposed for cultural and ethical values and traditions. Respect of teacher and unquestioning obedience of teacher targets are very strong sides of the Turkish socio-cultural factor that obliged to enhance evolution of e-learning systems at higher education in Turkey by strong following instructions and prescriptions of lecturers. At the same time, the weak point of Turkish “customs and traditions” component, having impact on e-learning system at higher education, is separation by social status. In case of e-learning, when students and lecturers don’t meet in real class, this point doesn’t have an impact on productivity of e-learning system process. The factor of Socio-Cultural factor layer of the new pilot model for Turkey EES Model-2 related to social differences has influence for education mostly in Turkey. Socially

Turkish students are very sensitive for status of their classmates. It is not a rule in Turkey but it was found that young people grouping into clusters by social status and don't allow access into this groups for the people of lower social class, as people came from villages or from families with low income. In such situations, to support more effective education, it is recommended to provide virtual classes for such students. According to this element of the new pilot model for Turkey EES Model-2, people with any disabilities or who feel inconvenience to attend open classes, could be related to this factor and receive benefits of e-learning. For these reasons e-learning system is the best solution for people who feel discomfort to attend regular classes at university and the new pilot model for Turkey EES Model-2 is common to be implemented for e-learning system at higher education in both countries, Estonia and Turkey (Güllü et al., 2015a).

4.2.3 Instructional layer

In a new EES Model-2 the Instructional layer was not modified after Cloets` EES Model and used without any changes (Fig. 4.2).

4.2.4 Educational layer (middleware)

Elements of the educational middleware layer were identified as (1) user authentication, (2) assignment, (3) course enrolments and (4) testing services. Standardization of e-learning systems must be applied to e-learning content and to e-learning platforms with an aim to fully support the reuse of content across systems and standardize the delivery e-learning system content. Implementation of standards of e-learning system is significant to be implemented in e-learning models to unify the process of adaptation and integration of e-learning systems with available sources.

4.2.5 E-paradigm layer

Object "combination" that explains by combination of synchronous and asynchronous objects was added into the E-paradigm layer of the new pilot model for Turkey EES Model-2. An example is that learner who has unstable time schedule on his job has opportunity to choose and combine between two main ways of study: synchronous (to study in the same time frame with lecturers attending real-time lecture) and asynchronous (to be independent of location, time and speed of the learning process).

4.2.6 Physical layer (bottom)

The Physical layer of the EES model was extended in the new pilot model for Turkey EES Model-2 to: "Government purchased devices" (e.g. laptops, tablets), "BYOD" (Bring Your Own Device, multiplatform, single platform), "computer laboratories".

4.2.7 Analyses of E-learning activities

This analysis is an important step in this work in order to see and understand the physical layer infrastructure of higher education in two countries, and their impacts on new updated EES Model-2. Physical layer of the EES Model-2 describes technological development level of the educational model. Due to technological development level is the best indicator of the level of e-learning development, I selected this layer of the new pilot model for Turkey EES Model-2 to analyse situation of e-learning systems in higher education in both countries (Güllü, et al., 2015b).

Three largest Turkish universities (AU, IU, SU) have been selected to compare activities and financial barriers with largest Estonian Universities (UT, TUT, TU) using new pilot model for Turkey EES Model-2. These universities were selected due to existence of e-learning education faculties on the bases of the universities. Due to big area and population in Turkey, large number of e-learning students at Turkish universities was found (Fig. 2.5). But absence of access to funding sources slowing down the development of the field of study in Turkey. There is very insignificant number of available e-courses with great capacity as a result. In a contrast, the Estonian example with small area and population, and established mechanisms for financial support of e-learning projects, is making this small European country very successful in the field of e-learning. Small number of students according to huge number of available high-quality e-courses (Fig. 2.2) attenuates output of the e-learning system and gives chances to students for choosing.

Analyses based on lowermost part of new pilot model for Turkey EES Model-2, Physical layer, shows a lack or very limited access to technical devices needed for e-learning systems in Turkish universities (Table 4.2). It was found that Estonian students have wider possibilities to use laptops and tablets in higher education.

“Government purchased devices” part of Physical layer consisting of access for students to laptops and tablets was studied and compared in the selected universities in two countries. It was found that in both countries this activities are still in a step of planning for future development. For example, very ambitious initiative of supporting school pupils with electronic gadgets was started in 2011 in Turkey–“Movement of Enhancing Opportunities and Improving Technology”, FATİH project. Since 2011, at least 63,000 tablets were distributed to students and 84000 classrooms were equipped with interactive whiteboards as part of initial distributions (Pouezevara et al., 2013). However, number of studies (Kuzu et al., 2013; Pamuk et al., 2013; Dündar and Akçayır, 2014) demonstrated problems that were encountered throughout the study are being not able to use the classroom management software, insufficient e-content and digital books, technical obstacles, and the lack of in-service training and inadequate technical support. Pamuk et al. (2013) as well presents the list of measures that should be taken into account to avoid such obstacles in a future. More trivial barriers were found on a classroom level such as, e.g., loss of student attention and contact with teacher during lessons. This initiative met these barriers according to age groups of students supported by gadgets (from fifth to twelfth grades) and it is suggested an implementation of similar project for higher education. This would significantly improve quality of higher education in Turkey. Estonian government approved on

February 13-th 2014 The Estonian Lifelong Learning Strategy (2014). Number of ambitious goals were set up expecting to provide access to a modern digital infrastructure, supporting usage of computers, digital and mobile personal devices for every school day studies on the 100% level. It should upgrade learning for all students and teachers in general education, vocational schools and higher education institutions. Until now there is a lack but, however, a big need in such initiatives in Turkey and in Estonia exists.

Physical layer's "Government purchased devices" part of new pilot model for Turkey EES Model-2 is strictly related to the next part "BYOD" approach. In case, if previous part is unavailable, the "BYOD" can solve the problem. The "BYOD" in EES Model-2 consists of Single and Multiplatform approaches. Single platform approach set a frames for technical parameters of needed gadgets for education (explaining a strict parameters: technical options, type of gadget: laptop or tablet, PC or Macintosh, etc.). The Multiplatform approach gives wider opportunities for gadgets parameters. It was explored in this thesis that students in higher education in Turkey were less equipped with electronic devices if compared with Estonian students. According to this part of the model Estonian students are above the EU average.

The last part of the Physical layer that should support students in e-learning systems, in case if previous parts of the new pilot model for Turkey EES Model-2 are unavailable, is "Computer laboratories". Here we reviewed a readiness of universities to provide stationary electronic devices in computer classes/laboratories for e-learning systems to students. Estonian universities were in the first positions in comparison with Turkish universities according to equipment available in the rooms and availability to provide this equipment to students. For example, TU has on its base Apple iMac computer laboratory equipped by the last word of technical development, supporting usage of powerful 21.5" Apple iMac computers, video projector and screen, and other modern and useful facilities and services. It was found that in all studied Estonian universities almost all faculties was supplied by computer laboratory. Well-equipped computer laboratory were found in Turkish universities as well, but according to number of students in each university it was impossible to satisfy needs of all students. Therefore, it is strictly recommended to increase number of available computer laboratories in Turkish universities to minimize the difference between huge number of students and opportunities available for e-learning systems.

4.2.7.1 Evaluation plane

The function of evaluation plane is the same as was described for EES model in previous paragraph. Formative evaluation is typically conducted during the lifetime of a process, whereas summative evaluation is conducted at the end, or after the lifetime of a process (Wills, 1995; Cloete, 2001).

Table 4.2. Comparison based on qualitative analysis of e-learning activities in the largest universities in Estonia and Turkey using Physical layer of EES Model-2.

EES-2 Model layer		Estonian universities	Turkish universities
Physical layer		Result	
Government purchased devices	Laptops	unavailable	unavailable
	Tablets	unavailable	unavailable
BYOD	Single platform	High	low
	Multiplatform	High	low
Computer laboratories		sufficient	Insufficient

4.2.7.2 Implementation example

In order to illustrate the mapping from the new pilot model for Turkey EES Model-2 onto our learning environment, I will model a very simple e-learning system situation for Turkish higher education. Due to the target students in Turkey prefer to study at their own time and pace, and very often Internet access is restricted or limited, example course design is dictated by the bottom-up algorithm.

As a first step, hardware technology and software technology objects are selected from the physical layer. EES Model-2 takes into account different types of hardware and gadgets with different types of operational systems and gives opportunity to update educational models according to technical development level. This step is crucial due to extremely fast speed of changes of technology that occur every year. Any types of electronic devices available in Turkey can be selected: PC, Macintosh, iPad, iPhone or gadgets on Android with Internet connection (cable or wireless), and a permanent email address as suitable methods for hardware technology. Methods for the software technology object include the Windows 7 (or higher), Mac OS, Linux, Android or iOS operating systems, an Internet Browser (Google Chrome, Mozilla Firefox, Opera, etc.), and/or email software. On the e-paradigm layer I select a combination type of object that gives opportunity to combine the asynchronous and synchronous ways of study. Standardization elements of e-learning systems to be implemented in e-learning models to unify the process of adaptation and integration of e-learning with available sources are available in educational middleware layer.

In the Socio-Cultural factor layer, I design our course around the outcomes that we wish to accomplish and select suitable methods to realise our outcomes. In my e-learning modelling I can take into account age of students. As example the technology available in gadgets from Apple Company could be implemented. For example, the e-learning environment could be customized for elderly people with bad eyes, when dynamic type settings can be turned on. Using this setting all text translated to larger size. Also this setting can be provided as zoom in the particular area. Another solution for people with eyes problems is automatic “text speech system”. You need just select text you need to read and system will read it for you. Some other minor moments can make e-learning platform environment friendlier for older people like: larger icons and

“voice over system”. This system will speak to the reader any text he showed on monitor by mouse or by finger on the pad screen. This is also great for students with learning disabilities.

In object of language differences I select possibility for students to select Turkish and Kurdish languages, as well as English for international students. Using Kurdish language will attract a big number of Kurdish students due to a large community of Kurds in Turkey.

According to cultural differences object I implement in the e-learning environment the system of feedback for each exercise. Using this system lecturer can show the satisfaction level of student's results and make for students feeling of permanent control by teacher. Due to cultural factor in Turkey it is very important for students to feel supervision by teacher and to demonstrate respect to him fulfil all prescriptions.

In respect of religion of the Turkey (Islam) and its importance for students from this country the selective element “religion” may be implemented in my example e-learning platform model to help Muslim students to fulfil their religious obligations. According to Islamic tradition all Muslim students obligated to pray five times a day in pre-set intervals according to the sun's sky path regardless of time zones and season. My e-learning environment will be provided with prayer time calculator, showing times of all prayer in specific region and in given season and prayer reminder. For gadgets users the special option will be available: Qibla compass, showing direction of prayer. Knowing, in which direction to pray be important aspect for Islamic prayer. All Muslims praying towards the same point is traditionally considered to symbolize the unity of the all Muslims community worldwide. From any point in the world, the direction facing the Kaaba is called the Qibla. Performing the prayer Muslims must be faced to the direction of Mecca located in Saudi Arabia, where the most sacred Muslim site of Islam is located – Grand Kaaba, or the most sacred mosque in Islam.

Also religion object in my model will provide Islamic calendar with reminder of the main Islamic events: (1) Friday obligatory congregational prayer – Jumuah, (2) Ramadan - month of fasting and (3) Uraza Bairam or Eid al-Fitr - Breaking the Fast Feast and (4) Kurban Bairam or Eid al-Adha –Festival of the Sacrifice.

Implementation of religion object in the e-learning platform modelling in Islamic country makes educational environment for student friendlier. Students feel them self-more comfortable, thus it improves educational results and productivity.

This implementation in respect of religion may differ according to the people with different perspective of religions in the companion educational institute.

To make sure that our efforts are reasonably successful and learning as I planned it, takes place, I include both formative and summative evaluation objects. For the formative evaluation process I design a number of short questionnaires to prompt the students at the end of certain events. Each questionnaire focusses on a specific topic and requires a simple reply and a possible elaboration.

To set up an effective summative evaluation, the questionnaire requires some professional input. One way of setting up a summative evaluation form is to use the objects from the Socio-Cultural factor layer, instructional, physical layer, as well as some of the educational middleware layer and ask simple questions (similar to those in

the formative evaluation forms) on each topic. Keeping questions simple also enhances the possibility of interpreting results correctly and incorporating comments into the planning of the next course.

4.2.7.3 Summary of EES Model-2

I used in this thesis EES model due to its flexibility and readiness to be updated for nowadays needs. On the bases of the analysis presented in chapter 4 we can accentuate the need to connect everyday life moments with educational system like socio-cultural factor and religion. Educational models must include objects that take into account needs of old people and people with disabilities. In this thesis EES model was updated with new elements into new reference model for Turkey EES Model-2.

The presented model will assist the designers of e-learning systems to plan and implement a specific learning situation, with the focus on the individual requirements and environments of the learning group.

4.2.8 Research-based design model

Current study was conducted as a cyclic iterative research-based design process. This process consisting of three iterations or phases (Fig. 4.3). First phase was based on a well-known Electronic Educational System (EES) model for comparative analysis (Cloete, 2000) consisting of four layers (Instructional, educational, e-paradigm, physical layers) and will be described further in detail. In this phase implementation patterns of e-learning for higher education in Turkey and Estonia were analysed and compared (Güllü et al., 2014).

According to a modern issues influenced educational process in our society the EES model was updated and new EES Model-2 was proposed (Güllü et al., 2015).

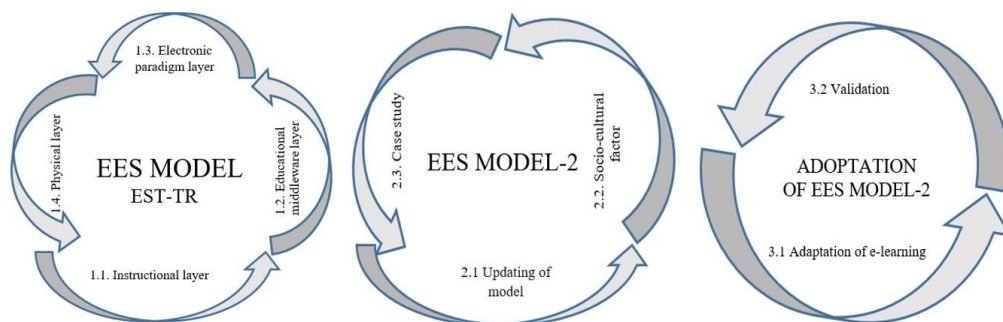


Figure 4.3. New three iterations model of research-based design.

Application of new pilot model - EES Model-2 is strongly recommended for Turkey to support high educational standards of higher education and provide rights of students and lecturers with different needs and abilities.

In this thesis, for the first time, socio-cultural differences and its' influence on e-learning systems in higher education in Estonia and Turkey were studied and compared

(Güllü et al., 2015a). In particular, this is a main factor of e-learning system pedagogical aspect design that is directly related to relationship between lecturers and students, who are main users of e-learning systems (Kolias, 2007; Reis and Gulsecen, 2014). Planel (1997) stated that students' achievement is connected with national cultural values and that a framework of cultural understanding is essential for cross-national educational research. Ehlers and Pawlowski (2006) said that in a globalized world, and with the attempt to enhance cross-cultural enterprises, e-quality models should then specifically consider cultural and cultural-pedagogical constructs.

In Güllü et al. (2015b), I have analysed and compared activities and number of e-learning systems courses and students, attending these courses in the main national universities of Estonia and Turkey using the new pilot EES Model-2. This study was done in the context of technical, pedagogical, economical aspects, socio-cultural factors and activities in the field of e-learning systems in higher education provided by the largest universities of Estonia and Turkey. These aspects and factors have a significant importance on development and implementation of web-based technology to the masses.

Güllü et al. (2015–2015a, b) are related to second iteration cycle (Fig. 4.3) – “EES Model-2”.

Last paper (Güllü et al., 2016) was included into a third part of the research-based design model – “Adaptation of EES Model-2” (Fig. 4.3) and aimed on comparison and analyses, adaptation and validation of e-learning at higher education in studied universities based on pilot EES Model-2 and extended TAM2 model.

This thesis proposed an integrated theoretical framework of university lecturers adoption of e-learning systems in Estonia with its advanced united e-learning system in higher education, and in Turkey, where the system need to be improved and unified. Current situation in e-learning was studied and compared using answers of questionnaire developed in this thesis (Güllü et al., 2016) on the basis of new pilot EES Model-2 and extended technology acceptance model (TAM2, 10 questions were added to the existed TAM model) and sent to lecturers from the studied universities. Strong and weak sides of e-learning systems and main barriers which hinder adoption of e-learning systems in Estonian and Turkish largest universities were found and analysed. Number of suggestions for Estonian and Turkish universities governances was presented to improve current situation in e-learning systems.

Estonia and Turkey are two absolutely different worlds on the basis of socio-cultural and other aspects. That's why it was important to study their background and educational approaches implemented in e-learning in higher education. The best practice of the Estonian example of e-learning systems development was offered as a model for Turkish universities.

Measures to support development and improvement of e-learning system in higher education in studied universities, as well as in other countries who meet similar barriers, were suggested.

A cyclic iterative research-based design process consisting of three iterations (“EES model (Est-Tr)”, “EES Model-2” and “Adaptation of EES Model-2”) was developed and used in this thesis due to needs of my research. First phase was based on EES model, (Cloete, 2000) for comparative analysis. This model consists of four layers

(Instructional, educational, e-paradigm, physical layers) (Figs 4.1, 4.2). In this phase implementation patterns of e-learning systems for higher education in Turkey and Estonia were compared (Güllü et al., 2014).

Second phase was aimed on EES model update (Güllü et al., 2015) and study and comparison of socio-cultural differences and its' influence on e-learning systems in higher education in Estonia and Turkey (Güllü et al., 2015a). New pilot model for Turkey - EES Model-2 was developed according to a modern issues influenced educational process in our society. Socio-cultural factor has big importance due to students' achievement is connected with national cultural values and that a framework of cultural understanding is essential for cross-national educational research (Planel, 1997). E-quality models should specifically consider cultural and cultural-pedagogical constructs in a globalized world (Ehlers and Pawlowski, 2006).

Comparison and analyses of e-learning systems activities was done using the new pilot model for Turkey - EES Model-2 (Güllü et al., 2015b).

Third phase of the cyclic iterative research-based design process was aimed on comparison and analyses, adaptation and validation of e-learning systems at higher education in studied universities in Estonia and Turkey. Adaptation and validation of e-learning systems was studied and compared using answers of questionnaire developed in this thesis (Güllü et al., 2016) on the basis of new EES Model-2 and TAM2 model, updated in this thesis (10 questions were added to the existed model). Questions about pedagogical barriers were included into the questionnaire (Güllü et al., 2016). As expected, number of pedagogical barriers were found in Estonian and Turkish universities.

5. Questionnaire and analysis of answers

The objectives of questionnaire were to analyse and compare adoption of e-learning systems by lecturers in three largest universities in Estonia (University of Tartu-UT, Tallinn University of Technology-TUT and Tallinn University-TU) and Turkey (Anadolu University-AU, Istanbul University-IU and Sakarya University-SU), covering policy, technical and pedagogical aspects. The developed questionnaire is verification for the new pilot model for Turkey EES Model-2. Decision to participate in the presented survey was supported by official agreements between rectors of TUT and the studied universities.

Questions were divided into two parts, (1) participant profile and (2) how participant feels that e-learning system adopted in his university for education environment (Appendix I, Table 1; Güllü et al., 2016).

Each part consists of different groups of questions. Groups in the first part contain four items (questions) to identify demographic attributes of respondents such as date of birth, gender, academic position and institution facility. Groups of the second part consist of two-four questions. These questions are partly based on TAM2 model (Groups: Perceived ease of use, Perceived usefulness, Attitude, Behavioural intention, E-learning self-efficacy, Subjective norm, System accessibility), consisting in total 17 questions. Groups such as Policy factor, Pedagogical level and Barriers consist in total 10 questions (Appendix I, Table 1; Güllü et al., 2016) were developed for this study by author according to discussion and validation by experts (professors of e-learning study, heads of e-learning centres, developers of e-learning system) in the field from the studied universities in Estonia and Turkey.

Total item pool of the scale consisted of 31 items, four in the first part and 27 in the second one. Participants were asked to complete a seven-point Likert-type scale (1-Strongly disagree, 2-Disagree, 3-Somewhat disagree, 4-Neither agree nor disagree, 5-Somewhat agree, 6-Agree, 7-Strongly agree) describing the level of agreement proposed by Vagias (2006). Items were adopted to be appropriate for participants (lecturers of e-learning) from studied universities in Estonia and Turkey.

5.1 Sample subjects

Participants in the study were lecturers in university (professors, associate professors, professor assistants and lecturers) who use e-learning systems in their practices. The number of sample subjects was set at 1,423 in Estonian universities and 2,775 in Turkish universities. Total number of respondents subjected to the questionnaire distribution was 4,198. Nine hundred twenty-three respondents from the selected universities in Estonia (n=298) and Turkey (n=625) voluntarily participated in the study that is 22% from the sample subject. The overall response rate of about 20% is considered to be satisfactory and accurate measurement in terms of the statistical reliability (Visser et al., 1996).

5.2 Statistical procedure

Data collected by the questionnaire were coded by the research assistants. The data were recorded first in Lime survey application, a free and open source on-line survey application written in PHP based on a MySQL, PostgreSQL or MSSQL database, distributed under the GNU General Public License (www.limesurvey.org). This software gives opportunity to users to develop and publish on-line surveys, collect responses, create statistics, etc. Collected data were transferred to MS Excel program for further analysis.

5.3 Questionnaire analysis: adoption of e-learning systems

Collected data show that respondents in Turkey were predominantly males P2(1) (n=354) than females P2(2) (n=265) (Fig. 5.1). Six respondents from Turkish universities did not identify their gender. Gender balance of respondents in Estonian universities was almost equal, but however females predominated (n=150 females vs n=148 males). Major respondents were Lecturers P3(4) in both countries (58% of respondents in Estonia and 36% in Turkey, Fig. 5.1). Assistant professors P3(3) represented 32% of all respondents in Turkish universities, when in Estonian universities only 15%. Associate professor option P3(2) was selected by 20% and 17% of respondents in Estonian and Turkey, respectively. Professors P3(1) composed only 7% of questionnaire participants in Estonian universities and more than two times in percentage professors participated in Turkish universities (15%, Fig. 5.2). In Appendix II (Figs 1-10; Tables 1-10) it is possible to see how respondents answered from different universities for questions of second part of questionnaire (AS) – “Adoption of e-learning system”. Figure 5.3 shows how respondents answered in average for presented questions in total. It is showing a general feeling/intention/satisfaction of users-lecturers of e-learning in their practice. These data shows users adaptation level. According to presented questions (Appendix 1, Table 1), positive answers show how users accept this technology, or how it was adopted in their environment.

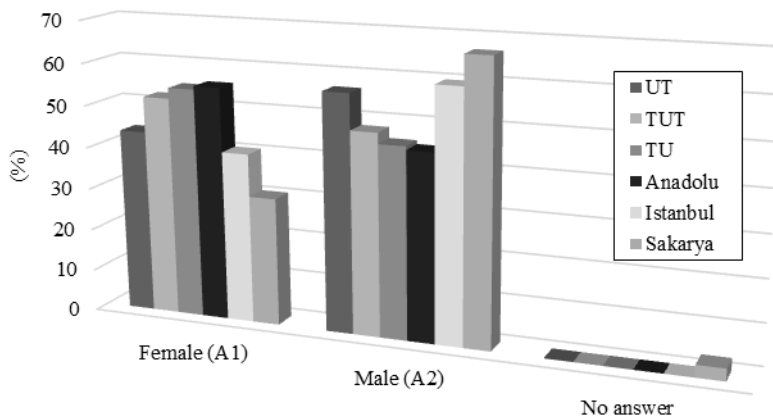


Figure 5.1. Participants profile (gender, P2)

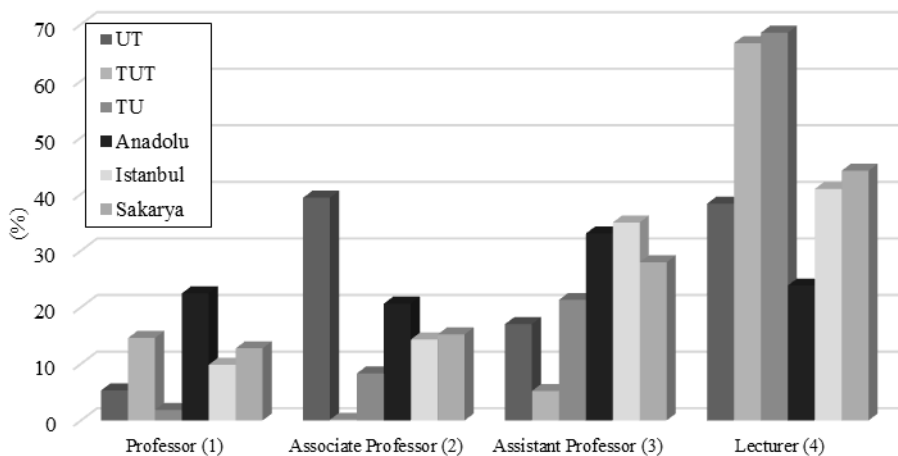


Figure 5.2. Participants profile (Academic position, P3)

The highest satisfaction of usage and adoption of e-learning system in higher education between studied largest universities of Estonia and Turkey was demonstrated by respondents from UT. About 87% of lecturers in average from this university (UT) participated in questionnaire were satisfied-“strongly agree”, “agree” and “somewhat agree”, when answered for proposed questions. It means that 87% of respondents from UT accepted or adopted this technology in their environment.

Only 13% in average of all respondents from UT were dissatisfied-disagree with different levels of confidence (“neither agree nor disagree”, “somewhat disagree”, “disagree”, “strongly disagree”) with statements in the questionnaire (Fig. 5.3).

TU is the next Estonian university and next between all studied universities according

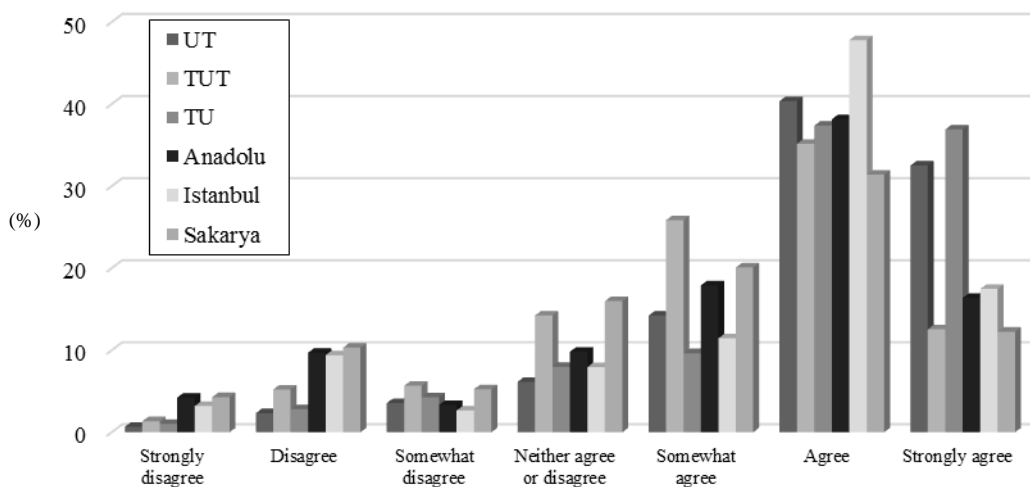


Figure 5.3. Summary table of all answers by respondents from six universities from Estonia and Turkey

to satisfaction of e-learning system. About 84% of respondents in average from TU were agree or accepted/adopted this technology in their environment and 16% in average were disagree or not accepted/adopted this technology with different levels of confidence when answered for our survey (Fig. 5.3).

We found that TUT has third place between Estonian largest universities according to satisfaction of usage and adoption of e-learning system in higher education.

About 74 and 26% of respondents in average answered with different levels of confidence in satisfaction and dissatisfaction mode, respectively (Fig. 5.3).

According to this research the highest satisfaction of usage and adoption of e-learning systems between largest Turkish universities has Istanbul University (average 77 and 23% of answers in satisfaction and dissatisfaction mode, respectively). Lower satisfaction showed Anadolu University with average 73 and 27% of answers with satisfaction and dissatisfaction mode, respectively. The most dissatisfied atmosphere of usage and adoption of e-learning by lecturers between Turkish largest and all studied universities was found in Sakarya University (average 64 and 36% of answers were satisfied and dissatisfied, respectively, with different levels of confidence) (Fig. 5.3).

This study showed that Estonian lecturers in total more satisfied with usage and adoption of e-learning system at higher education in their everyday work (82% in average of satisfied answers, Fig. 5.3). Their Turkish colleagues in average 10% less satisfied of this technology usage and adoption in higher education (71% in average of satisfied answers, Fig. 5.3).

Respondents from both countries don't find usage of e-learning system in their work difficult and agree in importance of implementation of the system in higher education to improve academic productivity and teaching performance. In general they were positively related to e-learning system in higher education and mentioned them self as active users of the system. However, according to received answers Estonian lecturers were more active in this practice. Respondents from both countries equally answered about their good skills and confidence in e-learning systems. The biggest difference in answers was found for Policy factor (PF), pedagogical level (PL), barriers (BR) groups of questions (Appendix I, Table 1).

Between Estonian universities TUT respondents showed lower satisfaction than TU and UT according to policy adaptation, security, financial support mechanisms and productive cooperation. The lowest satisfaction with questions of policy factor showed respondents from IU. Lecturers from TUT less than others support opinion that e-learning system is the main source of pedagogical innovation in higher education in Estonia.

The highest satisfaction of e-learning systems staff trainings proposed at universities was expressed by Estonian respondents. IU lecturers showed maximum dissatisfaction in this question. Respondents from all universities expressed need in pedagogical training of academic staff.

Poor technological infrastructure and outdated e-learning systems were noted as the main barrier that hinders adoption of e-learning (BR₁, Appendix I, Table 1) in UT and IU. Lecturers from TUT, AU and SU were disagree and strongly disagree with this statement. Poor readiness of academic staff to use e-learning system (BR₂, Appendix I, Table 1) was noted as the main barrier by lecturers from IU and UT.

We found that absence of clear vision and policy for e-learning development (BR₃, Appendix I, Table 1) is the main barrier that hinders adoption of e-learning in IU. Also big percentage of respondents from TU have noticed about this problem.

5.4 Conformity of questionnaire results with EES Model-2

These analyses has an importance to show differences in lecturers' opinions to e-learning systems in Estonia and Turkey to elaborate suggestions for Turkey, and to validate barriers presented in chapter 2.6.

Collins and Halverson (2009), Jahnke (2016) demonstrated importance of sociotechnical paradigm application in the modern teaching and learning systems environment and design of the interaction between social and technical parts. Synergy of the EES Model and TAM2 model produced a new EES Model-2 that provides this missed link. The implemented questionnaire was based on the developed EES Model-2 and TAM2 models.

Results of the questionnaire show conformity with objects proposed in a new software architecture model EES Model-2 for Turkey e-learning systems. Respondents from both countries in most cases answered affirmatively for "Pedagogical level" group of questions: (1) E-learning is the main source of pedagogical innovation in higher education in my country; (2) My university provides academic staff trainings to develop innovative pedagogical approaches for e-learning; (3) Academic staff in my university needs today more training in pedagogical aspects of e-learning and less in technological skills (Appendix I, Table 1; Appendix II, Table 9). This group of questions is related to objects of Socio-Cultural factor layer of EES Model-2, such as language differences, cultural diversity, religion, social and human factors, student's age (Fig. 4.2). Almost all respondents feel need to provide pedagogical innovation in higher education or/and declared that their university provide innovation of pedagogical approaches for e-learning system or/and showed need more trainings in this aspect. EES model-2 and TAM2 model provide this innovation by adding of the Socio-Cultural factor layer which previously was not considered. Results of the questionnaire showed importance of the layer in the model.

Answers for "Barriers" group of questions: (1) The main barrier that hinders adoption of e-learning in my university is poor technological infrastructure and outdated e-learning systems; (2) The main barrier that hinders adoption of e-learning in my university is poor readiness of academic staff to use e-learning system; (3) The main barrier that hinders adoption of e-learning in my university is absence of clear vision and policy for e-learning development (Appendix I, Table 1; Appendix II, Table 10) confirmed importance of Physical layer of EES Model-2 and its objects (Fig. 4.2). To present more technological infrastructure opportunities the Physical layer of EES Model-2 was extended in this study to "Government purchased devices" (e.g. laptops, tablets), "BYOD" (Bring Your Own Device, multiplatform, single platform), "computer laboratories".

Educational middleware and E-paradigm layers of the EES-Model 2 are related to following groups of questions from questionnaire-(i) Perceived ease of use: (1) I find e-learning system easy to use; (2) Learning how to use an e-learning system is easy for

me; (3) It is easy to become skillful at using an e-learning system; (ii) Perceived usefulness: (1) E-learning would improve my teaching performance; (2) E-learning would increase my academic productivity; (3) E-learning would make it easier to teach course content; (iii) Attitude: (1) Teaching (studying) through e-learning is a good idea; (2) Teaching (studying) through e-learning is a wise idea; (3) I am positive toward e-learning; (iv) Behavioral intention: (1) I intend to post announcements, assignments and learning materials via e-learning systems frequently; (2) I intend to be an active user of e-learning system; (v) E-learning self-efficacy: (1) I feel confident finding information in the e-learning system; (2) I have the necessary skills for using an e-learning system; (vi) Subjective norm: (1) What e-learning stands for is important for me as a university academic staff; (2) I like using e-learning because academic society values it; (3) In order to prepare students for their future jobs, it is necessary to provide them e-learning courses; (vii) System accessibility: (1) I have no difficulty accessing and using an e-learning system in the university; (viii) Policy factor: (1) My university has adopted policies for productive implementation of e-learning at higher education in my country; (2) Security aspects of e-learning at higher education are covered by policies in my country; (3) Financial support mechanisms of e-learning at higher education are involved in policies in my country; (4) E-learning policies in higher education are well implemented through productive cooperation between universities in my country. Educational middleware layer of EES Model-2 characterizes implementation of standardization of e-learning systems. Implementation of standards of e-learning is significant to be implemented in e-learning models to unify the process of adaptation and integration of e-learning with available sources. E-paradigm layer of the EES Model-2 characterized by synchronous and asynchronous objects and object “combination” that take into account both of these objects. Synchronous object presents opportunity to study in the same time frame with lecturers attending real-time lecture and asynchronous-to be independent of location, time and speed of the learning process.

While the feedback from Estonian lecturers can be suggesting, in the name of implementing EES Model-2, in order to improve the current e-learning systems from the point of pedagogical factors in Estonia, feedback from Turkish lecturers leads that implementing EES Model-2 will improve the present e-learning systems from the point of pedagogical, technological, political factors.

5.5 Analysis and comparison of adoption of e-learning systems

As expected, it was found that lecturers from the largest universities in Estonia are more satisfied of usage and adoption of e-learning system in their universities than their colleagues from Turkey (Fig. 5.3). This is due to Estonian e-learning system in higher education is advanced and united in the context of technical, pedagogical and economical aspects, and activities provided by this universities, when Turkish e-learning needs improvements and unification. United platform (like Moodle system in Estonia) was recommended to be involved in Turkey to integrate students, lecturers and all available data for e-learning system in higher education from all the studied universities into one independent e-learning environment (Güllü et al., 2014, 2015b). Weak and strong sides of e-learning system in higher education in Turkey and Estonia and which

aspects need to be improved were explored in this part of thesis. Immediate measures for improvement process were suggested.

A strong sides of e-learning systems in both countries are total acceptance and understanding of importance of implementation of the modern educational system by lecturers of largest universities. Good skills and confidence in e-learning are the next strong sides of the system. It makes adaptation process easier. As expected, Estonian respondents showed more activeness in this practice due to excellence of the country in IT development and integration. Problems in policy adaptation, security, financial support mechanisms and productive cooperation between institutions in Estonian universities were found. Lower success of these aspects in respondent's answers were found at TUT. Answers for questions of Policy factor group of questions by lecturers from TUT, we suppose, show that respondents are less informed by TUT governance than lecturers from TU and UT. Weak side of e-learning system or barrier that hinders adoption of e-learning at TU - the absence of clear vision and policy for e-learning development (BR₃; Appendix I, Table 1). Suggestion to both universities governance is to take measures to eliminate these gaps. Improving productive cooperation between institutions aspect only can solve consequently other existing problems due to positive experience of UT in these fields. United e-learning environment (Moodle) that supports productive cooperation between all participants of e-learning at higher education in Estonian universities is already exists and successfully implemented in the studied universities. This environment can be used as prospective tool to rich this aim. (i) Poor technological infrastructure and outdated e-learning systems and (ii) poor readiness of academic staff to use e-learning system were noted as barriers which hinder adoption of e-learning at UT. Those, it is suggested to UT administration to renovate technological aspect of e-learning system, taking as example infrastructure at TUT and TU. The second (ii) barrier is due to age of lecturers. Using a personal experience, we know that there is big number of experienced lecturers in the studied universities, whose experience based on old educational technologies and principles. More experienced lecturers often are less flexible to accept new technologies than younger ones and prefer old methods in education. I can suggest a way to solve this problem: to use a systemic change approach, that is effective measure according to previous studies (e.g. Su, 2009). One solution for making qualitative change in effective technology integration in the daily teaching and learning process is to use a systemic change approach. A systemic change is doable as there are successful cases in the literature (e.g. Fullan, 1993). If educators use a systemic approach to deal with both first- and second-order barriers, success will ultimately come. Reigeluth (1994) points out that systemic change is a paradigm shift that "entails replacing the whole thing" because "a fundamental change in one aspect of a system requires fundamental changes in other aspects in order for it to be successful". Education as a social enterprise is a very complex system that involves many stakeholders such as teachers, students, parents, administrators, business partners and policy makers. To effectively integrate technology, these people will either affect or be affected by the change (Su, 2009).

Main barriers, which hinder adoption of e-learning in Turkish largest universities were found in IU: (i) poor technological infrastructure and outdated e-learning systems,

(ii) absence of clear vision and policy for e-learning development, (iii) poor readiness of academic staff to use e-learning system. These results confirmed my expectations. The suggestion, first of all for IU, and other Turkish universities governance (AU and SU) is to take model of development of e-learning system in Estonian universities as example. (1) Establishment of strong and stable policy, (2) building a consortia between all universities in the field, (3) significant financing of a technological infrastructure, (4) regulation of financial support of projects related to development of e-learning system, (5) support of security measures to provide safe usage of e-learning and (6) developing of training system for new and existing specialists is recommendation for Turkish universities to begin with. To implement measures in a complex is a strongly suggestion to gain maximum effect. Selection of suggested tools separately will not guarantee stable, productive result of e-learning architecture. Wenger et al. (2002) demonstrated that the adoption of e-learning is actually influencing learning strategy, and that the simple delivery through technology cannot be sustained as a separate form of training, an appendix to traditional instructor-led activities. To be successful, it has to be seen as a part of a complete learning architecture that includes a variety of tools, approaches, and a coherent learning culture. The analysis shows two emerging phenomena: a different degree of success of the e-learning initiative depending upon its coherence with the organizational culture, and the learning strategy; a changing balance of classroom training and e-learning in relationship to the adoption of the Learning Management System in each department (Kok, 2013). Similar results were also presented in many studies, e.g. in Al-Adwan and Smedly (2012), Chokri (2012), King and Boyatt (2015), etc.

Author believes that results of study presented in this thesis will be helpful for improving e-learning systems in higher education in Estonia and Turkey, as well as in other countries who meet similar barriers.

5.6 Summary of results

Synergy of the EES Model and TAM2 model produced a new EES Model-2 that provides missed link between social and technical parts of the e-learning systems. The implemented questionnaire was based on the developed EES Model-2 and TAM2 models.

According to questionnaire results, implementation of e-learning systems was accepted as important measure by lecturers from largest universities in both countries. All respondents confirmed good skills and confidence in e-learning systems. Estonian lecturers were more satisfied of usage and adoption of e-learning system and showed more activeness than lecturers from Turkey.

Nevertheless, Estonian largest universities are in the high level of e-learning system development, several barriers in e-learning system were registered. TUT lecturers noticed gaps in policy adaptation, security, financial support mechanisms and productive cooperation between institutions in Estonian universities. Absence of clear vision and policy for e-learning development was observed at TU. Respondents from UT detected poor technological infrastructure and outdated e-learning systems and poor readiness of academic staff to use e-learning system.

Questionnaire analysis showed that main barriers, which hinders adoption of e-learning in Turkish largest universities are in Istanbul University (poor technological infrastructure and outdated e-learning systems, absence of clear vision and policy for e-learning development, poor readiness of academic staff to use e-learning system). Found barriers in Anadolu Universty (absence of clear vision and policy for e-learning system development, poor readiness of academic staff to use e-learning system, significant financing of a technological infrastructure) and Sakarya University (poor technological infrastructure, absence of clear vision and policy for e-learning development) in comparison with IU have lower impact on respondents answers.

6. Conclusions and future works

In this chapter conclusions of current thesis will be presented, recommendations for Turkey and Estonia will be introduced and future plans of author will be described.

6.1 Conclusions

In this thesis:

(1) The situation of e-learning systems in higher education and adoption of e-learning by lecturers in three largest universities in Estonia (Tartu University, Tallinn University of Technology and Tallinn University) and three largest universities in Turkey (Anadolu University, Istanbul University and Sakarya University) was analysed in this thesis for the first time. E-learning system in Turkey has grown during the last decade, but technical and pedagogical barriers are slowing down its development in the largest universities. E-learning system in Estonia has grown rapidly and successfully with some few problems.

(2) A cyclic iterative research-based design process, consisting of three iterations ("EES model (Est-Tr)", "EES Model-2" and "Adaptation of EES model-2") was developed and used in this study to reach research aims.

(3) Synergy of the EES Model and TAM2 model produced a new EES Model-2 that provides missed link between social and technical parts of the e-learning systems. A new reference model for Turkey - EES Model-2 extended from EES model was presented for more productive implementation in e-learning system process design and modelling in higher education in Turkey. The most updates were related to uppermost Socio-Cultural factor layer. Learning processes object of the layer was updated for adaptation of educational process for young and old people, taking into account interests and abilities of students of different age groups. Cultural diversity and language are important objects added to the uppermost layer. Communication object of the Socio-Cultural factor layer was updated and human and social factors were added. Object "combination" that explained by combination of synchronous and asynchronous objects was added to E-paradigm layer.

(4) EES Model-2 was used for comparative analyses of e-learning system and to study components of socio-cultural factor in Estonian and Turkish higher education e-learning systems. Most important components of socio-cultural factor with higher influence on e-learning system at higher education in Estonia: language, education language, population age and customs and traditions. Language, religion, customs, traditions and ethical values and population age are components that play significant role in e-learning system at higher education in Turkey. The component of language was estimated as the main in two countries.

(5) The implemented questionnaire was based on the developed EES Model-2 and TAM2 models. According to questionnaire results, barriers in e-learning system in largest Estonian universities were found: (i) gaps in policy adaptation, security, financial support mechanisms and productive cooperation between institutions in Estonian universities at TUT; (ii) absence of clear vision and policy for e-learning development at TU; (iii) poor technological infrastructure and outdated e-learning systems and poor

readiness of academic staff to use e-learning system at UT. Questionnaire analysis showed that main barriers, which hinders adoption of e-learning system in Turkish largest universities are in Istanbul University (poor technological infrastructure and outdated e-learning systems, absence of clear vision and policy for e-learning system development, poor readiness of academic staff to use e-learning system). Found barriers in Anadolu University (absence of clear vision and policy for e-learning development, poor readiness of academic staff to use e-learning system, significant financing of a technological infrastructure) and Sakarya University (poor technological infrastructure, absence of clear vision and policy for e-learning system development) in comparison with IU have lower impact on respondents answers.

6.2 Recommendations

According to aims and gained results of this research the number of suggestions to improve current situation in e-learning systems in higher education for universities governances was proposed, focusing on Turkish universities. Several recommendation were presented also for Estonian universities.

Recommendations for Turkey:

1. Taking the model of development of e-learning system in Estonian universities as example for all Turkish universities, beginning with establishment of strong and stable regulatory policy, to build consortia between all universities in the field, to finance significantly technological infrastructure, guarantee financial support of projects related to development of e-learning system, support security measures to provide safe usage of e-learning and develop training system for new and existing specialists.
2. United platform (like Moodle system in Estonia) was recommended to be involved in Turkey to integrate students, lecturers and all available data for e-learning system in higher education from all the studied universities into one independent e-learning environment.
3. Turkish e-learning system at higher education needs significant investments to supports big number of students with electronic devices, to set up reliable free internet connection with sufficient speed for e-learning system students, to provide enough computer classes and laboratories with modern technologies, to support development of number of e-learning courses for lecturers and students for productive cooperation and interaction within the e-environment.
4. Software necessary for productive e-learning system implementation and timely software update and upgrade if needed should be supported for all users (students and lecturers).
5. Socio-cultural factors are necessary to be implemented in modern modelling of higher education e-learning systems in Turkey.
6. Due to the fact that the Higher education council (YOK) is a prime regulation agency of higher education in Turkey, I recommend to YOK to provide general revision of state of e-learning systems in all universities in Turkey and prepare project to update and unify e-learning systems in Turkish universities, using EES Model-2 presented in this study and according to the best practices of Estonian higher education system.

Recommendations for Estonia:

1. Improvement of productive cooperation between Estonian institutions. It can solve existing problems at TUT and TU.
2. Renovation of technological aspect of e-learning system at UT, taking as example infrastructure at TUT and TU; and to use a systemic change approach that is effective measure to implement new technologies.
3. Socio-cultural factors are highly recommended to take into account during design of new educational systems in Estonia.

6.3 Future works

A new software architecture model for e-learning systems EES Model-2 is aimed to be implemented on Fatih University e-learning system. Fatih University involves students who are from all regions of Turkey with different socio-cultural factors. Especially, there is a big population of Kurdish students in the university.

During this thesis work, I already had a contact with the executive of e-learning centre in Fatih University. We are going to discuss the technical background of the current online e-learning software in the institute, and are going to work on the implementation on EES Model-2 on this system, by taking socio-cultural factors within the university students into account.

We aim this work to be a pilot implementation within universities in Turkey. We are planning after pilot implementation of EES Model-2 on the bases of feedback update EES Model-2 for the new requirements.

REFERENCES

- Acar, H., Akar, S., Akdemir, G., et al. (2006). Migration, urban poverty and underclass – “Working in the garbage”. *Soc. Work. Soc.*, 4(1), pp. 148–159.
- Adams, L. and Courtney, J. (2004). Achieving relevance in IS research via the DAGS framework. In R.H. Sprague Jr. (ed.), *Proceedings of the Thirty-Seventh Annual Hawaii International Conference on System Sciences*. Los Alamitos, CA: IEEE Computer Society Press,
<http://csdl2.computer.org/persagen/DLAbsToc.jsp?resourcePath=/dl/proceedings/&toc=comp/proceedings/hicss/2004/2056/08/2056toc.xml&DOI=10.1109/HICSS.2004.1265615>
- ADL (2004). Sharable Content Object Reference Model (SCORM), 2nd Edition Document Suite.
<http://www.adlnet.org/downloads/70.cfm>.
- Adobe Connect Pro, <http://kontakt.ut.ee>
- Agarwal, R. (2000). Individual acceptance of information technologies. Framing the domains of IT management: Projecting the future through the past, pp. 85–104.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, pp. 179–211.
- Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. *Action-control: From cognition to behavior*, 11.
- Ajzen, I., M. Fishbein, and R. Heilbroner, (1980). Understanding attitudes and predicting social behavior. Prentice-Hall Englewood Cliffs, NJ.
- Al-Adwan, A. and Smedly, J. (2012) Implementing E-Learning in the Jordanian Higher Education System: Factors Affecting Impact. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 8, pp. 121–135.
- Alexander, B. (2006). Web 2.0: A new wave of innovation for teaching and learning. *Learning*, 41(2), pp. 32–44.
- Ally, M. (2008). Foundations of educational theory for online learning. In T. Anderson (Ed.), *Theory and practice of online learning*. Athabasca, ABA: Athabasca University.
http://www.aupress.ca/books/120146/ebooks/01_Anderson_2008_Ally-Online_Learning.pdf
- Alonso, F., López, G., Manrique, D. and Viñes, J. M. (2005) An instructional model for web-based e-learning education with a blended learning process approach. *British Journal of Educational Technology*, 36(2), pp. 217–235.
- AlAwadhi, S. and Morris, A. (2008). The use of the UTAUT model in the adoption of e-government services in Kuwait, *Proceedings of the 41st Annual Hawaii International Conference on System Sciences*, IEEE. doi:10.1109/HICSS.2008.452
- Alzahrani, M. E. and Goodwin, R. D. (2012). Towards a UTAUT-based Model for the Study of E-Government Citizen Acceptance in Saudi Arabia. *World Academy of Science, Engineering and Technology, International Science Index 64, International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, 6(4), pp. 376–382.
- Anadolu University (2008). EUA Self-Evaluation Report. Eskisehir, Turkey, <ftp.anadolu.edu.tr/Documents/EUA-Report.pdf>
- Anadolu University distance education, <https://tojde.anadolu.edu.tr/tojde16/news/anadolu.htm>
- Anderson, J. and Schwager, P. (2004). SME Adoption of Wireless LAN Technology: Applying The UTAUT Model. 7th Annual Conference of the Southern Association for Information System. Savannah, Georgia.
- Anderson, J., Schwager, P. and Kerns, R. (2006). The drivers for acceptance of tablet PCs by faculty in a college of business. *Journal of Information Systems Education*, 17(4), pp. 429–440.

- Archer, L. B. (1984). Systematic method for designers. In N. Cross (ed.), *Developments in Design Methodology*. London: John Wiley, pp. 57–82.
- Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educ Psychol.*, 28, pp. 117–148.
- Bandura, A., Barbaranelli, C., Caprara, G. and Pastorelli, C. (1996). Multifaceted impact of self-efficacy beliefs on academic functioning. *Child Dev.*, 67, pp. 1206–1222.
- Barron, A. E. and Kysilka, M. L. (1993). The effectiveness of digital audio in computerbased training. *Journal of Research on Computing in Education*, 25(3), pp. 277–289.
- Cassidy, N. (2014). Next Silicon Valleys: Small Estonia has big ideas. BBC News, www.bbc.com. February 23, 2014.
- Berners-Lee, T. J. (1992). The worldwide web. *Computer Networks and ISDN Systems*, 25(4-5), pp. 454–459.
- Berners-Lee, T. (2006). The World Wide Web - Past, Present and Future. Retrieved April 9, 2010. <https://journals.tdl.org/jodi/article/viewArticle/3/3>
- Berners-Lee, T., Cailliau, R., Luotonen, A., Nielsen, H. F., and Secret, A. (1994). The World-Wide Web. *Commun. ACM*, 37(8), 76–82. doi:10.1145/179606.179671
- Berners-Lee, T. and Hendler, J. (2001). Scientific publishing on the semantic web. *Nature*, 410, pp. 1023–1024.
- Broderick, C. L. (2001). What is instructional design? Retrieved on July 10, 2006 from http://www.geocities.com/ok_bcirt/whatisID.htm.
- Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of the Learning Sciences*, 2(2), pp. 141–178.
- Burn, T. 2006. Agent of change: Blackboard CEO Michael Chasen erases the old way of learning, Washington SmartCEO, pp. 44–53, <http://www.smartceo.com/files/DCEO.05.06.pdf>
- Cakmakci, N. (2009). Üniversite Kapısını Doğru Tercih Açıyor. (Right Choice is opening the university door), retrieved 10/29/2009, <http://arama.hurriyet.com.tr/arsivnews.aspx?id=12057384>
- Carr, V. H. (2001). Technology adoption and diffusion. <http://www.au.af.mil/au/awc/awcgate/innovation/adoptiondiffusion.htm>
- Cavazos, A. G. (2015). Multilingual faculty across academic disciplines: language difference in scholarship. *Language and Education*, 29(4).
- Chau, P. (1996). An empirical assessment of a modified technology acceptance model. *Journal of management information systems*, 13(2), pp. 185–204.
- Chen, L., Gillenson, M. and Sherrell, D. (2002). Enticing online consumers: an extended technology acceptance perspective. *Information & Management*, 2002. 39(8), pp. 705–719.
- Chokri, B. (2012). Factors influencing the adoption of the e-learning technology in teaching and learning by students of a university class. *European Scientific Journal* December edition. 8(28), pp. 165–190.
- Clark, R. C. and Mayer, R. E. (2002). *E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning*. Pfeiffer.
- Cloete, E. (1999). Some perspectives on network centric distance learning and software engineering. *Proceedings of Future trends in distributed computing systems'99*. Cape Town, South Africa, December 1999.
- Cloete, E. (2000). Quality issues in system engineering affecting virtual distance learning systems. *Proceedings of COMPSAC'2000*. Taiwan, October 2000.
- Cloete, E. (2001). Electronic education system model. *Computers & Education*, 36, pp. 171–182.
- Cobb, P., Confrey, J., diSessa, A., Lehrer, R. and Schauble, L. (2003). Design experiments in educational research. *Educational Researcher*, 32(1), pp. 9–13.

- Cole, R., Purao, S., Rossi, M. and Sein, M. K. (2005). Being proactive: Where action research meets design research. In D. Avison, D. Galletta, and J.I. DeGross (eds.), *Twenty-Sixth International Conference on Information Systems*. Atlanta: Association for Information Systems, pp. 325–336.
- Collier, G. and Robson, R. (2002). *eLearning Interoperability Standards*. Sun Microsystems.
- Collins, A. and Halverson, R. (2009). *Rethinking education in the age of technology: The digital revolution and schooling in America*. New York: Teachers College Press.
- Coopman, S. J. 2009. A critical examination of Blackboard's e-learning environment. doi:10.5210/fm.v14i6.2434
- Cross, J. (2004). An Informal History of eLearning, *On the Horizon*, 12(3), pp 103–110.
- Davis, F. D. (1986). A technology acceptance model for empirically testing new end-user information systems: Theory and results. Doctoral dissertation. Cambridge, MA: MIT Sloan School of Management.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), pp. 319–340.
- Davis, F., Bagozzi, R. and Warshaw P. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management science*, 35(8), pp. 982–1003.
- Davydov, V. V. (1975a). Logical and psychological problems of elementary mathematics as an academic subject. *Soviet Studies in the Psychology of Learning and Teaching Mathematics*, 7, pp. 55–108.
- Davydov, V. V. (1975b). The psychological characteristics of the prenumerical period of mathematics instruction. *Soviet Studies in the Psychology of Learning and Teaching Mathematics*, 7, pp. 109–206.
- Davydov, V. V. and Markova, A. A. (1983). A concept of educational activity for school children. *Soviet Psychology*, 2(2), pp. 50–76.
- (DBRC) Design-Based Research Collective. (2003). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher*, 32(1), pp. 5–8.
- Della Chiesa, B., Scott, J. and Hinton, C. (eds) (2012). *Languages in a global world: learning for better cultural understanding*. OECD Pub. <http://dx.doi.org/10.1787/9789264123557-en>
- Demiray, U. (Ed.) (2010). *e-Learning practices: Cases and challenges facing e-learning and national development: Institutional studies and practices*, 1, Eskisehir, Turkey, Anadolu University.
- Design-Based Research Collective (2003). *Design-Based Research: An Emerging Paradigm for Educational Inquiry*. *Educational Researcher*, 32(1), pp. 5–8.
- Dick, W. O., Carey, L. and Carey, J. O. (2004). *Systematic design of instruction*. Boston, MA: Allyn and Bacon.
- Dick, W., Carey, L. and Carey, J. O. (2005). *The systematic design of instruction* (6th ed.). Boston: Allyn and Bacon.
- Dhiya Al-Jumeily and Abir Jaafar Hussain, (2014). The impact of cultural factors on technology acceptance: A technology acceptance model across Eastern and Western cultures. *International Journal of Enhanced Research in Educational Development (IJERED)*. 2(4), pp. 37–62.
- Drlik, M., and Skalka, J. (2011). Virtual Faculty Development Using Top-down Implementation Strategy and Adapted EES Model. *Procedia - Social and Behavioral Sciences*, 28(0), pp. 616–621. doi:10.1016/j.sbspro.2011.11.117
- Dremljuga-Telk, M., Koitla, E. and Kusnets, K. (2011). E-learning Quality Assurance System for e-Courses in Estonia, In Eischmidt, E. and Löfström, E. (Eds.) *Developing Quality Cultures in Teacher Education: Expanding Horizons in Relation to Quality Assurance*. Tallinn: Tallinn University, pp. 120–130.

- Drlik, M. and Skalka, J. (2011). Virtual Faculty Development Using Top-down Implementation Strategy and Adapted EES Model. *Procedia - Social and Behavioral Sciences*. Kyrenia, Cyprus, 3(28), pp. 616–621.
- Dron, J. and Anderson, T. (2014). *Teaching crowds: Social media and distance learning*. Athabasca: AU Press.
- Dulai, T., Medve A., Muhi, D. and Tarnay, K. (2013). Service discovery to create a well personalized e-learning system. *Proceedings of the 3rd European Conference on e-learning (ECEL)*, Paris, France, November pp. 25–26.
- Dündar, H. and Akçayır, M. (2014). Implementing tablet PCs in schools: Students' attitudes and opinions. *Computers in Human Behavior*, 32, pp. 40–46, <http://dx.doi.org/10.1016/j.chb.2013.11.020>
- Durant, W. (1980). The age of faith. In: Durant W (ed) *The story of civilization*. Sim. Sch., 4, pp. 162–186.
- Edelson, D. C. (2002). Design research: What we learn when we engage in design. *Journal of the Learning Sciences*, 11(1), pp. 105–121.
- Eekels, J. and Roozenburg, N. F. M. (1991). A methodological comparison of the structures of scientific research and engineering design: Their similarities and differences. *Design Studies*, 12(4), pp. 197–203.
- Efegil, E. (2011). Analysis of the AKP government's policy toward the Kurdish issue. *Tur. Stud.*, 12(1), pp. 27–40. doi:10.1080/14683849.2011.563938
- Ehlers, U. D. and Pawlowski J. M. (2006). *Handbook on quality and Standardisation in e-learning*. Springer, New York.
- Elloumi, F. (2004). Value chain analysis: A strategic approach to online learning. In A. Anderson and F. Elloumi (Eds.), *Theory and practice of online learning* (pp. 61–92). Athabasca, Canada: Athabasca University.
- Eren, H. (1990). *Ataturk ve milli kultur. Milli kultur unsurlarimiz uzerinde genel gorusler*. Ataturk kultur merkezi yayinlari.
- European Commission (2001). *Communication from the Commission to the Council and the European Parliament. The eLearning Action Plan, Designing Tomorrow's Education*. Brussel. COM(2001) 172 final.
- Falvo, D. A. and Johnson, B. F. (2007). The use of learning management systems in the United States. *TechTrends*, 51(2), pp. 40–45. <http://dx.doi.org/10.1007/s11528-007-0025-9>
- Finley, L. and Hartman, D. (2004). Institutional change and resistance: Teacher preparatory faculty and technology integration, *Journal of Technology and Teacher Education*, 12(3), pp. 319–337.
- Fishbein, M. and Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*.
- Fu, J.-R., Farn, C.-K. and Chao, W.-P. (2006). Acceptance of electronic tax filing: A study of taxpayer intentions. *Information & Management*, 43(1), pp. 109–126.
- Fullan, M. (1993). *Changing Forces: Probing the Depths of Educational Reform*. London: Falmer Press.
- Gallup Survey, The Gallup Poll, January 15-18, 2007, <http://www.galluppoll.com/content/default.aspx?ci=1690>.
- Shapoval, C. (2016). *Baltic startup. Estonia became a European equivalent of the American Silicon Valley*. Georgia-Caucasus Strategic Studies Institute (GCSSI), August 4, 2016.
- Gonçalves, A. and Pedro, N. (2012). Innovation, e-Learning and Higher Education: An Example of a University- LMS Adoption Process. *World Academy of Science, Engineering and Technology, International Science Index 66, International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, 6(6), pp. 1075–1082.

- Grandon, E., Alshare, O. and Kwan, O. (2005). Factors influencing student intention to adopt online classes: A cross-cultural study. *Journal of Computing Sciences in Colleges*, 20(4), pp. 46–56.
- Gunawardena, C. N., Nolla, A. C., Wilson, P. L., Lopez-Islas, J. R., Ramirez-Angel, N. and Megchun-Alpizar, R. M. (2001). A crosscultural study of group process and development in online conferences. *Distance Education*, 22(1), 85–121. doi:10.1080/0158791010220106
- Gupta, B., Dasgupta, S. and Gupta, A. (2008). Adoption of ICT in a government organization in a developing country: An empirical study. *The Journal of Strategic Information Systems*, 17(2), pp. 140–154.
- Gustafson, K. L. and Branch, R. M. (2002). What is instructional design? In R. A. Reiser & J. V. Dempsey (Eds.), *Trends and issues in instructional design and technology*. Columbus: OH, Merrill Prentice Hall, pp. 16–25.
- Güllü, F., Kuusik, R., Demiray, U. and Laanpere, M. (2014). Comparing implementation patterns of e-learning for higher education in Turkey and Estonia. *Proceedings of the ECEL-2014. Denmark, Copenhagen*, pp. 644–650.
- Güllü, F., Kuusik, R. and Laanpere, M. (2015). Electronic Education System Model-2. *Proceedings of the International Conference E-Learning 2015, Las Palmas De Gran Canaria, Spain, July 21-24*, pp. 162–166.
- Güllü, F., Kuusik, R., Laanpere, M., Sozcu, O. F. (2015a). Socio-cultural differences of e-learning in Estonia and Turkey. *Proceedings of 8th annual International Conference of Education, Research and Innovation (ICERI 2015), Seville, Spain, November 16–18*, pp. 6325–6332.
- Güllü, F., Kuusik, R., Laanpere, M. and Sozcu, O. F. (2015b). Using EES model-2 for comparison of e-learning activities of Estonian and Turkish biggest universities. *Proceedings of 8th annual International Conference of Education, Research and Innovation (ICERI 2015), Seville, Spain, November 16-18*, pp. 6333–6342.
- Güllü, F., Kuusik, R., Laanpere, M., Oysal, Y., Sozcu, O. F., Parlak, Z., Shogenov, K. An Analysis and Comparison of Adoption of E-learning Systems in Higher Education by Lecturers at Largest Universities in Estonia and Turkey. *Baltic J. Modern Computing*, Vol. 4 (2016), No. 3, pp. 428–440.
- Hara, N. (2000). Student distress in a web-based distance education course. *Information, Communication and Society*, 3(4), pp. 557–579.
- Harris, D. (1999). Internet-based learning tools. *Internet based learning*, pp. 165–177.
- Hevner, A. R., March, S. T. and Park, J. (2004). Design research in information systems research. *MIS Quarterly*, 28(1), pp. 75–105.
- Hogan-Brun, G. (2007). Language-in-education across the Baltic: policies, practices and challenges. *Com. Ed. Rev.*, 43(4), pp. 553–570.
- Hokanson, B. and Miller, C. (2009). Role-based design: A contemporary framework for innovation and creativity in instructional design. *Educational Technology*, 49(2), pp. 21–28.
- Horton, W. and Horton, K. (2003). *E-learning Tools and Technologies: A consumer's guide for trainers, teachers, educators, and instructional designers*. John Wiley & Sons.
- Hung, S. Y., Chang, C. M. and Yu, T. J. (2006). Determinants of user acceptance of the e-government services: the case of online tax filing and payment system. *Government Information Quarterly*, 23(1), pp. 97–122.
- IEEE (2006). IEEE Learning Technology Standards Committee Home page. <http://ieeeltsc.org/>
- IMS Global Learning Consortium (2006). IMS Global Learning Consortium home page. <http://www.imsglobal.org/>
- Ismail, J. (2002). The design of an e-learning system: Beyond the hype. *Internet and Higher Education*, 4, pp. 329–336.

- Jacquart, D. (2008). Islamic pharmacology in the Middle Ages: theories and substances. *Eur. Rev.*, 16(2), pp. 219–227.
- Jacobsen P. (2002). LMS vs. LCMS.
<http://www.elearningmag.com/ltimagazine/article/articleDetail.jsp?id=21264>.
- John-Steiner, V. and Mahn, H. 1996. Sociocultural approaches to learning and development: a Vygotskian framework. *Educ Psychol.*, 31, pp. 191–206.
- Jahnke, I. (2016). *Digital Didactical Designs. Teaching and Learning in CrossActionSpaces*. New York: Routledge. (<http://www.routledge.com/books/details/9781138928497>)
- Johnson-Laird, P. and Byrne, R. (2000). A gentle introduction. Mental Models Website, School of Psychology, Trinity College, Dublin, (available at www.tcd.ie/Psychology/Ruth_Byrne/mental_models/).
- Kalvet, T. (2007). The Estonian Information Society Developments since the 1990s. Tallinn: PRAXIS Center for Policy Studies.
- Kalvet, T. (2010). Policy Paper on Innovation: Estonia. Expert Evaluation Network delivering Policy Analysis on the Performance of Cohesion Policy 2007–2013. Brussels: DG Regional Policy.
- Kanuka, H. (2006). Instructional design and eLearning: A discussion of pedagogical content knowledge as a missing construct. *The e-Journal of Instructional Science and Technology*, 9(2) [online]. Retrieved March 17, 2008, from: http://www.usq.edu.au/electpub/e-jist/docs/vol9_no2/papers/full_papers/kanuka.htm
- Kay, A. and Goldberg, A. (1977). Personal dynamic media. *Computer*, 10(3), 31–41.
- Kelly, A., Lesh, R. and Baek, J. (Eds.). (2008). *Handbook of design research methods in education*. New York: Routledge.
- Kemppainen, R. P., Ferrin, S. E., Hite, S. J., et al. (2008). Socio-cultural aspects of Russian-speaking parents' choice of language of instruction for their children in Estonia. *Com. Ed. Rev.*, 52(1), pp. 93–119.
- Khalid, A. and Azeem, M. (2012). Constructivist vs traditional: effective instructional approach in teacher education. *International Journal of Humanities and Social Science*, 2(5), pp. 170–177.
- Kilmurray, J. (2003). E-learning: It's more than automation. The Technology Source archives. Retrieved from <http://technologysource.org/article/elearning/>
- Kim, J. S. (2005). The Effects of a Constructivist Teaching Approach on Student Academic Achievement, Self-Concept, and Learning Strategies. *Asia Pacific Education Review*, 6(1), pp. 7–19.
- King, E. and Boyatt, R. (2015). Exploring factors that influence adoption of e-learning within higher education. *British Journal of Educational*, 46(6), pp. 1272–1280.
- Kohn, T., Maier, R., Thalmann, S. (2010). Knowledge Transfer with E-Learning Resources to Developing Countries: Barriers and Adaptive Solutions. In: Breitner M., Lehner F., Staff J., Winand U. (eds) *E-Learning 2010. Physica, Heidelberg*, pp. 15–29.
- Kok, A. (2013). How to Manage the Inclusion of E-Learning in Learning Strategy: Insights from a Turkish Banking Institution. *International Journal of Advanced Corporate Learning (iJAC)*, 6(1), pp. 20–27. Kassel University Press GmbH.
- Kolias, A. (2007). Socio-cultural dimensions in the pedagogic design of e-learning and e-content for adult learners Available via A European Perspective (Grant Agreement number: 2005-3872/001-001 ELE-ELEB14). Project Acronym: Fe-ConE. <http://forth.gr>. Accessed 09 Feb 2015.
- Koohang, A. and Durante, A. (2003). Learners' perceptions toward the web-based distance learning activities/assignments portion of an undergraduate hybrid instructional model. *Journal of Information Technology Education*, 2, pp. 105–113.

- Koržel, J. (2013). How minority pupils in Estonia view and cope with studying Estonian and via Estonian. *Kieli, koulutus ja yhteiskunta*. www.kieliverkosto.fi/journal. Accessed 09 Feb 2015
- Kuzu, A., Kurt, A., A., Dursun, Ö. Ö., Güllüpinar, F. and Gültekin, M. (2013). Evaluation of the application process of fatih project: students' views. *World Journal on Educational Technology*, 5(3), pp. 395–412.
- Laanpere, M. (2013). *Pedagogy-driven Design of Virtual Learning Environments*. PhD thesis. Tallinn University, Tallinn.
- Lakkala, M., Ilomäki, L., Kosonen, K., Paavola, S. and Muukkonen, H. (2012). Exploring the applicability of dialogical design principles for examining knowledge practices in education. In A. Moen, A.I. Mørch, & S. Paavola (Eds.), *Collaborative Knowledge Creation: Practices, Tools, and Concepts*, Sense Publishers, pp. 141–161.
- Latchem, C., Özkul, A. E., Aydin, C. H. and Mutlu, M. E. (2006). The open education system, Anadolu University, Turkey: e-transformation in a mega-university, *Open Learning*, 21(3), pp. 221–235.
- Legrís, P., Ingham, J. and Colletette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management*, 40, pp. 191–204.
- Leinonen, T. (2010). *Designing Learning Tools - Methodological Insights*. Ph.D. Aalto University School of Art and Design. Helsinki: University of Helsinki. Jyväskylä: Bookwell. <https://www.taik.fi/-kirjakauppa/images/430c5f77373412b285ef7e32b5d16bd5.pdf>
- Leont'ev, A. N. (1981). *Activity, consciousness, and personality*. Englewood Cliffs, N.J.: Prentice-Hall.
- Lepkova, N., Arslan, V., Rimkuvienė, S., Selcukcan Erol, C. and Gulsecen, S. (2012). Distance Learning In Lithuania And Turkey: A Comparative Study. In *Fourth International Conference on Innovations in Learning for the Future: e-Learning*, Conference Proceedings, pp. 261–281.
- Lin, C. Y. C. and Fu, V. R. (1990). A comparison of childrearing practices among Chinese, immigrant Chinese, and Caucasian-American parents. *Ch. Dev.*, 61, pp. 429–433.
- Lin, J. C. and Lu, H. (2000). Towards an understanding of the behavioral intention to use a Web Site. *International Journal of Information Management*, 20, pp. 197–208.
- Luria, A. R. (1928). The problem of the cultural behavior of the child. *Journal of Genetic Psychology*, 35, pp. 493–506.
- Mac Keogh, K. and Fox, S. (2009). Opening access to higher education to all? Retrieved from www.edenonline.org/contents/conferences/research/paris/MacKeogh_Fox.pdf
- Malhotra, Y. and Galletta, D. F. (1999). Extending the technology acceptance model to account for social influence: Theoretical bases and empirical validation. *Proceedings of the 32nd Hawaii International Conference on System Sciences*, 1, January 1999.
- March, S. and Smith, G. (1995). Design and natural science research on information technology. *Decision Support Systems*, 15(4), pp. 251–266.
- Marcus, A. and Gould, E. W. (2000). Cultural dimensions and global Web user interface design: What? So what? Now what? *Proceedings of the 6th conference on Human Factor and the Web*, viewed 2000-06-19
- Masoumi, D. and Lindström, B. (2012). Quality in e-learning: a framework for promoting and assuring quality in virtual institutions. *J. Com. As. Lear.*, 28, pp. 27–41. doi:10.1111/j.1365-2729.2011.00440.x
- Mathieson, K. (1991). Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior. *Information systems research*, 2(3), pp. 173–191.
- Mayes, T. and de Freitas, S. (2004). Review of e-learning theories, frameworks and models: JISC eLearning Models Desk Study, Stage 2, available online in pdf format from http://www.jisc.ac.uk/whatwedo/programmes/elearning_pedagogy/

- Merrill, M. D., Barclay, M. and Van Schaack, A. (2008). Chapter 14 Prescriptive principles for instructional design. In J. M. Spector, M. D. Merrill, J. J. G. van Merriënboer & M. P. Driscoll (Eds.). *Handbook of Research on Educational Communications and Technology*, New York: Lawrence Erlbaum Associates: Taylor and Francis Group, 3, pp. 173–184.
- Metslang, H., Kibar, T., Kitsnik, M. et al. (2013). Kakskeelne õpe vene õppekeele koolis [Bilingual learning in Russian-medium schools]. <http://www.hm.ee/index.php?044827>. Accessed 09 Feb 2015
- Min, Q., Ji, S. and Qu, G. (2008). Mobile Commerce User Acceptance Study in China: A Revised UTAUT Model. *Tsinghua Science & Technology*, 13(3), pp. 257–264.
- Moore, T. E. (2002). Emerging competitors in executive education. *Rethinking Management Education for the 21st Century*, 157.
- Morrison, G., Ross, S. and Kemp, J. (2004). *Designing effective instruction*. Hoboken, NJ: John Wiley & Sons, Inc.
- Mott, J. (2010). Envisioning the Post-LMS Era. *EDUCAUSE Quarterly*, 33(1), pp. 1–9.
- Mutlu, M. E. (2004). E-Learning Applications in the Open Education Faculty of Anadolu University. *Proceedings of the European Association for Distance Learning (EADL) Conference 2004, Istanbul, 26-28 May 2004*.
- Myers, S. M. (1996). An Interactive Model of Religiosity Inheritance: The Importance of Family Context. *American Sociological Review*, 61, pp. 858–866.
- Nart, S. and Altunisik, R. (2013). Improving Distance Education System: Problems and Solutions from the Perspective of Lecturers, *The Online Journal of Distance Education and e-Learning*, 1(4), pp. 23–29.
- Nunamaker, J. F., Chen, M. and Purdin, T. D. M. (1990). Systems development in information systems research. *Journal of Management Information Systems*, 7(3), pp. 89–106.
- Noorlafshar, M. 2012. Education, its evolution and how it can be internationalised. *Asian Journal Social Sciences & Humanities*, 1(3), pp. 32–38.
- Oh, E. and Reeves, T. C. (2010). The implications of the differences between design research and instructional systems design for educational technology researchers and practitioners. *Educational Media International*, 47(4), pp. 263–275.
- O'Shea, T., and Self, J. (1984). *Learning and teaching with computers: artificial intelligence in education*. Brighton: Harvester Press.
- Paavola, S. and Hakkarainen, K. (2009). From meaning making to joint construction of knowledge practices and artefacts – A dialogical approach to CSCL. In C. O'Malley, D. Suthers, P. Reimann, & A. Dimitracopoulou (Eds.), *Computer Supported Collaborative Learning Practices: CSCL2009 Conference Proceedings*, Rhodes, Greece: International Society of the Learning Sciences (ISLS), pp. 83–92.
- Pamuk, S., Çakir, R., Ergun, M., Yilmaz, H. B. and Ayas, C. (2013). The use of tablet PC and interactive board from the perspectives of teachers and students: evaluation of the FATİH project. *Educational Sciences: Theory & Practice*, 13(3), pp. 1815–1822. doi:10.12738/estp.2013.3.1734
- Panofsky, C. P. (2003). The Relations of Learning and Student Social Class: Toward Re-“Socializing” Sociocultural Learning Theory. In A. Kozulin, V. Agayev, B. Gindis, S. Miller (Eds.), *Vygotsky's theory of education in cultural context*. New York: Cambridge University Press.
- Papert, S. (1997). Educational computing: How are we doing. *The Journal (Technological Horizons in Education)*, 24(11).
- Park, S. Y. (2009). An Analysis of the Technology Acceptance Model in Understanding University Students' Behavioral Intention to Use e-Learning. *Educational Technology & Society*, 12 (3), pp. 150–162.

- Peer, K. S. and McClendon, R. C. (2002). Sociocultural Learning Theory in Practice: Implications for Athletic Training Educators. *Journal of Athletic Training*, 37(4), pp. 136–140.
- Phipps, R. and Merisotis, J. (2000). *Quality on the Line: Bench-marks for Success in Internet-Based Distance Education*. The Institute of Higher Education Policy, Washington, DC.
- Planel, C. (1997). National cultural values and their role in learning: a comparative ethnographic study of state primary schooling in England and France. *Com. Ed.*, 33(3), pp. 349–373.
- Peppers, K., Tuunanen, T., Rothenberger, M. and Chatterjee, S. (2008). A design science research methodology for information systems research. *Journal of Management Information Systems*, 24(3), pp. 45–77.
- Pogue, L. S. (2009). Instructivism Vs Constructivism. <http://ezinearticles.com/?Instructivism-Vs-Constructivism&id=1857834>
- Population and Social Statistics Department of Estonia: <http://www.stat.ee>
- Pouzevara, S., Dincer, A., Kipp, S. and Sariisik, Y. (2013). Turkey's FATIH project: A plan to conquer the digital divide or a technological leap of faith? Research Triangle Park, NC & Istanbul, Turkey: RTI International & Education Reform Initiative (ERI).
- Poulsen, M.F. (2002) Online Education Systems: Discussion and Definition of Terms. <http://nettskolen.nki.no/forskning/Definition%20of%20Terms.pdf>
- Prensky, M. (2001). *Digital game-based learning*. New York: McGraw-Hill.
- Reigeluth, C. M. (1994). The imperative for systemic change. In C.M. Reigeluth & R.J. Garfinkle (Ed.), *Systemic Change in Education*. Englewood Cliffs, NJ: Educational Technology Publications.
- Reinking, D. and Bradley, B. A. (2008). *Formative and design experiments: Approaches to language and literacy research*. New York: Teachers College Press.
- Reis, Z. A. and Gulsecen, S. (2014). The socio-cultural dimensions of e-learning in Turkish higher education institutions. In: V. Zuzevičiūtė, E. Butrimė, D. Vitkutė-Adžgauskienė, V. Vladimirovich Fomin, and K. Kikis-Papadakis (Eds.), *E-learning as a socio-cultural system: A multidimensional analysis*, pp. 237–252. Hershey, PA: Information Science Reference. doi:10.4018/978-1-4666-6154-7.ch014
- Ringvee, R. (2011). Is Estonia really the least religious country in the world? *The Guardian*, 1.
- Rassuli, K. M. and Tippins, M. J. (1997). History and cyberspace: A marketing history of the CD-ROM book industry. *Journal of Macromarketing*, 17, pp. 89–106.
- Reeves, T. C. (2006). Design research from a technology perspective. In J. van den Akker, K. Gravemeijer, S. McKenney and N. Nieveen (Eds.), *Educational design research*, London: Routledge, pp. 52– 66.
- Rogers, E. M. (2003). *Diffusion of innovations* (5th Ed.). New York, NY: Free Press.
- Rossi, M. and Sein, M. K. (2003). Design research workshop: A proactive research approach. Paper presented at the Twenty-Sixth Information Systems Research Seminar in Scandinavia, Information Systems Research in Scandinavia Association, Haikko, Finland, August 9–12, 2003.
- Rowland, G. (1992). What do instructional designers actually do? An initial investigation of expert practice. *Performance Improvement Quarterly*, 5(2), pp. 65–86.
- Rowland, G. (1993). Designing and instructional design. *Educational Technology Research & Development*, 41(1), pp. 79–91.
- Saadé, R. G. (2003). Web-based education information system for enhanced learning, EISL: Student assessment. *Journal of Information Technology Education*, 2, pp. 267–277.
- Sahin, I. and Thompson, A. (2006). Using Rogers's theory to interpret instructional computer use by COE faculty. *Journal of Research on Technology in Education*, 39(1), pp. 81–104.
- Saliba, G. (1994). *A history of Arabic astronomy: planetary theories during the Golden Age of Islam*. New York University Press, pp. 254 and 256–257.

- Salomoni, P., Mirri, S. and Gay, G. R. (2007). E-learning. In: Encyclopedia of Internet Technologies and Applications, Idea Group Reference, pp. 179-184.
- Salvatore, C. (2002). Implications of culture in distance education. *The Reference Librarian*, 77, 107-119.
- Sandoval, W. A. (2004). Developing learning theory by refining conjectures embodied in educational designs. *Educational Psychologist*, 39(4), pp. 213-223.
- Sangrà, A., Vlachopoulos, D. and Cabrera, N. (2012). Building an inclusive definition of e-learning: An approach to the conceptual framework. *International Review of Research on Open and Distance Learning*, 13(2), pp. 145-159.
- Scardamalia, M. and Bereiter, C. (2006). Knowledge building: Theory, pedagogy, and technology. In K. Sawyer (Ed.), *Cambridge Handbook of the Learning Sciences*, New York: Cambridge University Press, pp. 97-118.
- Scardamalia, M. and Bereiter, C. (2010). A brief history of knowledge building. *Canadian Journal of Learning and Technology*, 36(1).
- Scott, S. E. and Palincsar, A. S. (2009). Sociocultural Theory. In M. Anderman & L. H. Anderman (Eds.) *Psychology of Classroom Learning: An Encyclopedia*. Farmington Hills, MI: Gale Group
- Seufert, S. (2002). eLEARNING BUSINESS MODELS Strategies, Success Factors, and Best Practice Examples. *Rethinking management education for the 21st century*, 109.
- Sheppard, B., Hartwick, J. and Warshaw, P. (1988). The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of Consumer Research*, 15(3), pp. 325-343.
- Sherkat, D. E. (1998). Counterculture or Continuity? Competing Influences on Baby Boomers? Religious Orientations and Participation. *Social Forces*, 76, pp. 1087-1115.
- Sherkat, D. E. (2007). Religion and higher education: The good, the bad, and the ugly. Retrieved from <http://religion.ssrc.org/reforum/Sherkat.pdf>
- Sims, R. (1988). Futures for computer-based training: Developing the learner-computer interface. *Australian Journal of Educational Technology*, 4(2), pp. 123-136.
- Sloman M. (2002). The E-Learning Revolution: How Technology is Driving a New Training. Paradigm. American Management Association.
- Smith, P. L. and Ragan, T. J. (1999). *Instructional design* (2nd ed.). New York: Merrill, Macmillan Publishing Company.
- Statistical Yearbook for Asia and the Pacific (2013). Thailand, Bangkok: United Nations publication, ESCAP, <http://www.unescap.org/stat/data/syb2013/escap-syb2013.pdf>
- Stolzenberg, R. M., Blair-Loy, M. and Waite, L. J. (1995). Religious Participation Over the Early Life Course: Age and Family Life Cycle Effects on Church Membership. *American Sociological Review*, 60, pp. 84-103.
- Su, B. (2009). Effective technology integration: Old topic, new thoughts. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*. California State University Monterey Bay, USA, 5(2), pp. 161-171.
- Sumner, J. (2000). Serving the System: A Critical History of Distance Education. *Towson University. Open Learning*, 15(3), pp. 267-285.
- Surry, D. W., Ensminger, D. C. and Haab, M. (2005). A model for integrating instructional technology into higher education. *British Journal of Educational Technology*, 36(2), pp. 327-329.
- Television of the University of Tartu UTTV, <http://uttv.ee>
- Terry, N. P. and Irving, M. A. (2010). Cultural and linguistic diversity: Issues in education, 5(4), Kendall Hunt Publishing Co.
- The Concise Columbia Encyclopedia. 1992. Columbia University Press.

- The Estonian Lifelong Learning Strategy 2020 (2014). Tallinn, <http://www.kogu.ee/wp-content/uploads/2014/05/Lifelong-Learning.pdf>
- The Guinness book of records (1998). pp. 242.
- Thong, J. Y. L., Hong, W. and Tam, K. (2002). Understanding user acceptance of digital libraries: What are the roles of interface characteristics, organizational context, and individual differences? *International Journal of Human-Computer Studies*, 57, pp. 215–242.
- Times Higher Education World University Rankings 2013-14, <http://www.timeshighereducation.co.uk/world-university-rankings/2013-14/world-ranking/range/351-400>
- Tudge, J., Hogan, D., Lee, S. et al. (1999). Cultural heterogeneity: parental values and beliefs and their preschoolers' activities in the United States, South Korea, Russia, and Estonia. In *Children's engagement in the world: sociocultural perspectives*, pp. 62–96. A. Göncü, ed. Cambridge: Cambridge University Press.
- Tulviste, T. (2013). Socialization values of mothers and fathers: Does the child's age matter? *Trames: J. Hum. Soc. Sci.*, 17(2), pp. 129–140.
- Tulviste, T., Mizera, L. and De Geer, B. (2012). Socialization values in stable and changing societies: a comparative study of Estonian, Swedish, and Russian Estonian mothers. *J. Cross-Cult. Psych.*, 43(3), pp. 480–497.
- Tulviste, T., Mizera, L., De Geer, B. et al. (2007). Child-rearing goals of Estonian, Finnish, and Swedish mothers. *Scan. J. Psych.*, 48, pp. 487–497.
- Tuomi, I. (2002). *Networks of innovation*. Oxford University Press.
- UN Demographic Yearbook 2009-2010 (2011). New York, NY: United Nations publication, <http://unstats.un.org/unsd/demographic/products/dyb/dybsets/2009-2010.pdf>
- University of Tartu e-learning portal, <http://www.etu.ut.ee/2014/e-oppe-statistika-2>
- University of Tartu, <http://www.ut.ee>
- Usun, S. (2004). Factors Affecting the Application of Information and Communication Technologies (ICT) in Distance Education. *The Turkish Online Journal of Distance Education*, 5(1).
- Vagias, Wade M. (2006). Likert-type scale response anchors. Clemson International Institute for Tourism & Research Development, Department of Parks, Recreation and Tourism Management. Clemson University.
- van den Akker, J. (1999). Principles and methods of development research. In J. van den Akker, N. Nieveen, R.M. Branch, K.L. Gustafson & T. Plomp (Eds.), *Design methodology and developmental research in education and training* (pp. 1–14). The Netherlands: Kluwer Academic Publishers.
- van den Akker, J., Gravemeijer, K., McKenney, S. and Nieveen, N. (2006). *Educational design research*. London: Routledge.
- Venkatesh, V. (1999) Creation of favorable user perceptions: exploring the role of intrinsic motivation. *MIS quarterly*. 23(2), pp. 239–260.
- Venkatesh, V. and Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46, pp. 186–204.
- Venkatesh, V., Morris, M. G., Davis, G. B. and Davis, F. D. (2003), User acceptance of information technology: Toward a unified view. *INFORM MANAGEMENT*, 2003. 27(3), pp. 425–478.
- Visser, P. S., Krosnick, J. A., Marquette, J. and Curtin, M. (1996). Mail Surveys for Election Forecasting? An Evaluation of the Colombia Dispatch Poll. *Public Opinion Quarterly*, 60, pp. 181–227.
- Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press; Cambridge, MA.

- Walls, J., Widmeyer, G. and El Sawy, O. (1992). Building an information system design theory for vigilant EIS. *Information Systems Research*, 3(1), pp. 36–59.
- Walls, J., Widmeyer, G. and El Sawy, O. (2004). Assessing information system design theory in perspective: How useful was our 1992 initial rendition? *Journal of Information Technology Theory & Application*, 6(2), pp. 43–58.
- Wang, F. and Hannafin, M. J. (2005). Design-based research and technology-enhanced learning environments. *Educational Technology Research and Development*, 53(4), pp. 5–23.
- Wang, S. and Tamis-LeMonda, C. S. (2003). Do childrearing values in Taiwan and the United States reflect cultural values of collectivism and individualism? *J. Cross-Cult. Psyc.* 34, pp. 629–642.
- Weller, M. (2007). *Virtual Learning Environments: Using, Choosing and Developing your VLE*. Oxon: Routledge.
- Wenger, E., McDermott, R. and Snyder, W. (2002). *Cultivating Communities of Practice*. Boston, Mass: Harvard Business School Press.
- Whyte, W.F. (ed.) (1991) *Participatory Action Research*. Sage, CA.
- Wills, W. (1995). Instructional development for distance education. In *Distance education at a glance*. Engineering Outreach at University of Idaho, October 1995. www.uidaho.edu/evo/dist3.html).
- Yamamoto, G. T., Demiray, U. and Demirci, B. B. (2011) *Türkiye’de E-öğrenme: Gelişmeler ve Uygulamalar II*, Istanbul.
- Yamamoto, G. T., Demiray, U. and Kesim, M. (2010). *Türkiye’de E-öğrenme: Gelişmeler ve Uygulamalar*, Ankara.
- Yi, M. and Hwang, Y. (2003). Predicting the use of web-based information systems: Self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International Journal of Human-Computer Studies*, 59, pp. 431–449.
- Zhou, T., Lu, Y. and Wang, B. (2010). Integrating TTF and UTAUT to explain mobile banking user adoption. *Computers in Human Behavior*, 26(4), pp. 760–767.

ACKNOWLEDGEMENTS

First of all, I would like to thank my supervisor prof. Dr Rein Kuusik from Tallinn University of Technology (Estonia) for his kind support.

I am indebted to my co-supervisors Dr Mart Laanpere (Tallinn University, Estonia) and Dr Kazbulat Shogenov (Tallinn University of Technology, Estonia).

I am also indebted to my adviser Dr Omer Faruk Sozcu (Fatih University, Istanbul, Turkey)

I appreciate the assistance of prof. Dr Yusuf Oysal (Anadolu University, Eskisehir, Turkey) and Dr Zeki Parlak (Sakarya University, Sakarya, Turkey), prof. Dr Ugur Demiray (Anadolu University, Eskisehir, Turkey), Dr Rein Paluoj (Tallinn University of Technology, Estonia).

I am also grateful to the prof. Dr Andres Keevallik and Vedat Oguz for motivation.

My sincere thanks are addressed to my family, my wife Emine Gullu, my son Baki Gullu, my daughter Mine Eveline Gullu, my mother Ayse Gullu and my father Mehmet Gullu for their understanding, motivation and support.

ABSTRACT

The aim of this PhD research was to find barriers in e-learning systems at higher education in Turkey ways to improve existing situation by comparison of activities and structure, quality and issues of e-learning, covering policy, technical, pedagogical and socio-cultural aspects. The situation in e-learning systems at higher education in three largest Estonian universities, University of Tartu (UT), Tallinn Technical University (TUT) and Tallinn University (TU) and three largest Turkish mega-universities Anadolu (AU), Istanbul (IU) and Sakarya (SU) was analysed and compared.

This study proposed an integrated theoretical framework of university lecturers adoption of e-learning systems in Estonia with its advanced united e-learning system in higher education and in Turkey, where the system need to be improved and unified. Current situation in e-learning system was studied and compared using answers of questionnaire developed in this thesis on the basis of new EES Model-2 and extended technology acceptance model (TAM2) and sent to lecturers from the studied universities.

A cyclic iterative research-based design process consisting of three iterations ("EES model (Est-Tr)", "EES model-2" and "Adaptation of EES model-2") was developed and used in this thesis to reach research aims.

A new EES Model-2 extended from EES model was presented for more productive implementation in e-learning process design and modelling in higher education. The most updates were related to uppermost Socio-Cultural factor layer. The new layer consists of intermediate elements, Learning process and Learning environment strategies, and main objects: social influence elements (subjective norm, voluntariness, and image), cognitive instrumental processes (job relevance) and experience. Learning processes object of the layer was updated for adaptation of educational process for young and old people, taking into account interests and abilities of students of different age groups. Cultural diversity and language are important objects added to the uppermost layer. Communication object of the Instructional layer was updated and human and social factors were added. The methods of study of Instructional layer were updated with selective object "religion". Object "combination" that explained by combination of synchronous and asynchronous objects was added to E-paradigm layer. Religion was selected as second important component of socio-cultural factor in Turkey with high positive impact into the e-learning system at higher education and was presented in Estonia with insignificant impact. It was found that Turkish population is younger than Estonian one and component of age of socio-cultural factor is important for integration of e-learning between older lecturers and students. Component of customs and traditions including respect others, hard-working, independence and self-direction is positive and helpful in Estonian e-learning. Merged with a component of ethical values in Turkish case the customs and traditions consist of respect of teacher and unquestioning obedience of teacher targets. Weak side of the customs and traditions

of socio-cultural factor in Estonia is low importance of obedience if compare with Turkish values and separation by social status in Turkey.

Total number of students and academic staff in the studied Estonian universities is 39,259 and 3,991, respectively, and 1,194,735 and 9,076, respectively, in the studied Turkish universities. Results of acceptance and usage of e-learning by 923 lecturers (298 from Estonia and 625 from Turkey) or 22% from the sample subject, took part in the research from the studied universities, were analysed. Total number of respondents subjected to the questionnaire distribution was 4,198 (1,423 in Estonia and 2,775 in Turkey). According to results of applied survey, lecturers from both countries largest universities completely accept and understand importance of implementation of e-learning and showed good skills and confidence in e-learning. However, lecturers from the largest universities of Estonia were more satisfied of usage and adoption of e-learning system and showed more activeness than lecturers from Turkey.

Number of barriers in e-learning systems in largest Estonian and Turkish universities were found: gaps in policy adaptation, security, financial support mechanisms and productive cooperation between institutions in Estonian universities at TUT; absence of clear vision and policy for e-learning development at TU; poor technological infrastructure and outdated e-learning systems and poor readiness of academic staff to use e-learning system at UT; poor technological infrastructure and outdated e-learning systems, absence of clear vision and policy for e-learning development, poor readiness of academic staff to use e-learning system were found mostly at Istanbul University.

The obtained results were analysed and following suggestions were developed for Estonian and Turkish universities governances to improve current situation in e-learning. Necessary measures include: improvement of productive cooperation between Estonian institutions; renovation of technological aspect of e-learning system at UT and to use a systemic change approach that is effective measure to implement new technologies; taking the model of development of e-learning system in Estonian universities as example for all Turkish universities, beginning with establishment of strong and stable regulatory policy, building a consortia between all universities in the field, significant financing of technological infrastructure, financial support guarantee of projects related to development of e-learning system, support of security measures to provide safe usage of e-learning and develop training system for new and existing specialists. It was highly recommended to implement all measures in a complex. Selection of suggested tools separately will not guarantee stable, productive result of e-learning architecture. General revision of state of e-learning at all universities in Turkey and preparation of the project to update and unify e-learning systems in Turkish universities, using EES Model-2, presented in this study, and the best practices of Estonian higher education system is recommended to the Higher education council (YOK) as a prime regulation agency of higher education in Turkey.

Results of this study will help to improve e-learning systems at higher education in Turkey, as well as in other countries that meet similar barriers.

KOKKUVÕTE

Käesoleva doktoritöö eesmärgiks oli määratleda Türgi kõrghariduse e-õppe süsteemis esinevaid probleeme ja kitsendusi ning leida viise olukorra parendamiseks. Selleks tuli uurida vastavaid tegevusi, struktuuri, kvaliteeti ning e-õppega seotud küsimusi nende eri aspektides, nagu näiteks, tehniline, pedagoogiline, sotsio-kultuuriline ja haldamise aspekt. Töö raames analüüsiti ja võrreldi e-õppe olukorda kolmes suurimas Eesti ülikoolis - Tartu Ülikoolis, Tallinna Tehnikaülikoolis ja Tallinna Ülikoolis ning kolmes Türgi suurülikoolis - Anadolu, Istanbuli ja Sakarya Ülikoolis.

Uuringu tulemusena pakuti töös välja e-õppe süsteemi integreeritud teoreetiline raamistik EESModel-2 (EESM-2) , mis on suunatud kasutamisele nii Eestis, kus on ühine ja arenenud kõrghariduse e-õppe süsteem, kui ka Türgis, kus see süsteem vajab arendamist ja ühtsustamist. Käesoleva töö raames koostati küsimustik töös arendatud EESM-2 ja laiendatud TAM2 (technology acceptance model) põhjal, mis saadeti uuringus osalenud ülikoolide õppejõududele. Laekunud vastuste alusel uuriti ja võrreldi praegust e-õppe situatsiooni Eestis ja Türgis.

Et saavutada teadusuuringu eesmäärke, kasutati töös tsüklilist iteratiivset teaduspõhist projekteerimise protsessi, mis koosnes kolmest iteratsioonidest

("EES mudel (Est -Tr) " , " EES Mudel - 2 " ja "EES Mudel – 2 Adaptsioon").

E-õppe protsessi veel produktiivsemaks disainiks ja modelleerimiseks kõrghariduses esitati EESMudelist arendatud uus EESMudel-2. Enamus uuendusi puudutas ülemist Sotsio-kultuurilist kihti. Uus kiht koosneb vaheelementidest, õppimisprotsessist ja õppestrateegiatest ning põhiobjektidest, milleks on sotsiaalsed mõjuelemendid (subjektiivsed normid, vabatahtlikkus, kuvand), kognitiivne instrumentaalprotsess (töö asjakohasus) ja kogemus. E-paradigma kihti lisati objekt "kombinatsioon", mille olemuseks on sünkroonsete ja asünkroonsete objektide kombineerimine. Uuringu tulemusena tuvastati, et Türgis valiti sotsio-kultuuriliste faktorite hulgast üheks oluliseks komponendiks "religioon", seda eelkõige oma positiivse mõju poolest kõrghariduse e-õppe süsteemile. Samal ajal aga Eestis oli religiooni roll peaaegu tähtsusetu. Leiti, et kuna Türgi rahvastik on ealt noorem kui Eesti oma, siis vanus sotsio-kultuurilise faktori komponendina on Türgis oluline üliõpilaste ja vanemate õppejõude e-õppesse integreerimisel. Kommete ja traditsioonide komponendil, mis muuhulgas sisaldab austust teiste vastu, töökust, iseseisvust ja enesesuunamist, on Eesti e-õppe kontekstis positiivne ja abistav roll. Samas Türgi korral, ühendatuna eetiliste väärtuste komponendiga, kommete ja traditsioonide komponent hõlmab ka õpetaja austamist ja õpetaja eesmärkidele ilma kahtlusteta allumist. Sotsio-kultuurilise faktori kommete ja traditsioonide komponendi nõrgaks küljeks Eestis on aga sõnakuulelikkuse vähenemine tähtsus võrreldes Türgi samade väärtustega ja seal valitseva sotsiaalsest staatusest tuleneva eraldatusega.

Üliõpilaste ja akadeemilise personali koguarv Eestis oli vastavalt 39 259 ja 3991 inimest (2014). Türgi ülikoolide vastavad arvud olid 1 194 735 ja 9076 inimest. Küsimustikule vastanud õppejõude, kes aktsepteerisid ja kasutasid e-õpet, oli 923.

Vastanud õppejõude oli Eestist 298 ja Türgist 625, see on 22% valimist. Küsimustiku saanud respondentide koguarv oli 4198, kellest 1423 oli Eestist ja 2775 Türgist. Küsimustiku tulemuste põhjal võib järeldada, et mõlema riigi juhtivate ülikoolide õppejõud aktsepteerivad ja mõistavad e-õppe kasutamise tähtsust ning demonstreerisid antud valdkonnas häid oskusi ja enesekindlust. Samas, Eesti tippülikoolide õppejõud olid rohkem rahul e-õppe süsteemi kasutamisega ja näitasid üles suuremat aktiivsust kui nende Türgi kolleegid.

Uuringu tulemusena leiti e-õppe süsteemi kasutamisel mitmeid takistusi ja seda nii Eesti kui Türgi juhtivates ülikoolides: Tallinna Tehnikaülikooli puhul osutusid takistusteks kohandamispoliitika, turvalisus, finantstoetuse mehhanismid ja produktiivne koostöö Eesti ülikoolide vastavate institutsioonidega; takistustena Tallinna Ülikoolis toodi välja selge visiooni ja poliitika puudumist e-õppe arendamisel; Tartu Ülikooli takistusteks olid puudulik tehnoloogiline infrastruktuur, vananenud e-õppe süsteemid ja akadeemilise personali vähene valmisolek e-õppe kasutamiseks. Türgi ülikoolide puhul leiti takistusteks puudulik tehnoloogiline infrastruktuur, vananenud e-õppe süsteemid, e-õppe arendamise selge visiooni ja põhimõtete puudumine ning akadeemilise personali vähene valmisolek e-õppe kasutamiseks.

Uuringu tulemusena tehti Eesti ning Türgi ülikoolide e-õppe hetkeolukorra parendamiseks järgmised ettepanekud: produktiivsema koostöö arendamine Eesti institutsioonide vahel, Tartu Ülikooli e-õppe süsteemi tehnoloogiline renoveerimine ja süstemaatilise muutmise lähenemise kasutamine, mis tagaks uute tehnoloogiate efektiivse kasutuselevõtu; võtta Eesti ülikoolide e-õppe süsteemi arendamise mudel hea näitena kasutusele kõigis Türgi ülikoolides, alustada tugeva ja stabiilse reguleerimispoliitika loomisega; koostöös kõikide ülikoolidega rajada ühtne võrgustik, tagada tehnoloogilise infrastruktuuri märkimisväärne rahastus, garanteerida finantstoetus projektidele, mis on seotud e-õppe süsteemi arendamisega, toetada e-õppe turvalisuse tagamiseks vajalike meetmete kasutamist ning arendada välja koolitussüsteem uutele ja olemasolevatele õppejõududele. Kõiki neid meetmeid soovitatakse kasutada komplekselt. Ettepanekute selektiivne kasutuselevõtt ei taga stabiilset ja produktiivset e-õppe süsteemi arendamist ja rakendumist. Türgi Kõrghariduse Nõukogule (YOK) kui peamisele kõrghariduse reguleerimise asutusele Türgis on tehtud ettepanek ülikoolide e-õppe süsteemide revisjoniks ja vastava arendusprojekti ettevalmistamiseks, et ajakohastada ja unifitseerida e-õppe süsteeme Türgi ülikoolides, kasutades käesolevas töös esitatud EES Mudel-2 ja parimaid praktikaid, sh Eesti e-õppesüsteemide arenduskogemusi.

Antud uuringu tulemused aitavad parendada Türgi kõrghariduses kasutatavaid e-õppe süsteeme ning ka teiste riikide omi, kus esinevad sarnased takistused.

Appendixes

Appendix I. SUMMARY OF MEANS, CONCEPTS AND INDEXES IN QUESTIONNAIRE

Table 1. Summary of means, concepts and indexes

Concept	index	Group	index	Measurement instrument		index				
Participant profile	P	Date of Birth	P1	Year		-				
		Sex	P2	Male		1				
				Female		2				
		Academic position	P3	Professor		1				
				Associate Professor		2				
Assistant Professor				3						
Lecturer				4						
	Your Faculty	P4	For each university different lists of faculties were applied							
Adoption of e-learning system	AS	Perceived ease of use	PE	I find e-learning system easy to use Learning how to use an e-learning system is easy for me It is easy to become skillful at using an e-learning system		E ₁ E ₂ E ₃				
		Perceived usefulness	PU	E-learning would improve my teaching performance E-learning would increase my academic productivity E-learning would make it easier to teach course content		U ₁ U ₂ U ₃				
		Attitude	AT	Teaching (studying) through e-learning is a good idea Teaching (studying) through e-learning is a wise idea I am positive toward e-learning		A ₁ A ₂ A ₃				
		Behavioral intention	BI	I intend to post announcements, assignments and learning materials via e-learning systems frequently I intend to be an active user of e-learning system		B ₁ B ₂				
		E-learning self-efficacy	SE	I feel confident finding information in the e-learning system I have the necessary skills for using an e-learning system		S ₁ S ₂				
		Subjective norm	SN	What e-learning stands for is important for me as a university academic staff I like using e-learning because academic society values it In order to prepare students for their future jobs, it is necessary to provide them e-learning courses		N ₁ N ₂ N ₃				
				System accessibility	SA	I have no difficulty accessing and using an e-learning system in the university		SA		
				Policy factor	PF	My university has adopted policies for productive implementation of e-learning at higher education in my country Security aspects of e-learning at higher education are covered by policies in my country Financial support mechanisms of e-learning at higher education are involved in policies in my country E-learning policies in higher education are well implemented through productive cooperation between universities in my country		PF ₁ PF ₂ PF ₃ PF ₄		
		Pedagogical level	PL			E-learning is the main source of pedagogical innovation in higher education in my country My university provides academic staff trainings to develop innovative pedagogical approaches for e-learning Academic staff in my university needs today more training in pedagogical aspects of e-learning and less in technological skills		PL ₁ PL ₂ PL ₃		
						Barriers	BR	The main barrier that hinders adoption of e-learning in my university is poor technological infrastructure and outdated e-learning systems The main barrier that hinders adoption of e-learning in my university is poor readiness of academic staff to use e-learning system The main barrier that hinders adoption of e-learning in my university is absence of clear vision and policy for e-learning development		BR ₁ BR ₂ BR ₃

Appendix II. SUMMARY OF ANSWERS IN QUESTIONNAIRE

Table 1. Adoption of e-learning system (AS)-Perceived ease of use (PE)

University	UT	TUT	TU	Anadolu	Istanbul	Sakarya
Question	I find e-learning system easy to use (E1)					
Answer	N	%	N	%	N	%
Strongly disagree	0	0.00	0	0.00	3	1.48
Disagree	1	1.06	3	3.12	2	0.98
Somewhat disagree	3	3.19	6	6.25	8	3.45
Neither agree or disagree	4	4.26	5	5.21	1	0.93
Somewhat agree	10	10.64	26	27.08	7	6.48
Agree	24	25.53	43	44.79	47	43.52
Strongly agree	52	55.32	13	13.54	43	39.81
Question	Learning how to use an e-learning system is easy for me (E2)					
Answer	N	%	N	%	N	%
Strongly disagree	0	0.00	1	1.04	0	0.00
Disagree	1	1.06	3	3.12	1	0.93
Somewhat disagree	2	2.13	4	4.17	5	4.63
Neither agree or disagree	1	1.06	5	5.21	2	1.85
Somewhat agree	12	12.77	29	30.21	14	12.96
Agree	26	27.66	42	43.75	43	39.81
Strongly agree	52	55.32	12	12.50	43	39.81
Question	It is easy to become skillful at using an e-learning system (E3)					
Answer	N	%	N	%	N	%
Strongly disagree	0	0.00	0	0.00	1	0.93
Disagree	2	2.13	4	4.17	1	0.93
Somewhat disagree	2	2.13	7	7.29	4	3.70
Neither agree or disagree	3	3.19	12	12.50	5	4.63
Somewhat agree	9	9.57	35	36.46	10	9.26
Agree	26	27.66	33	34.38	49	45.37
Strongly agree	52	55.32	5	5.21	38	35.19

N – number of respondents
% - percentage of respondents

Figure 1. Answers to questions (in %) of part II (AS), group of questions – PE. (a) Plot, showing answers to question E₁; (b) Plot, showing answers to question E₂; (c) Plot, showing answers to question E₃. The legend is shown in the figure 1c.

Appendix II

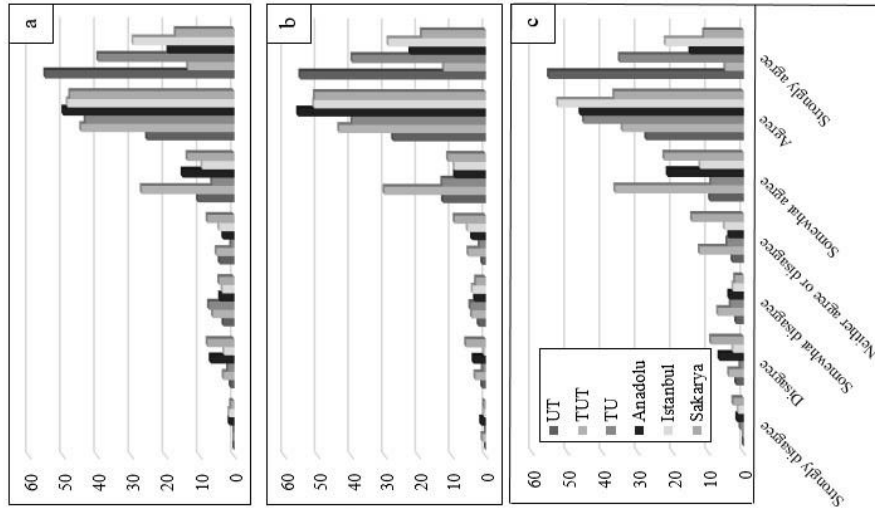
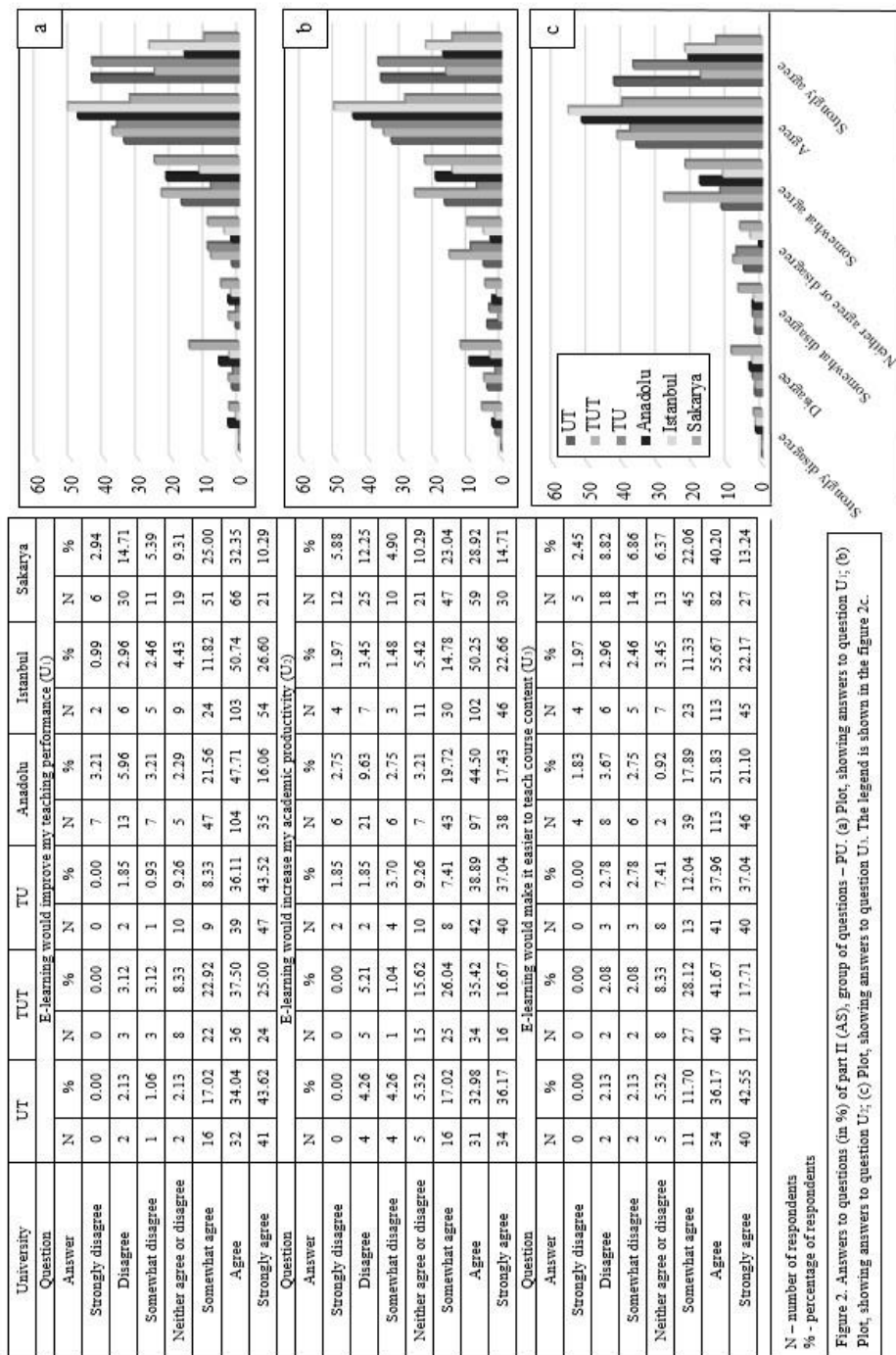


Table 2. Adoption of e-learning system (AS)-Perceived usefulness (PU)

Appendix II



N - number of respondents
% - percentage of respondents

Figure 2. Answers to questions (in %) of part II (AS), group of questions - PU. (a) Plot, showing answers to question U₁; (b) Plot, showing answers to question U₂; (c) Plot, showing answers to question U₂. The legend is shown in the figure 2c.

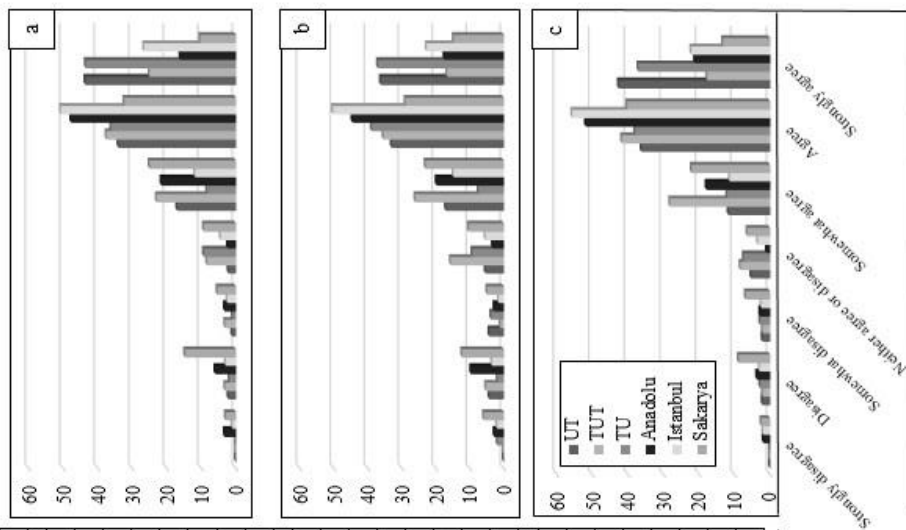


Table 3. Adoption of e-learning system (AS)-Attitude (AT)

University	UT	TUT	TU	Anadolu	Istanbul	Sakarya
Question	Teaching (studying) through e-learning is a good idea (A ₁)					
Answer	N	%	N	%	N	%
Strongly disagree	0	0.00	0	0.00	1	0.46
Disagree	1	1.06	0	0.00	11	5.05
Somewhat disagree	1	1.06	2	2.08	5	2.29
Neither agree or disagree	5	5.32	9	9.38	6	5.56
Somewhat agree	11	11.70	31	32.29	12	11.11
Agree	18	19.15	37	38.54	39	36.11
Strongly agree	58	61.70	17	17.71	45	41.67
Question	Teaching (studying) through e-learning is a wise idea (A ₂)					
Answer	N	%	N	%	N	%
Strongly disagree	0	0.00	0	0.00	1	0.93
Disagree	1	1.06	1	1.04	7	6.48
Somewhat disagree	0	0.00	4	4.17	6	5.56
Neither agree or disagree	8	8.51	12	12.50	7	6.48
Somewhat agree	8	8.51	26	27.08	12	11.11
Agree	18	19.15	39	40.62	47	43.52
Strongly agree	59	62.77	14	14.58	34	31.48
Question	I am positive toward e-learning (A ₃)					
Answer	N	%	N	%	N	%
Strongly disagree	0	0.00	0	0.00	0	0.00
Disagree	0	0.00	0	0.00	0	0.00
Somewhat disagree	1	1.06	1	1.04	5	4.63
Neither agree or disagree	4	4.26	4	4.17	3	2.78
Somewhat agree	14	14.89	19	19.79	9	8.33
Agree	17	18.09	49	51.04	49	45.37
Strongly agree	58	61.70	23	23.96	42	38.89

N – number of respondents
% - percentage of respondents

Figure 3. Answers to questions (in %) of part II (AS), group of questions – AT. (a) Plot, showing answers to question A₁; (b) Plot, showing answers to question A₂; (c) Plot, showing answers to question A₃. The legend is shown in the figure 3c.

Appendix II

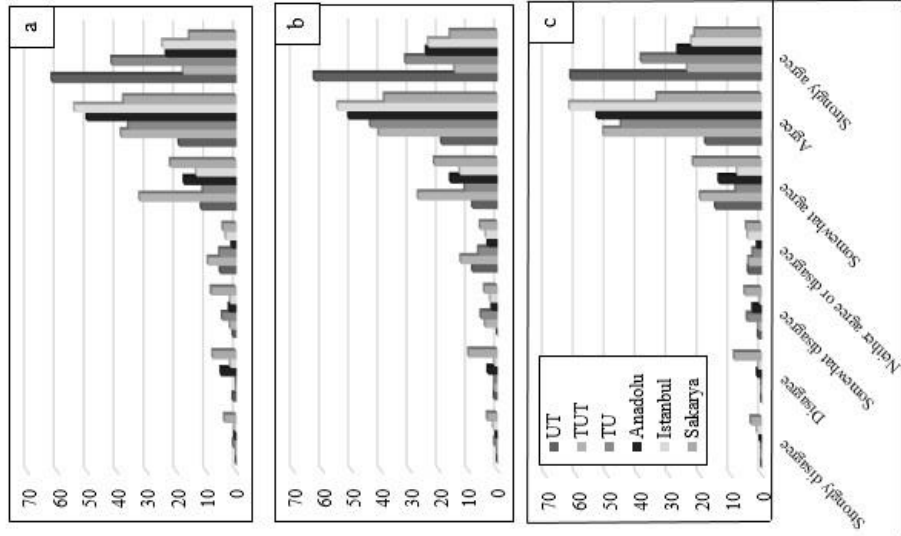


Table 4. Adoption of e-learning system (AS)-Behavioral intention (BI)

University	UT	TUT	TU	Anadolu	Istanbul	Sakarya
Question	I intend to post announcements, assignments and learning materials via e-learning systems frequently (B ₁)					
Answer	N	%	N	%	N	%
Strongly disagree	0	0.00	0	0.00	7	3.21
Disagree	1	1.06	2	2.08	1	0.93
Somewhat disagree	3	3.19	3	3.12	3	2.78
Neither agree or disagree	5	5.32	4	4.17	3	2.78
Somewhat agree	4	4.26	14	14.58	10	9.26
Agree	40	42.55	39	40.62	43	39.81
Strongly agree	41	43.62	34	35.42	48	44.44
Question	I intend to be an active user of e-learning system (B ₂)					
Answer	N	%	N	%	N	%
Strongly disagree	0	0.00	0	0.00	8	3.67
Disagree	0	0.00	1	1.04	2	1.85
Somewhat disagree	3	3.19	2	2.08	4	3.70
Neither agree or disagree	5	5.32	7	7.29	5	4.63
Somewhat agree	15	15.96	29	30.21	10	9.26
Agree	44	46.81	35	36.46	42	38.89
Strongly agree	27	28.72	22	22.92	45	41.67

N – number of respondents
% - percentage of respondents

Figure 4. Answers to questions (in %) of part II (AS), group of questions – BI. (a) Plot, showing answers to question B₁; (b) Plot, showing answers to question B₂. The legend is shown in the figure 4b.

Appendix II

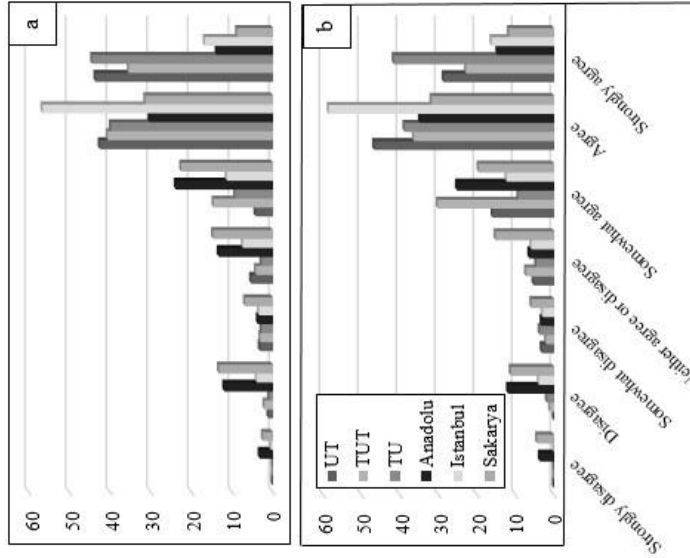


Table 5. Adoption of e-learning system (AS)-E-learning self-efficacy (SE)

University	Question	UT		TUT		TU		Anadolu		Istanbul		Sakarya	
		N	%	N	%	N	%	N	%	N	%	N	%
I feel confident finding information in the e-learning system (S.)	Answer	0	0.00	0	0.00	1	0.93	2	0.92	0	0.00	6	2.94
	Strongly disagree	1	1.06	3	3.12	2	1.85	9	4.13	2	0.99	13	6.37
	Disagree	2	2.13	4	4.17	2	1.85	10	4.59	4	1.97	8	3.92
	Somewhat disagree	3	3.19	13	13.54	4	3.70	14	6.42	10	4.93	23	11.27
	Neither agree or disagree	16	17.02	26	27.08	14	12.96	53	24.31	29	14.29	51	25.00
I have the necessary skills for using an e-learning system (S.)	Somewhat agree	47	50.00	40	41.67	42	38.89	95	43.58	130	64.04	87	42.65
	Agree	25	26.60	10	10.42	43	39.81	35	16.06	28	13.79	16	7.84
	Strongly agree												
Question	Answer	N	%	N	%	N	%	N	%	N	%	N	%
		N	%	N	%	N	%	N	%	N	%	N	%
I feel confident finding information in the e-learning system (S.)	Strongly disagree	0	0.00	0	0.00	0	0.00	1	0.46	3	1.48	2	0.98
	Disagree	0	0.00	1	1.04	4	3.70	2	0.92	1	0.49	9	4.41
	Somewhat disagree	4	4.26	2	2.08	1	0.93	4	1.83	2	0.99	2	0.98
	Neither agree or disagree	2	2.13	3	3.12	6	5.56	5	2.29	9	4.43	7	3.43
	Somewhat agree	14	14.89	34	35.42	15	13.89	23	10.55	14	6.90	27	13.24
I have the necessary skills for using an e-learning system (S.)	Agree	44	46.81	44	45.83	39	36.11	110	50.46	122	60.10	99	48.53
	Strongly agree	30	31.91	12	12.50	43	39.81	73	33.49	52	25.62	58	28.43

N – number of respondents
% - percentage of respondents

Figure 5. Answers to questions (in % of part II (AS), group of questions – SE. (a) Plot, showing answers to question S.; (b) Plot, showing answers to question S. The legend is shown in the figure 5b.

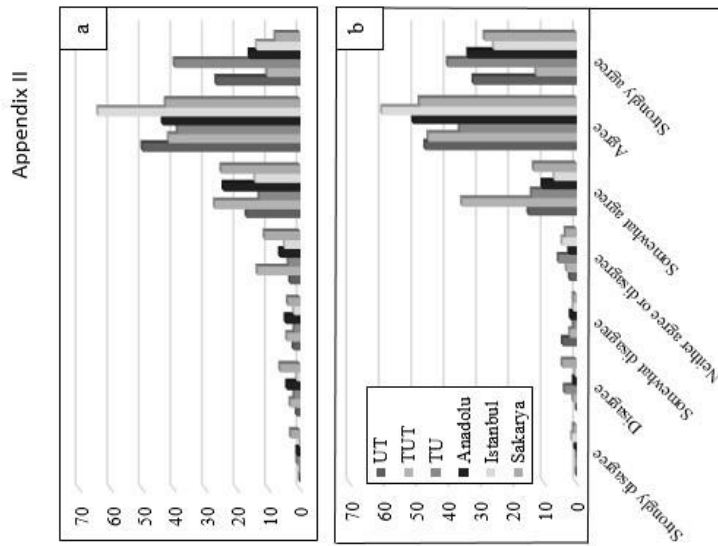


Table 6. Adoption of e-learning system (AS)-Subjective norm (SN)

Appendix II

University	UT	TUT	TU	Anadoluh	Isanbul	Sakarya
Question	What e-learning stands for is important for me as a university academic staff (N _i)					
Answer	N	%	N	%	N	%
Strongly disagree	0	0.00	0	0.00	1	0.46
Disagree	2	2.13	2	2.08	8	3.67
Somewhat disagree	2	2.13	3	3.12	4	1.83
Neither agree or disagree	2	2.13	9	9.38	6	2.56
Somewhat agree	14	14.89	28	29.17	8	3.94
Agree	49	52.13	42	43.75	48	21.58
Strongly agree	25	26.60	12	12.50	40	18.75
Question	I like using e-learning because academic society values it (N _i)					
Answer	N	%	N	%	N	%
Strongly disagree	1	1.06	4	4.17	3	2.78
Disagree	6	6.38	6	6.25	4	3.70
Somewhat disagree	2	2.13	4	4.17	7	6.48
Neither agree or disagree	10	10.64	29	30.21	14	12.96
Somewhat agree	23	24.47	28	29.17	10	9.26
Agree	37	39.36	18	18.75	35	32.41
Strongly agree	15	15.96	7	7.29	35	32.41
Question	In order to prepare students for their future jobs, it is necessary to provide them e-learning courses (N _i)					
Answer	N	%	N	%	N	%
Strongly disagree	0	0.00	2	2.08	2	1.85
Disagree	4	4.26	6	6.25	3	2.78
Somewhat disagree	6	6.38	6	6.25	2	1.85
Neither agree or disagree	6	6.38	17	17.71	10	9.26
Somewhat agree	17	18.09	33	34.38	10	9.26
Agree	44	46.81	24	25.00	37	34.26
Strongly agree	17	18.09	8	8.33	44	40.74

N - number of respondents
% - percentage of respondents

Figure 6. Answers to questions (in % of part II (AS), group of questions - SN. (a) Plot, showing answers to question N_i; (b) Plot, showing answers to question N_i; (c) Plot, showing answers to question N_i. The legend is shown in the figure 6c.

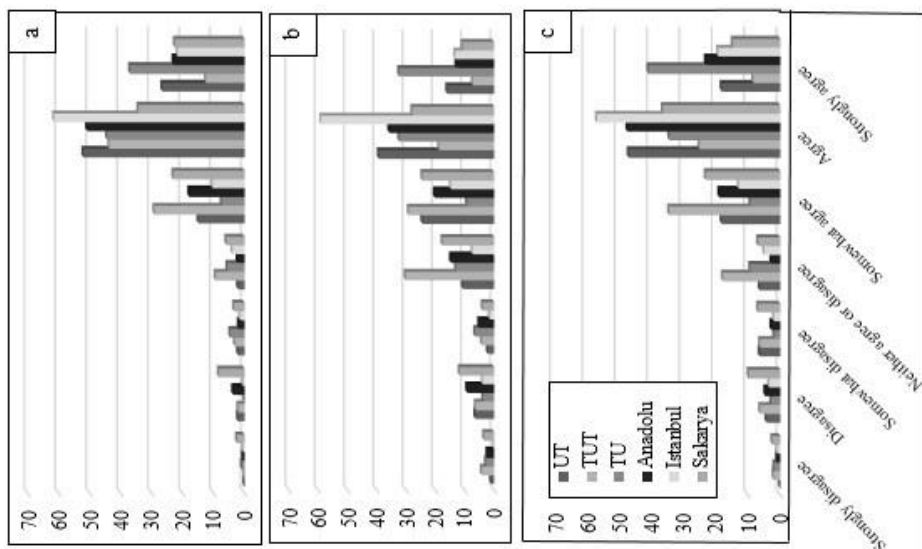


Table 7. Adoption of e-learning system (AS)-System accessibility (SA)

University Question	UT		TUT		TU		Anadolu		Istanbul		Sakarya	
	N	%	N	%	N	%	N	%	N	%	N	%
I have no difficulty accessing and using an e-learning system in the university (SA)												
Strongly disagree	0	0.00	0	0.00	0	0.00	5	2.29	0	0.00	3	1.47
Disagree	0	0.00	3	3.12	1	0.93	12	5.50	12	5.91	12	5.88
Somewhat disagree	2	2.13	6	6.25	6	5.56	3	1.38	3	1.48	6	2.94
Neither agree or disagree	2	2.13	4	4.17	4	3.70	12	5.50	24	11.82	26	12.75
Somewhat agree	11	11.70	21	21.88	6	5.56	30	13.76	38	18.72	35	17.16
Agree	51	54.26	45	46.88	51	47.22	104	47.71	96	47.29	83	40.69
Strongly agree	28	29.79	17	17.71	40	37.04	52	23.85	30	14.78	39	19.12

N - number of respondents
% - percentage of respondents

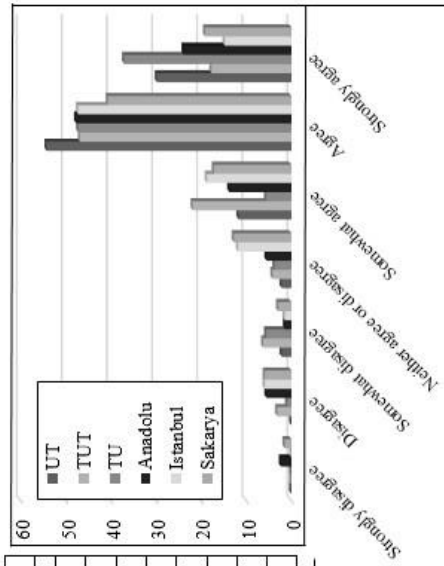
**Figure 7.** Answers to question (in %) of part II (AS), group of questions - SA. Plot showing answers to question SA

Table 8. Adoption of e-learning system (AS)-Policy factor (PF)

University	UT	TUT	TU	Anadolu	Istanbul	Sakarya
Question	My university has adopted policies for productive implementation of e-learning at higher education in my country (PF ₁)					
Answer	N	%	N	%	N	%
Strongly disagree	0	0.00	0	0.00	3	1.38
Disagree	0	0.00	3	3.12	0	0.00
Somewhat disagree	1	1.06	2	2.08	4	3.70
Neither agree or disagree	3	3.19	9	9.38	17	15.74
Somewhat agree	10	10.64	27	28.12	6	5.56
Agree	50	53.19	46	47.92	41	37.96
Strongly agree	30	31.91	9	9.38	40	37.04
Security aspects of e-learning at higher education are covered by policies in my country (PF ₂)	N	%	N	%	N	%
Strongly disagree	0	0.00	0	0.00	0	0.00
Disagree	0	0.00	1	1.04	1	0.93
Somewhat disagree	1	1.06	4	4.17	5	4.63
Neither agree or disagree	10	10.64	33	34.38	20	18.52
Somewhat agree	9	9.57	13	13.54	6	5.56
Agree	57	60.64	37	38.54	36	33.33
Strongly agree	17	18.09	8	8.33	40	37.04
Financial support mechanisms of e-learning at higher education are involved in policies in my country (PF ₃)	N	%	N	%	N	%
Strongly disagree	0	0.00	0	0.00	0	0.00
Disagree	0	0.00	1	1.04	1	0.93
Somewhat disagree	1	1.06	4	4.17	5	4.63
Neither agree or disagree	10	10.64	33	34.38	20	18.52
Somewhat agree	9	9.57	13	13.54	6	5.56
Agree	57	60.64	37	38.54	36	33.33
Strongly agree	17	18.09	8	8.33	40	37.04
E-learning policies in higher education are well implemented through productive cooperation between universities in my country (PF ₄)	N	%	N	%	N	%
Strongly disagree	0	0.00	1	1.04	3	2.78
Disagree	3	3.19	6	6.25	3	2.78
Somewhat disagree	8	8.51	12	12.50	5	4.63
Neither agree or disagree	8	8.51	26	27.08	13	12.04
Somewhat agree	9	9.57	24	25.00	14	12.96
Agree	47	50.00	23	23.96	33	30.56
Strongly agree	19	20.21	4	4.17	37	34.26
Answers to questions (in % of part II (AS), group of questions – PF ₁ (a) Plot, showing answers to question PF ₁ ; (b) Plot, showing answers to question PF ₂ ; (c) Plot, showing answers to question PF ₃ ; (d) Plot, showing answers to question PF ₄ . The legend is shown in the figure 8d.	N	%	N	%	N	%
Strongly disagree	0	0.00	0	0.00	0	0.00
Disagree	0	0.00	0	0.00	0	0.00
Somewhat disagree	1	1.06	1	1.04	5	4.63
Neither agree or disagree	4	4.26	4	4.17	3	2.78
Somewhat agree	14	14.89	19	19.79	9	8.33
Agree	17	18.09	49	51.04	49	45.37
Strongly agree	58	61.70	23	23.96	42	38.89

N – number of respondents
% - percentage of respondents

Figure 8. Answers to questions (in % of part II (AS), group of questions – PF₁ (a) Plot, showing answers to question PF₁; (b) Plot, showing answers to question PF₂; (c) Plot, showing answers to question PF₃; (d) Plot, showing answers to question PF₄. The legend is shown in the figure 8d.

Appendix II

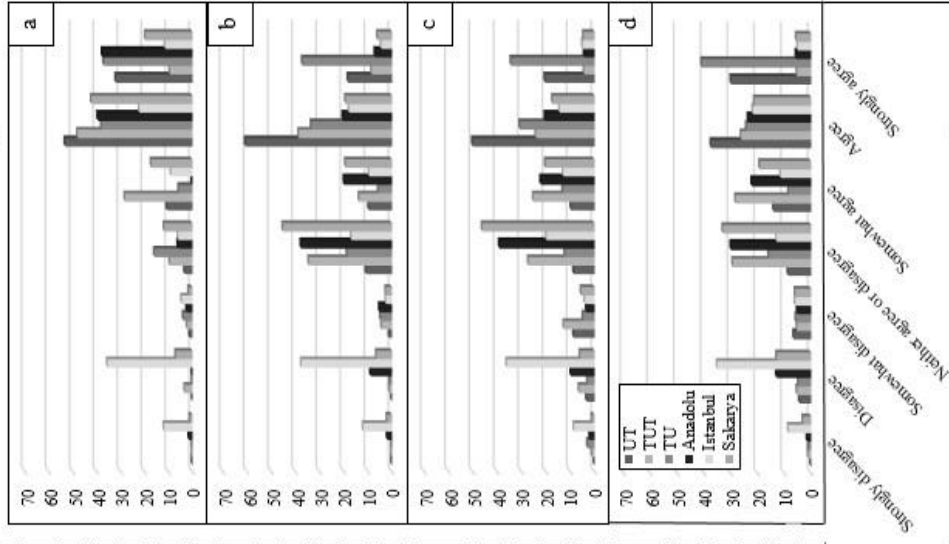


Table 9. Adoption of e-learning system (AS)-Pedagogical level (PL)

University	UT	TUT	TU	Anadolu	Istanbul	Sakarya
Question	E-learning is the main source of pedagogical innovation in higher education in my country (PL ₁)					
Answer	N	%	N	%	N	%
Strongly disagree	3	3.19	1	1.04	2	1.85
Disagree	6	6.38	4	4.17	6	5.56
Somewhat disagree	2	2.13	12	12.50	9	8.33
Neither agree or disagree	11	11.70	31	32.29	10	9.26
Somewhat agree	12	12.77	28	29.17	13	12.04
Agree	41	43.62	18	18.75	31	28.70
Strongly agree	19	20.21	2	2.08	37	34.26
Question	My university provides academic staff trainings to develop innovative pedagogical approaches for e-learning (PL ₂)					
Answer	N	%	N	%	N	%
Strongly disagree	0	0.00	1	1.04	3	2.78
Disagree	2	2.13	3	3.12	2	1.85
Somewhat disagree	1	1.06	2	2.08	2	1.85
Neither agree or disagree	1	1.06	3	3.12	2	1.85
Somewhat agree	17	18.09	22	22.92	9	8.33
Agree	55	58.51	51	53.12	51	47.22
Strongly agree	18	19.15	14	14.58	39	36.11
Question	Academic staff in my university needs today more training in pedagogical aspects of e-learning and less in technological skills (PL ₃)					
Answer	N	%	N	%	N	%
Strongly disagree	0	0.00	0	0.00	0	0.00
Disagree	1	1.06	1	1.04	1	0.93
Somewhat disagree	1	1.06	8	8.33	3	2.78
Neither agree or disagree	6	6.38	22	22.92	11	10.19
Somewhat agree	26	27.66	26	27.08	14	12.96
Agree	46	48.94	33	34.38	43	39.81
Strongly agree	14	14.89	6	6.25	36	33.33

N – number of respondents
% - percentage of respondents

Figure 9. Answers to questions (in %) of part II (AS), group of questions – PL. (a) Plot, showing answers to question PL₁; (b) Plot, showing answers to question PL₂; (c) Plot, showing answers to question PL₃. The legend is shown in the figure 9c.

Appendix II

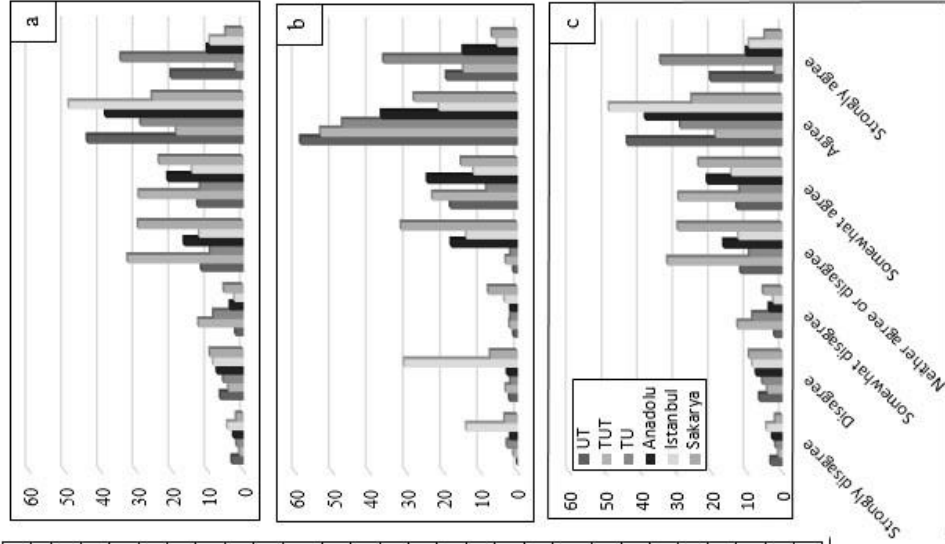
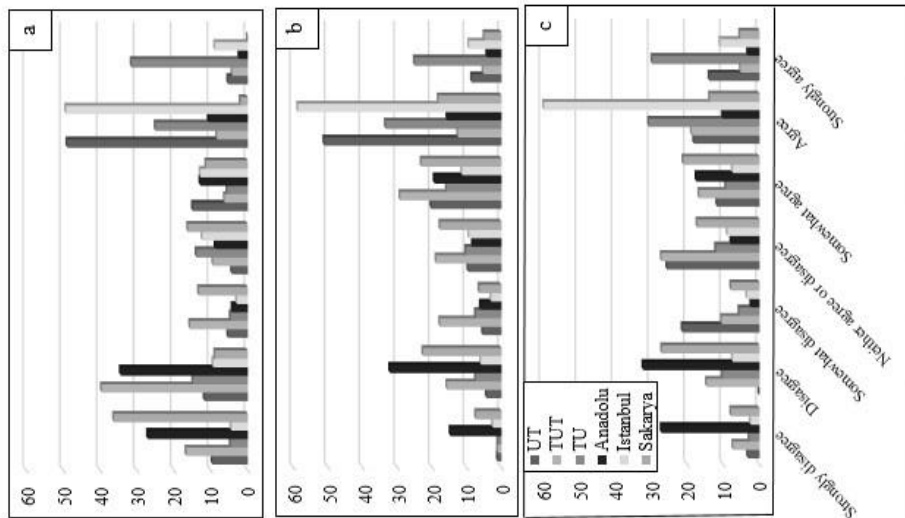


Table 10. Adoption of e-learning system (AS)-Barriers (BR)

University	UT		TUT		TU		Anadolu		Istanbul		Sakarya	
Question	The main barrier that hinders adoption of e-learning in my university is poor technological infrastructure and outdated e-learning systems (BR ₁)											
Answer	N	%	N	%	N	%	N	%	N	%	N	%
Strongly disagree	9	9.57	16	16.67	5	4.63	59	27.06	9	4.43	74	36.27
Disagree	11	11.70	38	39.58	16	14.81	75	34.40	19	9.36	18	8.82
Somewhat disagree	5	5.32	15	15.62	5	4.63	9	4.13	6	2.96	27	13.24
Neither agree or disagree	4	4.26	9	9.38	15	13.89	19	8.72	25	12.32	33	16.18
Somewhat agree	14	14.89	6	6.25	6	5.56	28	12.84	26	12.81	23	11.27
Agree	46	48.94	8	8.33	27	25.00	23	10.55	100	49.26	4	1.96
Strongly agree	5	5.32	4	4.17	34	31.48	5	2.29	18	8.87	0	0.00
Question	The main barrier that hinders adoption of e-learning in my university is poor readiness of academic staff to use e-learning system (BR ₂)											
Answer	N	%	N	%	N	%	N	%	N	%	N	%
Strongly disagree	1	1.06	1	1.04	1	0.93	32	14.68	5	2.46	15	7.35
Disagree	4	4.26	15	15.62	8	7.41	70	32.11	12	5.91	46	22.55
Somewhat disagree	5	5.32	17	17.71	8	7.41	13	5.96	6	2.96	13	6.37
Neither agree or disagree	9	9.57	18	18.75	11	10.19	18	8.26	19	9.36	36	17.65
Somewhat agree	19	20.21	28	29.17	17	15.74	42	19.27	23	11.33	47	23.04
Agree	48	51.06	12	12.50	36	33.33	34	15.60	119	58.62	37	18.14
Strongly agree	8	8.51	5	5.21	27	25.00	9	4.13	19	9.36	10	4.90
Question	The main barrier that hinders adoption of e-learning in my university is absence of clear vision and policy for e-learning development (BR ₃)											
Answer	N	%	N	%	N	%	N	%	N	%	N	%
Strongly disagree	3	3.19	7	7.29	3	2.78	59	27.06	5	2.46	16	7.84
Disagree	6	0.06	14	14.58	11	10.19	70	32.11	15	7.39	55	26.96
Somewhat disagree	20	21.28	10	10.42	6	5.56	5	2.29	7	3.45	16	7.84
Neither agree or disagree	24	25.53	26	27.08	13	12.04	17	7.80	18	8.87	35	17.16
Somewhat agree	11	11.70	16	16.67	10	9.26	38	17.43	15	7.39	43	21.08
Agree	17	18.09	18	18.75	33	30.56	22	10.09	121	59.61	28	13.73
Strongly agree	13	13.83	5	5.21	32	29.63	7	3.21	22	10.84	11	5.39

Figure 10. Answers to questions (in %) of part II (AS), group of questions – BR. (a) Plot, showing answers to question BR₁; (b) Plot, showing answers to question BR₂; (c) Plot, showing answers to question BR₃. The legend is shown in the figure 10c.

Appendix II



ORIGINAL PUBLICATIONS

PAPER I. GÜLLÜ, F., KUUSIK, R., DEMIRAY, U. and LAANPERE, M. (2014). Comparing implementation patterns of e-learning for higher education in Turkey and Estonia. Proceedings of the ECEL-2014. Denmark, Copenhagen, 644-650.

Comparing implementation patterns of e-learning for higher education in Turkey and Estonia

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Abstract: Wide-scale implementation of technology-enhanced learning in schools and higher education has been supported by national and institutional level strategies and policies. In this paper for the first time we compare and contrast the strategic development of technology enhanced learning on the national and institutional levels in Estonia and Turkey, relying on analysis of existing technical and pedagogical basics. Although these two countries are contrastingly different from each other (Estonia is small and Northern and Turkey is large and Southern), there are many similarities in the e-learning ways in the higher education has been introduced on the national and institutional levels. The paper is the first part of author's PhD study, focused on finding ways to improve existing structure and approaches for e-learning in Turkey.

Keywords: E-learning, educational systems, technology infrastructure, higher education, quality.

1. Introduction

A century ago the educational development was inspired by new pedagogical ideas (e.g. by Rudolf Steiner, Maria Montessori, Celestin Freinet), and 30 years ago by school effectiveness movement. Today, on the other hand, the modern Information and Communication Technologies (ICT) seem to become the most influential driver in educational innovation. While in 1970's the computers were used in classrooms mainly to replace the teachers, today's paradigm of technology enhanced learning sees technology as an amplifier of creative and collaborative learning and knowledge building processes, where the teacher's role has changed. Today e-learning innovation has grown beyond experimentation of few enthusiastic teachers, as most of developed countries and their educational institutions have short- and long-term strategies for systemic educational change involving the use of new technology. During the last decade, the exploitation of e-learning systems has been growing steadily in universities worldwide. These new digital tools have become a natural part of teaching and learning environment in higher education. This change has been a result of combining bottom-up initiatives led by innovative teachers with systemic implementation of new infrastructure, requirements and policies, both on institutional and national levels.

As an e-learning is one of the key concepts of this paper, we should define it clearly, before proceeding to the discussion on its patterns implementation. The term "e-learning" was coined in 1998 by Jay Cross (Cross 2004). Soon it was picked up by policymakers and researchers. Yet, even today a multitude of definitions of e-learning exists. Sangra et al. (2012) provide an overview of alternative definitions of e-learning in four categories:

- technology-driven definitions: e-learning as the use of various technological tools for learning
- delivery system oriented definitions: e-learning as a means of accessing knowledge (or learning resources)
- communication-oriented definitions: e-learning as a set of methods of communication, interaction, and collaboration through digital channels
- educational paradigm oriented definitions: e-learning as a radically changed way of learning or as an improvement on existing teaching and learning methods.

Herewith, we define e-learning or technology-enhanced learning in line with European Commission (2001), Alonso et al. (2005), Ehlers and Pawlowski (2006) as "the use of new multimedia technologies and internet to improve the quality of learning by facilitating access to resources and services, as well as remote exchange and collaboration". This definition implies that systemic management of e-learning innovation cannot focus merely on upgrading and making available new digital tools, it should also involve introduction of new teaching methods, learning habits, assessment practices, cultural norms for internet behaviour, as well as legal frameworks and business models for digital educational contents production and delivery.

Human factor plays an important role in successful implementation of e-learning innovation, both on administrators, students and lecturers side. Adopting an online learning environment is often not easy for academic staff members, as it requires a lot of extra work and changes of habits. Having explicit policies and support measures could make it easier to cope with changes. In this context many countries have initiated

successful national e-learning strategies at the higher education level, where pedagogical innovation has been combined with the technological one. This paper, as a first part of first author's PhD study, focusing on finding ways to improve existing structure and approaches for e-learning in Turkey, compares the implementation of e-learning innovation in higher education of the countries, such as Estonia and Turkey. In one side we have Estonia with total population of 1.3 million and 55.000 students enrolled in 6 public and few private universities. On the other side we have some universities of Turkey, such as Anadolu University with almost 2 million enrolled students, being the second largest university in the world. Most of the barriers in implementing of e-learning come from the absence of the necessary computer program or programs, speed of internet access, personal and corporate security concerns, the quality of materials used, qualifications of the academic staff, which is required for e-learning and inadequacy of equipment bearing. Along the technical barriers in Turkey, we should need to apply first an e-learning system to train the lecturers. Thus, the errors and incorrect methods of visual and auditory materials can be corrected. Furthermore, the students would have the opportunity to be able to bring in front of eye and making it practical, even in the most cramped quarters can go in the direction of development. E-learning content for all the institutions of the system and the requirements for this system of universities measure the willingness and attitude that have not been any studies reported in the literature. The lecturer level needs to be increased for practical use and situation of the awareness rise has been targeted by analysis. This paper focuses on similarities and differences in e-learning implementation patterns on the higher educational level in Estonia and Turkey. Although, these two countries are contrastingly different from each other (Estonia is small and Northern and Turkey is large and Southern), many similarities in the ways of e-learning in the higher education has been introduced on the national and institutional levels.

The special attention is on implementation patterns of technology enhanced learning (TEL) in higher education institutions in both countries, where both e-learning methods and technological infrastructure play a key role in survival and improvement of university education in the new economic situation. Our study demonstrates that the core infrastructure and administration of technology enhanced learning on the national level is more efficiently implemented in Estonia than in Turkey, thanks to tight cooperation between Estonian universities. Most of the challenges related to implementation of TEL in Turkey come from the big cities, where the population is too high and capacity of accepted students in big universities is large. In some universities of Turkey, like Anadolu, Istanbul, Sakarya or Ankara, where the capacity of the students are around 1 million, the e-learning technology infrastructure have a lot of barriers, compared to the biggest universities of Estonia, like Tallinn University of Technology, Tallinn University or Tartu University. Most of the barriers come from the absence of the necessary computer program or programs, speed of internet access, personal and corporate security concerns, the quality of materials used, qualifications of the academic staff, which are required for e-learning and inadequacy of equipment bearing. In this paper, for the first time, we are focusing on similarities and differences in e-learning implementation patterns on the higher educational level in Estonia and Turkey.

From the methodological perspective, our comparative analysis is driven by the Electronic Education System model, EES (Cloete 2001). Tiered EES model contains four layers:

- Physical layer: computer hardware and network setup (e.g. BYOD vs computer labs)
- E-paradigm layer: pedagogical beliefs and ideas (e.g. knowledge transfer vs "learning by doing")
- Educational middleware layer: e-learning software tools and digital content available
- Instructional layer: actual practice of teaching and learning in courses.

The strategic development of e-learning can be carried out either on top-down or bottom-up manner, or as combination of both.

2. E-learning system in higher education of Estonia

E-learning innovation in higher education of Estonia has started in 1998, where only few enthusiasts in Tallinn University of Technology, Tallinn Pedagogical University and Tartu University initiated some online courses on the WebCT (Course Tools) platform. In four years the number of online courses grew rapidly and so did the price for WebCT licenses. Optimisation of costs and to finding funds for expanding e-learning innovation leaf to cooperation between universities. The eight biggest universities of Estonia decided in 2003 to create Estonian e-university consortium to increase the quality of e-learning system and to find a solution for national level hosting and licensing of WebCT platform. For this reason the Estonian e-University consortium was established in 2003. Two years later the second consortium, Estonian e-VET consortium (consortium of vocational education organizations) was developed. The Estonian e-VET consortium started to coordinate e-learning activities at the vocational education level. Based on these two consortia, the Estonian e-learning Development Centre was established in 2006 (E-learning Development Centre 2007, Dremļuga-Telk et al. 2011). In 2010 these consortia has grown into 10 universities. The main task was to coordinate and develop e-

learning activities at the higher education level. Afterward, e-learning system has grown rapidly in different universities, which are shown clearly in Figures 1 and 2.

Nowadays, e-learning system in higher education of Estonia has most of the barriers in pedagogical way, than in technical way. Technical infrastructure in e-learning system is on a high level, where some few problems can't influence to the quality of this system. In the process of e-learning system, as pedagogical barriers, we have identified some issues, which are listed as follows:

- Some of the lecturers want to give lessons face to face and for this reason they can't except to use e-learning system
- Content to be transferred onto the internet in a monotonous way
- Excessive or inadequate presentation of information
- No transparency in results of examinations time
- Appropriate and timely feedback cannot be given.

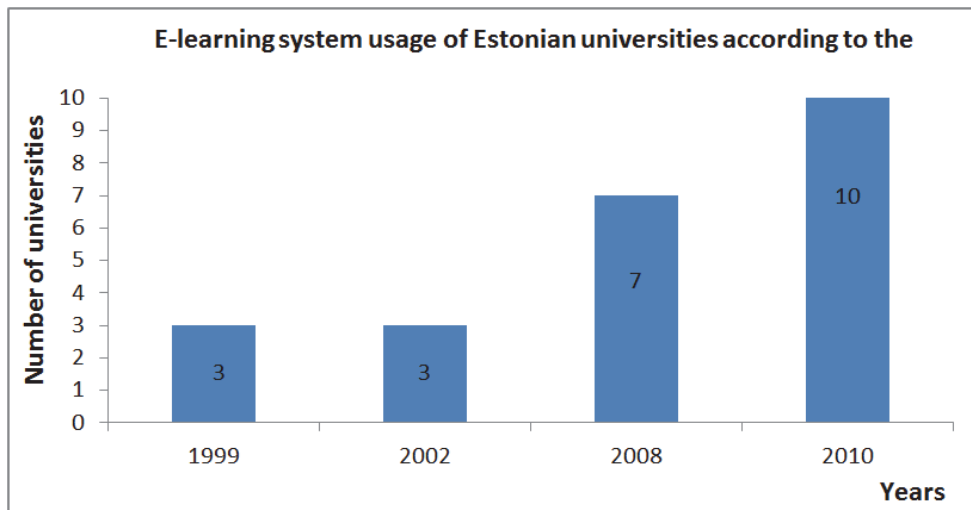


Figure 1: Usage of e-learning system in Estonian Universities

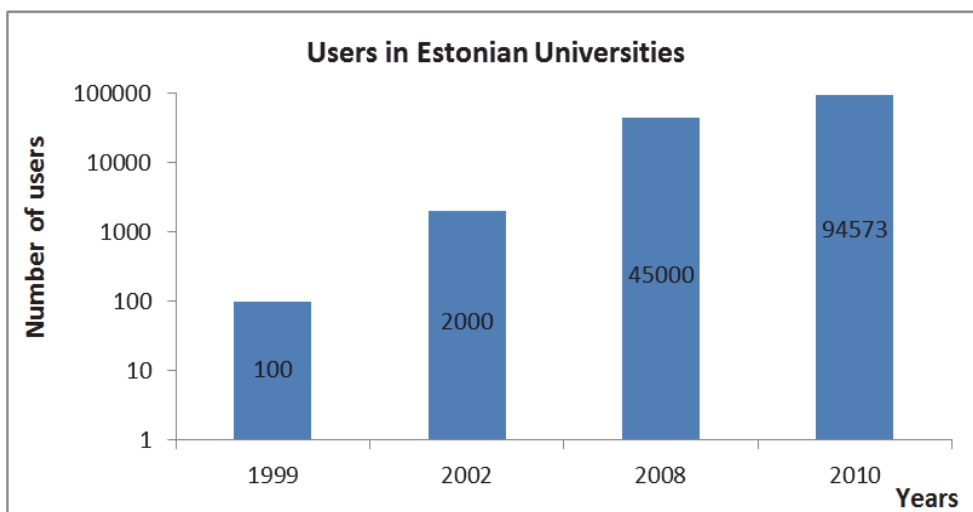


Figure 2: Number of users in Estonian Universities (Dremljuga-Telk et al. 2011)

Based on the sources mentioned above, the strategic implementation of e-learning development was carried out in a bottom-up manner in Estonia during the first phase (1997 – 2005), but after the establishment of Estonian IT Foundation and its E-learning Development Centre, the centralised top-down coordination started to play more important role on the level of educational middleware layer in the EES model. Centrally funded and hosted e-learning services (LMS, repositories of learning objects) boosted the bottom-up experimentation with new instructional designs by growing number of university staff. This was supported by centralised staff training opportunities provided by EITSA (Estonian IT Foundation), which had a top-down impact on disseminating the new e-paradigm (collaborative blended learning), at the second layer of EES model. Development of the physical layer was mostly left to single universities, which in most cases moved slowly towards Bring Your Own Device model by encouraging students to use their own laptops both in classrooms and for individual studies. Such interplay between top-down and bottom-up implementation models has proved to be successful in a small and dynamic country such as Estonia. Within the period of 2004 – 2012, more than 4800 fully or partly online courses were created and taught in centralised Moodle LMS and additional 4200 courses were made available through locally developed IVA LMS platform (Laanpere, 2013). In the universities that belonged to Estonian E-university consortium, more than 40% of all courses included e-learning component by 2013.

3. E-learning system in higher education of Turkey

The development of world countries in e-learning system has given a very good example for development of the modern Turkey in e-learning system starting from the year 1982. The good example was chosen from British Open University, starting from 1974 in distance education. Afterward, Anadolu University was the first university that provide distance education initially with printed material, television and radio, as well as audio-visual course materials and academic counselling services, which have enabled application to use internet in the year 1990. Also in Sakarya and Middle East Technical University had been implemented distance education, which was based on web application (Isman et al. 2008). After internet technology being conveniently accessible in most of the universities, the e-learning system has taken the first step and starting to grow rapidly, starting from the year 1997. As we suspected, in general the e-learning system aren't widely used and implemented in many universities in Turkey. Exceptionally, there are small universities, which have established or successfully applied these systems in the past. Most of the problems in the e-learning systems came from the largest universities like Anadolu, Istanbul, Sakarya or Ankara (Nart and Altunisik 2013). Almost in the Anadolu University, where capacity of students is around 2 million, we have seen that problems came from technical and pedagogical barriers (Yamamoto et al. 2010, 2011). There are three important explanations that can describe the e-learning system in relation of technology infrastructure and their barriers, including hardware and software, which are shown below:

- Technological infrastructure is the foundation of e-learning system that has to be taken firstly into consideration. The accurate and purposeful e-learning infrastructure planned facilities cannot be used without technology innovation, content excellence, trainers and learners qualifications, intended to achieve the goals
- E-learning necessary hardware for computers, servers (web server, email server, video server, voice server, chat server, etc.), modems, network appliances, wireless devices, printers, scanners, cameras, microphones, backup and storage devices consist of e-learning software size, the word processor, e-mail packages, presentation programs, support software (plug-ins), data bases, learning management systems (LMS), learning content management systems (LCMS), authoring tools
- E-learning system in the design of bandwidth, connection speed, the quality of materials used, such as multi-media considerations appear to be advantages on the one hand, the wrong choice of technology or technology barriers can arise as impossibilities. An e-learning application speed internet connection, voice and video communication will enable the necessary software and hardware with a learner for an enjoyable e-learning experience gives an impression of a slow, limited internet connectivity, with the necessary technological hardware and software lacks another learning a serious emerges as a barrier.

In Figures 3 and 4 is shown the evolution of e-learning system in Turkish universities (Yamamoto et al. 2010). Furthermore, in e-learning system of the biggest universities of Turkey there are technical barriers, which can be listed as follows (Yamamoto et al. 2011):

- Absence or lack of technological infrastructure
- Lack of or insufficient speed of internet access
- Lack of the equipment required
- The absence of a computer program or programs

- Available computer program or programs not being up to date
- Costs of the related software needed, authoring tools or systems
- The software needed, authoring tools or nature and quality of systems
- Personal and corporate security concerns
- Unsafe technology infrastructure and inconsistencies in access to e-learning environment
- The quality of multimedia materials used, the suitability and design
- Interface and visual design
- Technical limitations
- Technical infrastructure, authoring tools or systems, such as excessive expectations regarding the capacity of the technological elements
- Read program design and limitations on the use of multimedia material

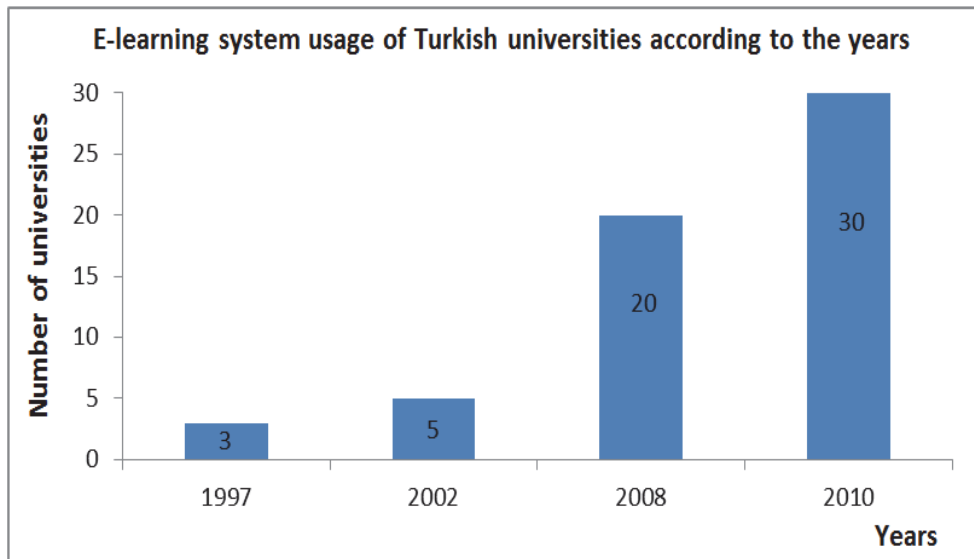


Figure 3: Usage of e-learning system in Turkish Universities (Yamamoto et al. 2010)

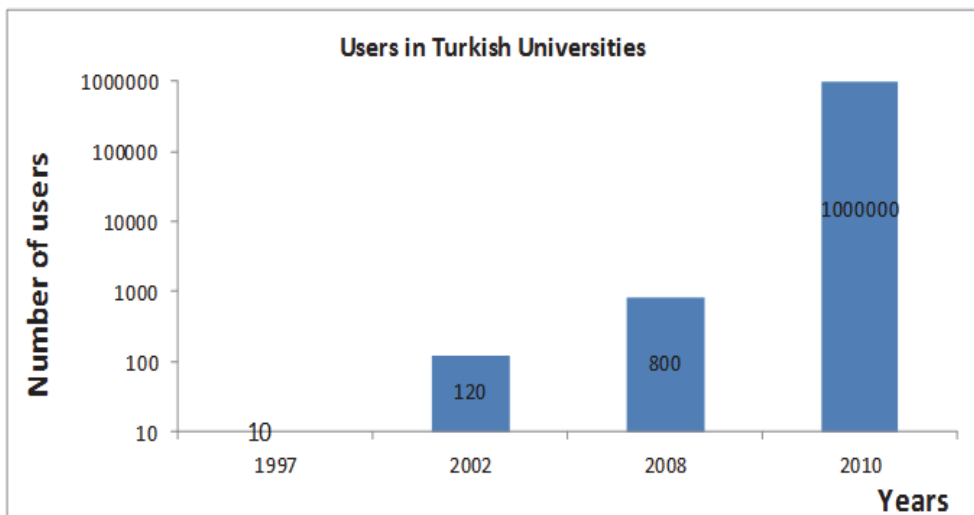


Figure 4: Number of the users in Turkish Universities (Yamamoto et al. 2010)

In the process of e-learning system, as pedagogical barriers, we have identified some issues, which are listed as follows:

- E-learning content did not match the expectations of learners
- Content to attract the attention of students
- E-learning programs and quality concerns related to the conformity of inconsistency of content, logical errors, lack of clear improper design, improper content, wrong methods, techniques and strategy selection
- To appeal to different learning styles, one being flat and boring
- Allowing applications to interact failure, ineffectiveness
- Content to be transferred onto the internet in a monotonous way
- Lack of instructional design
- Excessive or inadequate presentation of information
- Multimedia materials timely and appropriately used in improper system of educational content, authoring tool or work placement programs
- Appropriate and timely feedback cannot be given

The main Turkish universities, e.g. Anadolu, Ankara and Sakarya, independently have well designed systems for e-learning and distance education for high level education: (1) Anadolu University Open Education System, (2) Ankara University's Distance Education Centre (ANKUZEM), (3) Distance Learning Research and Development Centre, respectively. During last decade this systems and programs of e-learning already showed progress and significant results (Latchem et al. 2006, Mutlu 2004). In 2007, more than 550.000 students logged in the portal of Anadolu University Open Education System more than 11.7 million times and used the e-learning services (Anadolu University 2008). ANKUZEM currently serves 1,190 distance education students, 940 at undergraduate level and 250 at certificate level. In 2009, in the Distance Learning Research and Development Centre at Sakarya University were registered 50 students for the four-year degree programs, 460 postgraduate students, 41 in master's program. At the same time, there is a lack of cooperation between these institutions. Due to different approaches of the systems, users of different universities don't have possibility to collaborate, exchange knowledge and experience.

The data for the study were gathered through literature and web content analysis.

4. Comparisons of e-learning systems in higher educations between Estonia and Turkey

In the area of higher education, e-learning system is playing an important role in both countries, such as Estonia and Turkey. Estonia is a small country, in comparison with Turkey. High level e-learning systems were implemented in Estonia. However, there are some problems due to pedagogical barriers. From other side we have Turkey with large population, where the problems occurred from technical and pedagogical barriers. There are different reasons to understand that e-learning systems have these kinds of barriers, which are:

- Consortium between universities of Turkey doesn't exist in the biggest university, such as Anadolu, Sakarya, Ankara and Middle East Technical University. In some universities we have important problems to collaborate the faculties with each other's
- Consortium between universities of Estonia has worked very well, where 10 universities are collaborating together for increasing the quality of e-learning system
- The budget in the biggest universities of Turkey weren't enough for minimizing these important barriers that we mentioned above
- The probability is very low to participate and to get different projects from European Union (EU) because the capacity of these biggest universities is too high
- In the case of Estonia, the probability is too high for getting different projects from EU because the capacity of the biggest universities is fifty times lower than Turkish universities and they have all the facilities for implementation their projects successfully.

The final aim of the project is to provide measures for progressive improvement of general principals of Turkish e-learning system in higher education, using successful experience, applied in Estonia in the field of e-learning.

5. Conclusions

In this research, for the first time, we have analysed the situation of e-learning systems in higher education of Estonia and Turkey. E-learning system in Turkey has grown during the last decade, but in the biggest universities they have still again some problems, which are focused on technical and pedagogical barriers. E-learning system in Estonia has grown rapidly and successfully with some few problems, which are coming from

pedagogical barriers. The process for improving the quality and minimizing these barriers in Turkey needs to get consortiums between universities, like Estonian example. Results of this research will be used in further investigations, aimed to solve problems in the field of e-learning in a higher education in Turkey.

References

- Alonso, F., López, G., Manrique, D., and Viñes, J. M. (2005) An instructional model for web-based e-learning education with a blended learning process approach, *British Journal of Educational Technology*, Vol 36, No. 2, pp 217-235.
- Anadolu University (2008) EUA Self-Evaluation Report, Eskisehir, Turkey, <ftp.anadolu.edu.tr/Documents/EUA-Report.pdf>.
- Cloete, E. (2001) Electronic education system model. *Computers & Education*, Vol 36, pp 171-182.
- Cross, J. (2004) An Informal History of eLearning, *On the Horizon*, Vol 2, No. 3, pp 103-110.
- Dremljuga-Telk, M., Koitla, E., Kusnets, K. (2011) E-learning Quality Assurance System for e-Courses in Estonia, In Eischmidt, E. and Löfström, E. (Eds.) *Developing Quality Cultures in Teacher Education: Expanding Horizons in Relation to Quality Assurance*. Tallinn: Tallinn University, pp 120-130.
- E-Learning Development Centre (2007) Strategy 2007-2012. http://www.e-oee.ee/images/50000894/eLDC_Strategy.pdf.
- Ehlers, U.D. and Pawlowski, J.M. (2006) *Handbook on Quality and Standardisation in E-Learning*, ISBN: 978-3-540-32787-5, Springer, New York.
- European Commission (2001) Communication from the Commission to the Council and the European Parliament, The eLearning Action Plan, Designing Tomorrow's Education. Brussel. COM(2001) 172 final.
- Işman, A. (2008) *Distance Education*, Pegem Academy, Ankara.
- Laanpere, M. (2013) *Pedagogy-driven Design of Virtual Learning Environments*. PhD thesis. Tallinn University, Tallinn.
- Latchem, C., Özkul, A.E., Aydin, C.H., and Mutlu, M.E. (2006) The open education system, Anadolu University, Turkey: e-transformation in a mega-university, *Open Learning*, Vol 21, No. 3, pp 221-235.
- Mutlu, M.E. (2004) E-Learning Applications in the Open Education Faculty of Anadolu University, European Association for Distance Learning (EADL) Conference 2004, Istanbul, 26-28 May 2004.
- Nart, S. and Altunisik, R. (2013) Improving Distance Education System: Problems and Solutions from the Perspective of Lecturers, *The Online Journal of Distance Education and e-Learning*, Vol 1, No. 4, pp 23-29.
- Sangrà, A., Vlachopoulos, D., Cabrera, N. (2012) Building an inclusive definition of e-learning: An approach to the conceptual framework, *International Review of Research on Open and Distance Learning*, Vol 13, No. 2, pp 145-159.
- Yamamoto, G.T., Demiray, U. and Kesim, M. (2010) *Türkiye'de E-öğrenme: Gelişmeler ve Uygulamalar*, Ankara.
- Yamamoto, G.T., Demiray, U. and Demirci, B.B. (2011) *Türkiye'de E-öğrenme: Gelişmeler ve Uygulamalar II*, Istanbul.

PAPER II. GÜLLÜ, F., KUUSIK, R. and LAANPERE, M. (2015).
Electronic Education System Model-2. Proceedings of the International
Conference E-Learning 2015, Las Palmas De Gran Canaria, Spain July 21-24,
pp. 162–166.

ELECTRONIC EDUCATION SYSTEM MODEL-2

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ABSTRACT

In this study we presented new EES Model-2 extended from EES model for more productive implementation in e-learning process design and modelling in higher education. The most updates were related to uppermost Instructional layer. We updated learning processes object of the layer for adaptation of educational process for young and old people, taking into account interests and abilities of students of the different age groups. Important added objects of the uppermost layer are cultural diversity and language. We updated communication object of the Instructional layer and added human and social factor. The methods of study of Instructional layer were updated with selective object "religion". We added to E-paradigm layer an object "combination" that explains by combination of synchronous and asynchronous objects.

Our study has high significance for increase of quality of e-learning in higher education in specific cases. We strongly recommend application of this updated EES Model-2 to support high educational standards of higher education and provide rights of students with different needs and abilities.

KEYWORDS

EES model, EES Model-2, higher education, e-learning

1. INTRODUCTION

Because enabling technologies present many opportunities as well as challenges in the realizing of electronic learning (e-learning), it is imperative that educators and institutions planning to embark on the development of e-learning systems, have a clear and accurate understanding of the capabilities, limitations and influences of these technologies (Cloete, 2000). Creative approaches and competent strategies to manage these limitations at the instructional design, the user levels as well as integration to other systems, need to be established and understood in order to ensure a degree of quality comparable to that of traditional learning. Without the integration of well-established methods and techniques, many of the e-learning efforts may be futile, leaving frustrated facilitators and badly educated students in their wake (Cloete, 1999, 2001).

The creation of an e-learning system needs to have a model. The first generation of e-learning system was to manage and measure the learning process, display some kind of learning objects but they didn't deal with reusability and organization. These were the Learning Management System. The second generation electronic learning systems, based on Ismail (2002), has to be able to manage searchable, reusable and platform-independent learning objects. Cloete (2001) has improved the system and developed a layered model for second-generation e-learning systems: Electronic Education System (EES) Model. The aim of the model is to assist the designers of different e-learning settings to plan and implement a specific learning situation, with the focus on the individual requirements and milieu of the learning group (Cloete, 2001). The multilevel EES model contains four layers (Fig. 1, Cloete, 2001).

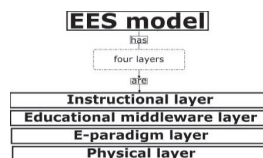


Fig. 1. Four-tier model for Electronic Education System (modified after Cloete, 2001)

These layers are strictly separated in their functions and each layer uses the services of the lower level layers (Dulai et al, 2013). The strategic development of e-learning can be carried out either on top-down or bottom-up manner, or as combination of both (Gullu et al, 2014). These approaches were implemented by many universities. Their target is application of the potential of e-learning to enhance teaching and learning. In addition, staff training is seen as essential to successful e-learning but flexible support structures and mechanisms are seen as even more important (MacKeogh and Fox, 2009; Drlik and Skalka, 2011).

The need to update existing EES model raised from the modern issues influenced on educational process in our society. We explored that diversities of age, religion, language, culture are making significant influence on educational process of current generation of students. According to number of studies based on personal interviews and detailed research we found that current students can be older, more religious and with strongly marked commitments to language, culture and nationality (e.g. Stolzenberg et al, 1995; Myers, 1996; Sherkat, 1998; Sherkat, 2007; Terry and Irving, 2010; Cavazos, 2015).

In this study we extended the EES model, explaining in details each layer, and presented new EES Model-2 taking into account described issues.

2. EES MODEL-2 STRUCTURE

The basis for extended EES Model-2 is EES model developed by Cloete (2001). This is a model where can be implemented a top-down and a bottom-up algorithm approaches to design of a strategic model for a particular e-learning situation. Cloete (2001) described in detail implementation of these approaches and basic design of the EES model. In this study we updated some layers adding new elements into the EES Model-2 and described them in detail.

2.1 Instructional layer (uppermost)

The purpose of the instructional layer is to serve as a window between the learning process and the underlying strategies necessary to establish the learning environment. The instructional layer is composed of various objects, each containing one or more methods (Cloete, 2001). In our EES Model-2 the Instructional layer consists of intermediate elements, Learning process and Learning environment strategies, and main objects (Fig. 2). The Learning process can be adopted for young and old people, who have different needs and ways for study. The main objects are containing different methods of study (by watching, reading, discovering, observing, listening, doing and cooperative learning). We added religion into the methods of instructional layer as an important object, which can strongly motivate students for seeking of knowledge in countries where religion has big importance (i.e. Turkey, Arabic countries, Malaysia and Indonesia). This element is mentioned as selective due to its specific implementation.

The main object element contains of communication objects and objects of content. The communication objects describe differences of students by social and human factors. Human factor means that every person is individual and specific approaches can be implemented for different persons. We found that social factor is important element in Turkey. Turkish people are very sensitive for social status of different persons and respective environment must be applied in such cases.

Objects of content describes cultural and language differences. We analysed cultural and linguistic situations in Estonia and Turkey and found that these elements have high importance for e-learning. Implementation of cultural element and language preferences of different groups of students into the e-

learning environment will increase interest for education and motivate students of different cultural and linguistic societies for study.

2.2 Educational layer (middleware)

The educational middleware layer provides services for a reliable and effective learning environment (Cloete, 2001). It contains (1) user authentication, (2) assignment, (3) course enrollments and (4) testing services.

2.3 E-paradigm layer

The objective of the e-paradigm layer is to provide an electronic learning paradigm composed of technological strategies possible in electronic learning. The objects found on this layer form the basis of the specific learning situation. They often prescribe which objects from upper layers may be suitable for selection (Cloete, 2001). The E-paradigm layer 2 represented by “Possible technological strategies” (synchronous, asynchronous and combination). The synchronous and asynchronous objects are commonly identified on the e-paradigm layer. In synchronous learning environments geographically dispersed, students and lecturers share a virtual classroom within the same physical time frame. Examples include remote lecture rooms with video conferencing, or students attending real-time lectures from home. The asynchronous object is characterised by its being independent of location, time, and learning speed of the learner. A typical example is that of the learner who prefers to study at his/her own pace and time. The number of methods for objects on this layer is limited, and is realised on other levels. For example, selection of the asynchronous object will have a direct influence on the methods of the course distribution object found on the educational middleware layer. Methods may be through web downloads or precompiled CDs while in the synchronous environment, e-books and on-line material may be more relevant (Cloete, 2001). In our EES Model-2 we added to this layer an object “combination” that explains by combination of synchronous and asynchronous objects. An example is that learner who has unstable time schedule on his job has opportunity to choose and combine between two main ways of study: synchronous (to study in the same time frame with lectures attending real-time lectures) and asynchronous (to be independent of location, time and speed of the learning process).

2.4 Physical layer (bottom)

The physical layer provides for the transparent transmission of messages (which may be course communication, course material or course directives) between students and lecturers tied together in an e-learning scenario. The physical layer includes the specification of hardware and software technology objects necessary to accomplish e-learning. The number of methods included in these objects is usually limited to one but may sometimes extend to two. For example, an object on this layer may be an Internet connection. The methods of the Internet connection object describe the prerequisite hardware and software strategies necessary to accomplish an Internet connection. The Physical layer of the EES model was extended in the EES Model-2 to: “Government purchased devices” (e.g. laptops, tablets), “BYOD” (Bring Your Own Device, multiplatform, single platform), “computer laboratories”.

2.5 Evaluation plane

An evaluation plane stretches across the top two layers. This plane performs evaluation functions related to these two layers as a whole. The purpose of the evaluation layer is to determine whether or not the methods selected from the instructional layer and from the educational middleware layer are accomplishing the established goals and objectives. The evaluation plane is divided into a summative evaluation sub-plane and a formative evaluation sub-plane. Formative evaluation is typically conducted during the lifetime of a process, whereas summative evaluation is conducted at the end, or after the lifetime of a process (Wills 1995; Cloete

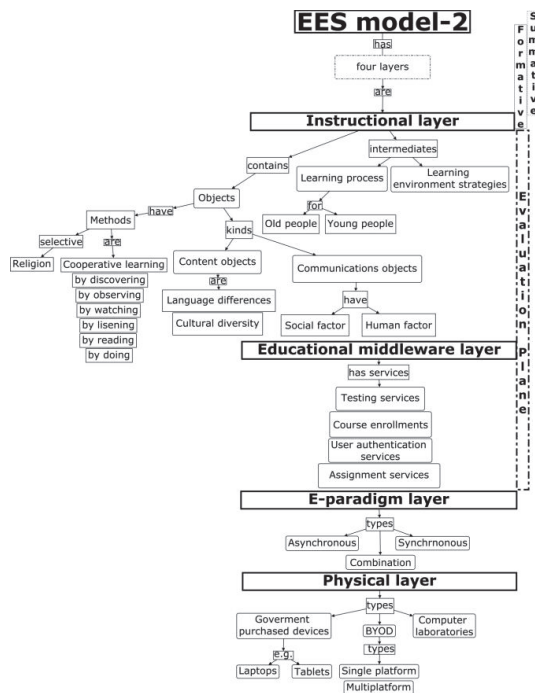


Fig. 2. Electronic Education System Model-2

2001). In an e-learning system, one may for example choose to do both types of evaluation and must then include objects from both sub-planes, or one can include only one type of evaluation, analysing one's learning situation through various methods (from selected objects) as found in that particular sub-plane. More detailed description of evaluation plane can be found in Cloete (2001).

3. DISCUSSION

The Cloet's (2001) EES model was updated and extended in this study (EES Model-2). We found that several factors, such as student's age, differences of students by social-cultural and human factors, language differences and religion were not included into EES model. According to many studies in the field (e.g. Sherkat, 2007; Terry and Irving, 2010; Cavazos, 2015), nowadays these issues are very actuals in modern society and have significant influence to education and higher education in particular. Thus we added them into the EES Model-2. This updates are important for further studies related to e-learning process modelling.

The most updates were related to uppermost Instructional layer. First we updated Learning processes object of the layer taking into account interests of students of the different age groups. For example, older people are more conservative in implementation of new technologies into to their life and need more time for adaptation to the new environment.

Other important objects of the uppermost layer are cultural diversity and language differences. Cultural preferences must be taking into account during e-learning process design. In Turkey customs are very important part of life of young people and can be used to design more productive educational process. For example, respect of old people and teachers is still common in this country.

It was found that language differences factor is very important and sensitive for young and old students in both countries, Turkey and Estonia, which are very different. Thus, we highly recommend apply this object in e-learning design.

Next updates were related to communication object of the Instructional layer. We added human and social factors to be implemented in e-learning modelling in the part of communication specifications. Human factor contains individual specific needs of every student. Taking into account this factor the efficiency of the e-learning can be increased. For example some students can be more familiar with some objects of study, other need more time for explanation. Or some students are very flexible for change of software environment and other needs more time to adopt. The social factor is important element in Turkey. Turkish people are very sensitive for social status of different persons. It is not a rule in Turkey, but, for example, we found it very often that young people grouping into clusters by social status and don't allow access this groups for the people of lower social class, as people came from villages or from families with low income. In such situations, to support more effective education, it is recommended to provide different virtual classes for such students.

We added religion into the methods of study of instructional layer. This element is mentioned as selective due to its specific implementation. Religion can strongly motivate students for seeking of knowledge in countries where religion has big importance. Islamic religion prescribes and motivates all age people to learn and discover the world in all the ways. This factor has absolutely importance in such Islamic countries as, i.e., Turkey, all Arabic countries, Malaysia, Indonesia, some African countries, etc. From the other side some authors (e.g. Sherkat, 2007) found that there is a fundamentalist Christianity problem in our society, in American society in particular. According to this study, young sectarian and fundamentalist Christians often have difficulty dealing with environments. E-learning will ease educational process in this particular case. Anyway, e-learning system model have to take into account this factor for societies, where this problem exist. This issue is case specific and preliminary explorations must be provided in each particular study.

Our study has high significance for increase of quality of e-learning in higher education in specific cases. We strongly recommend application of this updated EES Model-2 to support high educational standards of higher education and provide rights of students with different needs and abilities. The new developed EES Model-2 will be used for our future work to enhance quality of e-learning in higher education in particular countries (like Turkey), as well as in the field of study in general.

REFERENCES

- Cavazos, A. G., 2015. Multilingual faculty across academic disciplines: language difference in scholarship. *Language and Education*. Vol. 29, No. 4.
- Cloete, E., 1999. Some perspectives on network centric distance learning and software engineering. *Proceedings: future trends in distributed computing systems'99*. Cape Town, South Africa, December.
- Cloete, E., 2000. Quality issues in system engineering affecting virtual distance learning systems. *Proceedings: COMPSAC'2000*. Taiwan, October 2000.
- Cloete, E., 2001. Electronic education system model. *Computers & Education*, Vol. 36, pp. 171-182.
- Ismael, J., 2002. The design of an e-learning system: Beyond the hype. *Internet and Higher Education*, Vol. 4, pp. 329-336.
- Drlik, M., Skalka, J., 2011. Virtual Faculty Development Using Top-down Implementation Strategy and Adapted EES Model. *Procedia - Social and Behavioral Sciences*. Kyrenia, Cyprus, Vol. 3, No. 28, pp. 616-621.
- Dulai, T. et al, 2013. Service discovery to create a well personalized e-learning system. *Proceedings of the 3rd European Conference on e-learning (ECEL)*, Paris, France, November 25-26.
- Gullu, F. et al, 2014. Comparing implementation patterns of e-learning for higher education in Turkey and Estonia. *ECEL-2014*. Denmark, Copenhagen, pp. 644-650.
- Myers, S. M., 1996. An Interactive Model of Religiosity Inheritance: The Importance of Family Context. *American Sociological Review*, Vol. 61, pp. 858-866.
- Sherkat, D. E., 1998. Counterculture or Continuity? Competing Influences on Baby Boomers? Religious Orientations and Participation. *Social Forces*. Vol. 76, pp. 1087-1115.
- Sherkat, D. E., 2007. Religion and higher education: The good, the bad, and the ugly. Retrieved from <http://religion.ssrc.org/reforum/Sherkat.pdf>
- Stolzenberg, R. M., Blair-Loy, M., Waite, L. J., 1995. Religious Participation Over the Early Life Course: Age and Family Life Cycle Effects on Church Membership. *American Sociological Review*, Vol. 60, pp. 84-103.
- Terry, N. P., and Irving, M. A., 2010. *Cultural and linguistic diversity: Issues in education*. (5 ed., Vol. 4). Kendall Hunt Publishing Co.

PAPER III. GÜLLÜ, F., KUUSIK, R., LAANPERE, M. and SOZCU, O.F.
(2015a). Socio-cultural differences of e-learning in Estonia and Turkey. Proceedings of 8th annual International Conference of Education, Research and Innovation (ICERI 2015), Seville, Spain, November 16-18, pp. 6325-6332.

SOCIO-CULTURAL DIFFERENCES OF E-LEARNING IN ESTONIA AND TURKEY

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Abstract

In this paper for the first time we studied and compared socio-cultural differences and its' effect on e-learning at higher education in Estonia and Turkey using EES Model-2. Element of uppermost Instructional layer of the EES Model-2 of Turkish and Estonian e-learning system at higher education, socio-cultural factor, was compared and analyzed for the first time. Advantages and problematic aspects of components of socio-cultural factor in both countries were analysed. Most important components of socio-cultural factor with higher influence on e-learning at higher education in Estonia are (1) language, (2) education language, (3) population age and (4) customs and traditions. (1) The language, (2) religion, (3) customs, traditions and ethical values and (4) population age are components which play significant role in Turkey. The component of language was estimated as the main in two countries. The religion, second important component in Turkey with high positive impact on e-learning at higher education, was presented in Estonia but with insignificant impact. Component age is significant in two countries, as well as customs and traditions. Merged with ethical values in Turkish case this component has higher influence on e-learning at higher education.

Keywords: E-learning, higher education, Estonia, Turkey, socio-cultural differences, EES Model-2.

1 INTRODUCTION

E-learning or technology-enhanced learning is a new approach to education, teaching, and learning. This movement started in higher education more than 15 years ago and in the beginning it was a hobby for a small number of innovators among the university staff [1], [2], [3], [4]. Today, most of the universities have implemented institutional e-learning platforms and enhancing the learning with the help of web technologies is becoming a norm. Essential number of models and guidelines were developed for enhancing and assuring quality in e-learning [5], [6]. Studies trying to compare and to model evolution of the e-learning systems at higher education in their countries with examples in advanced countries using different factors and barriers, such as, technical, pedagogical and economical [4], [7]. In many of e-quality models, there is a tendency to focus on single aspects, thus failing to capture the holistic nature of problems and their solutions in virtual institutions [8].

Previously, we have studied and compared e-learning systems of Estonia and Turkey. Estonian e-learning system at higher education is advanced and unified, when Turkish one needs to be improved and unified. Studies were provided in the context of technical, pedagogical and economical aspects, and activities provided by the biggest universities of the countries [4], [7]. However, unappreciated specific socio-cultural factor of a given country has a significant importance on development and implementation of web-based technology to the masses, that often not under consideration in a modeling of the e-learning system. In particular, this is a main factor of e-learning system pedagogical aspect design that is directly related to relationship between lectures and students, who are main users of e-learning [9], [10]. Planel [11] stated that students' achievement is connected with national cultural values and that a framework of cultural understanding is essential for cross-national educational research. Ehlers [2] said that in a globalized world, and with the attempt to enhance cross-cultural enterprises, e-quality models should then specifically consider cultural and cultural-pedagogical constructs.

At the heart of socio-cultural basis Estonia and Turkey are two absolutely different worlds. That's why this factor should be studied in detail and taken into account in further modeling of the development of Turkish e-learning system.

In this paper, for the first time, we studied and compared socio-cultural differences and its' effect on the e-learning at higher education in Estonia and Turkey using the new Electronic Education System (EES) Model-2 [7].

1.1 Estonia

Main components of socio-cultural factor in Estonia as post-Soviet Union country were estimated: (1) language, (2) nationality, (3) history, (4) education language, (5) age (6) gender (7) art and literature, (8) customs and traditions and (9) social status. The most important factors (1, 4, 5 and 8) with higher influence on e-learning were chosen for the study.

Estonia has a population of 1,315,819 in 2014 (<http://www.stat.ee/34278/>). The official language is Estonian and minority languages are Russian, Ukrainian, Belorussian and others (Fig.1). In 1989, just before Estonia got independence, 36% of the entire population of Estonia was foreign-born [12] with the majority of this group being composed of immigrants from Russian or other Soviet republics. This politically privileged Russophone minority used Russian in both public and private spheres, leading to a de facto state of asymmetrical bilingualism wherein Estonians were required to learn Russian for socio-economic and political survival but Russians frequently saw little use in learning Estonian [12], [13]. Indeed, by 1991, 34.8% of the total population identified Russian as their first language or mother tongue [13]. It should be noted that while Estonian was not actively persecuted from 1940-91, the lack of a policy supporting its importance and its use in public spheres meant that socially and psychologically Estonian became a de-privileged language, even among Estonians [14].

Specific of Estonian educational system, according to study of Worden from Harvard University [14], is that education remains the only sphere in Estonia where both Estonian and Russian are afforded equal status as official languages of instruction, at the basic level. Higher education is taught solely in Estonian, although University rectors do retain some decision-making power in language choices. As of 2007, the Russophone community in Estonia accounted for approximately 28% of the overall population [13] at which time about 70% of these children attended Russian language schools [12], where they have been required to study Estonian as a non-native language [13].

Within the last two decades the Estonian skills of the non-native speakers of Estonian have improved considerably. Nevertheless, the results of secondary school graduation exams show that language skills acquired by the end of secondary education are often not sufficient for managing in the Estonian society, education and work. The implementation of the language reform in education for Russian medium schools has been slow in Estonia, both for political and practical reasons. It was completed in the school year of 2011/2012. The elementary schools may decide whether and how they teach subjects in Estonian. The national curriculum determines that on the upper secondary level all pupils have to study in total of 60% of their subjects in Estonian [15], [16].

The Central Intelligence Agency (CIA) published following population age distribution in Estonia: ages 0–14 are 15.6%, ages 15–24 are 11.2%, ages 25–54 are 41.5%, ages 55–64 are 13.2% and 65 years and over are 18.5% by 2014 (<https://www.cia.gov>).

Estonia is a country in transition in regard to the value system with wide diversity and complexity in value systems [17], [18], [19]. For instance, mothers from Estonia have been found to value some values of self-direction (independence, imagination) for their children as highly as parents in the U.S., Russia, and South Korea [20], parents from Finland [20], and mothers from Sweden [22]. At the same time, they emphasize self-confidence less, and upkeep traditional values [23].

According to study of Tulviste [23], Estonian parents were most likely to choose between important qualities that children should be encouraged to learn at home first of all, trustworthy, respect others, hard-working, and independence. They have never chosen obedience, religion, unselfishness, sporty and good looking. Parental educational level appeared to be associated with the extent to which the parents value self-directive behavior over conformity and traditional values. University-educated mothers were less likely to choose qualities related to traditional values (e.g. trustworthy, polite, good manners, and obedient), and more likely to choose those related to self-direction (e.g. imagination, self-confidence, healthy lifestyle, determination, and smartness) among the five most important qualities to develop in children than less-educated mothers. The fathers with university education valued imagination, and healthy lifestyle more highly, and good manners, and hard work less highly than those fathers whose educational level was lower [23].

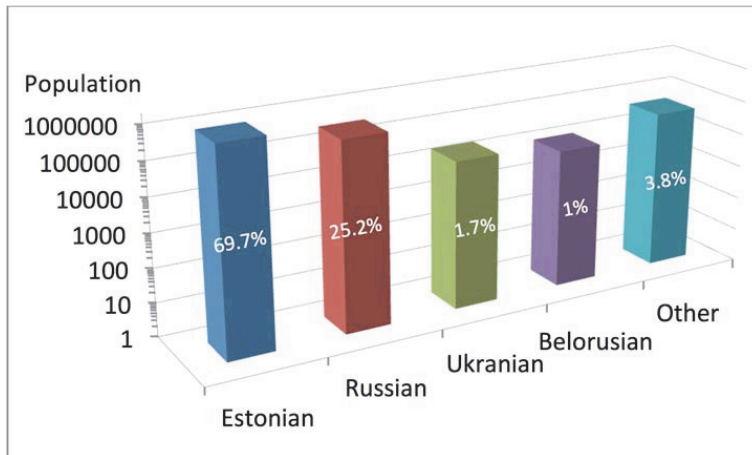


Fig. 1. Languages in Estonia (<http://www.stat.ee/34278/>).

1.2 Turkey

Main components of socio-cultural factor in Turkey as transcontinental country are (1) language, (2) religion, (3) art and literature, (4) history, (5) customs and traditions, (6) gender, (7) age, (8) education condition, (9) average life duration and (10) ethical values [24]. Most important components (1, 2, 5, 7 and 10) with higher influence on e-learning were chosen for the study. Components 5 and 10 were merged in this study.

Total population in 2014 was recorded at 77.32 million people [25], [37]. The official language is Turkish and minority languages are Kurdish, Arabic, Circassian and others (Fig. 2).

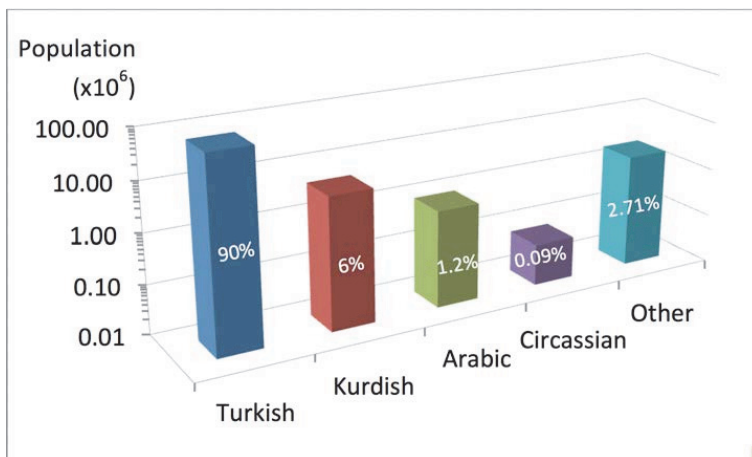


Fig. 2. Languages in Turkey [25], [26], [37].

In 1923, with the aim of establishing a secular, Westernized Turkey, Mustafa Kemal Atatürk began to implement his modernization policy in which he desired to create a new regime based upon concepts of cultural unity, rationalism, secularism and a liberal economy. In this respect, all former Ottoman subjects living in Anatolia were accepted as members of the new Turkish nation. However, this policy of cultural unity pursued by the Kemalists gave rise to the emergence of Kurdish uprisings against the central government ever since 1925. Until the 1990s, the Turkish government rejected the Kurdish identity as well as the Kurdish issue [27].

Turkey is officially a secular country. Islam is the largest religion of Turkey with around 81% percent of the population being a Muslims. Christians (Oriental Orthodoxy, Greek Orthodox and Armenian Apostolic) and Jews (Sephardi), who comprise the non-Muslim population, make up 0.7% of the total [10]. Due to almost all children in Turkey involved into learning of basic rules of Islamic religion this factor and motivation points derived from Islam are becoming important in the pupils future attitudes for a higher education and for e-learning in particular. Islam strongly motivates its followers for study and increasing of knowledge in all life aspects. As evidence, the development of a science in the Middle Ages, called "Islamic Golden Age", by Muslim scholars after spreading of Islam. The Muslim scientists, fathers of modern science, developed a scientific method, and established a basement for all scientific units, as mathematics, chemistry, physics, astronomy, medicine, etc. [28], [29], [30]. The world's oldest degree-granting university the University of Al-Karaouine, founded in 859, is related to this time period [31].

Turkish society is strongly separated by social status that could be related to a negative side. Main factors affect the separation are wealth and education. Number of poor people in Turkey has reached 20 million in 2003. About 23% of families and 37.8% of pre-school children live under poverty line [32]. The basic categories include the wealthy urban educated class, the urban middle class, the urban lower class, the large rural landowner class, and the general rural population. A university education is the minimum qualification for entry into the urban educated class, in which there are numerous substrata.

However, there are number of positive sides in Turkish culture, which could have influence on e-learning. Very strong following traditions, culture and respect of ethical values is an integral feature of Turkish people. One of the important and specific Turkish customs, usual for eastern and Caucasian nations and unfamiliar for European and Western world, came from the past and based on a full trust to the teacher. Children were giving by parents to a teacher for a long study. The teacher was becoming the next person after parents. A strict upbringing of children and respect of parents and older people are another basic customs in Turkey. Usually the word of parents is a law as well for small children, as for adults. Turkish traditions, customs and ethical values are identical with almost all the minority nations living in Turkey.

According to the CIA, Turkey had following population age distribution in 2014: 0–14 years: 25.5%, 15–24 years: 16.8%, 25–54 years: 42.9%, 55–64 years: 8.1%, 65 years and over: 6.7% (<https://www.cia.gov>). Approximately half of the population of Turkey is younger than 28 years old [10].

2 METHODS

A new layered system EES Model-2 was applied for comparative analysis presented by Gullu et al. [7]. This model was extended from existing EES Model [33].

The uppermost Instructional layer consists of intermediate elements: learning process, learning environment strategies and main objects. The Learning process has two options: adaptation for young and old people. The main objects contain different methods of study (by watching, reading, discovering, observing, listening, doing and cooperative learning). Methods contain a religion as selective option. The main object element contains of communication objects and objects of content. The communication objects describe differences of students by social and human factor. Objects of content describes cultural and language differences [7].

Educational middleware layer in the EES Model-2 describes: e-learning software tools and digital content available (user authentication, assignment and testing services, course enrollments, indexing and searching objects).

E-paradigm layer presents possible technological strategies (combination, asynchronous, synchronous).

The Physical layer in the EES Model-2 is government purchased devices (e.g. laptops, tablets), BYOD (Bring Your Own Device, multiplatform, single platform), computer laboratories.

The strategic development of e-learning can be carried out either on top-down or bottom-up manner, or as combination of both [4].

The Instructional layer of the EES Model-2 was selected as analytical segment for comparison of components of socio-cultural factor in Estonia and Turkey.

Data were collected by reviewing available literature, according personal experience and discussion with Estonian and Turkish students and other representatives of scientific communities from both countries.

3 RESULTS

We estimated most important components of socio-cultural factor with higher influence on e-learning at higher education in Estonia: language, education language, population age and customs and traditions. The language, religious, customs, traditions and ethical values and population age are components play significant role in e-learning at higher education in Turkey. The language is the main component in the both countries. However, in Estonia this component is strengthened by education language component, that absent in Turkish case. The next component, according to its' importance for e-learning at higher education in Estonia is population age. The same component in Turkey is the last one due to its importance. Three other components having higher influence for e-learning in Turkey are religion, customs and traditions and ethical values. The customs and traditions components in Estonian case have minor impact to e-learning.

4 DISCUSSION

Comparison of socio-cultural differences in the field of e-learning at higher education in Estonia and in Turkey shows differences and similarities in components, which play significant role in a field of the study. The component of language of socio-cultural factor was estimated as main in two countries. It was found a big difference between spreading of main republic language in Estonia (69.7%) and Turkey (90%). However, this factor is crucial in both cases. Due to post-Soviet Union history there is a new generation of citizens in Estonia, whose parents were immigrants from Russia and others Commonwealth of Independent States countries (CIS). We found problems in linguistic integration of Russian-speaking population into the Estonian community, including the education area. That's why the "education language" of socio-cultural factor was selected as second important component for e-learning in Estonia. At the same time, Turkey, transcontinental, multi-national country, with big number of other nationalities living on its' territory, having more tough position in understanding of integration, anyway has a problematic moments in this field. As stated by Efegil [34], for many years Kurds and other groups were forced to absorb Turkish values and culture instead of developing their own local identities. Anyway, 100% of Turkish students speak Turkish language fluently.

Thereby, the "language" and "education language" in Estonian case have the highest impact on e-learning development and could significantly decrease effectiveness of implementation of e-learning at higher education due to problems with integration of part of students whose mother language is different from country native one. Students very often meet difficulties owing national language of the country they live and, therefore, may have difficulties in relationship between classmates. These problems where found in Estonia, when Russian speaking students have problems with integration into the local environment and in Turkey, with Turkish-Kurdish integration. Estonian and Turkish e-learning systems must take into account needs of Russian- and Kurdish-speaking students, respectively, to support effective cooperation between students and lectures, not only in educational environments but in a private communication. Application of these components should enhance or slow down development of e-learning at higher education in Estonia and Turkey and should be implemented in further e-learning system modeling.

The "religion", the second important component in Turkey, was not presented in Estonia with high impact on education. Estonia is one of the least religious country in Europe with highest population (about 71%) considering them self as unbelievers [35]. Meanwhile, over 81% of the total Turkish population considered themselves as adherents of Islam, the main religion of the country [10]. According to results of Gallup poll [36], when people were asked in 42 countries the question "Does religion occupy an important place in your life?", Estonia and Turkey gained opposite locations in the table with 84% and 9%, respectively answering "no". This factor should make a positive input into e-learning system at higher education in Turkish case in general due to motivation points derived from Islam for study and increasing of knowledge in all life aspects.

It was found that religion, as a component of socio-cultural factor can very significantly motivate Turkish students for productive study according to islamic tradition. At the same time, according to political regime and new laws, practicants of islamic religion can meet problems to support their religion duties during visits of Turkish Universities (e.g. wearing islamic traditional headwear, hijab, for

woman). In comparison with Turkey, the religion question in Estonia in most cases does not play significant role, but according to situation in the world it becomes more actual and should be taking into account in e-learning modeling [7]. Due to actual political situation related to escalation of situation in islamic world by media and problems in migration policies, which obliged EU countries to accept migrants from islamic countries, population in Estonia more and more feels dislike and scares of practicans of islamic religion even if they are Estonians.

The component "age" was estimated as third in Estonia and fourth in Turkey. Older people are unwilling to adopt for new technologies and methods as e-learning is. As a consequence, this component influences on e-learning accessibility for older lectures and students, eventually losing of number of lectures and students involved into e-learning. Our study shows that Turkish population is younger than Estonian one. We suppose that Estonian education system could meet more problems related to integration of e-learning between older lectures and students than Turkish one.

Components "customs and traditions" and "ethical values" are very specific, delicate and individual components in the list of influences on e-learning at higher education that may vary significantly from person to person. It may significantly stimulate development, as well as slow down effectiveness of e-learning at higher education. "Customs and traditions" is fourth component of socio-cultural factor, with lower impact on e-learning at higher education in Estonia, was estimated as the last one. Estonian families traditionally raise in children respect others, hard-working, independence and self-direction. These personal qualities could be significantly helpful factors in e-learning study at higher education, e.g. helping to reach the highest goals, working independently, what is very important in e-learning environment. However, such important component for productive education as obedience is not common in Estonian society. Not following the prescriptions of lecture may consequently decrease effectiveness of e-learning study. The same component in Turkey has third position and was merged with "ethical values" component. This component is more important for Turkish side due to Turkish society is historically more predisposed for cultural and ethical values and traditions. Respect of teacher and unquestioning obedience of teacher targets are very strong sides of the Turkish socio-cultural factor that obliged to enhance evolution of e-learning at higher education in Turkey by strong following instructions and prescriptions of lectures. At the same time, the weak point of Turkish "customs and traditions" component, having impact on e-learning system at higher education, is separation by social status. In case of e-learning, when students and lectures don't meet in real class, this point doesn't have an impact on productivity of e-learning process.

The factor of Instructional layer of EES Model-2 related to social differences has influence for education mostly in Turkey. Socially Turkish students are very sensitive for status of their classmates. It is not a rule in Turkey but we found that young people grouping into clusters by social status and don't allow access into this groups for the people of lower social class, as people came from villages or from families with low income. In such situations, to support more effective education, it is recommended to provide virtual classes for such students. According to this element of the EES Model-2, people with any disabilities or who feel inconvenience to attend open classes, could be related to this factor and receive benefits of e-learning. For these reasons e-learning is the best solution for people who feel discomfort to attend regular classes at university and the EES Model-2 is common to be implemented for e-learning at higher education in both countries, Estonia and Turkey.

5 CONCLUSIONS

- Components of socio-cultural factor in Estonia and Turkey were estimated and compared using EES Model-2.
- Most important components of socio-cultural factor with higher influence on e-learning at higher education in Estonia: language, education language, population age and customs and traditions.
- The language, religion, customs, traditions and ethical values and population age are components play significant role in e-learning at higher education in Turkey.
- The component of language was estimated as the main in two countries.
- The religion was selected as second important component of socio-cultural factor in Turkey with high positive impact into the e-learning system at higher education and was presented in Estonia with insignificant impact.

- Our study shows that Turkish population is younger than Estonian one and component of age of socio-cultural factor is important for integration of e-learning between older lectures and students.
- Component of customs and traditions including respect others, hard-working, independence and self-direction is positive and helpful in Estonian e-learning. Merged with a component of ethical values in Turkish case the customs and traditions consist of respect of teacher and unquestioning obedience of teacher targets.
- Weak side of the customs and traditions of socio-cultural factor in Estonia is low importance of obedience if compare with Turkish values and separation by social status in Turkey.

REFERENCES

- [1] Cross, J. (2004). An informal history of eLearning. *On the Hor* 12(3), pp. 103-110.
- [2] Ehlers, U. D., Pawlowski J. M. (2006). *Handbook on quality and standardisation in e-learning*. Springer, New York.
- [3] Sangrà, A., Vlachopoulos, D., Cabrera, N. (2012). Building an inclusive definition of e-learning: An approach to the conceptual framework. *Int Rev of Res on Open and Dist Lear* 13(2), pp. 145-159.
- [4] Gullu, F., Kuusik, R., Demiray, U. et al. (2014). Comparing implementation patterns of e-learning for higher education in Turkey and Estonia. In: Abstract in proceedings of the 13th European Conference on e-Learning ECEL-2014, Denmark, Copenhagen, 30-31 October 2014, pp. 644-650.
- [5] Phipps, R., Merisotis, J. (2000). *Quality on the Line: Bench-marks for Success in Internet-Based Distance Education*. The Institute of Higher Education Policy, Washington, DC.
- [6] Watty, K. (2003). When will academics learn about quality? *Quality in Higher Education* 9, pp. 213-221.
- [7] Gullu, F., Kuusik, R., Laanpere, M. (2015). Electronic Education System Model-2. *Proceedings of the International Conference E-Learning 2015, Las Palmas De Gran Canaria, Spain July 21-24*, pp. 162-166.
- [8] Masoumi, D., Lindström, B. (2012). Quality in e-learning: a framework for promoting and assuring quality in virtual institutions. *J Com As Lear* 28, pp. 27-41. doi:10.1111/j.1365-2729.2011.00440.x
- [9] Kolias, A. (2007). Socio-cultural dimensions in the pedagogic design of e-learning and e-contents for adult learners Available via A European Perspective (Grant Agreement number: 2005 - 3872 / 001 - 001 ELE-ELEB14). Project Acronym: Fe-ConE. <http://forth.gr>. Accessed 09 Feb 2015.
- [10] Reis, Z.A., Gulsecen, S. (2014). The socio-cultural dimensions of e-learning in Turkish higher education institutions. In: Zuzevičiūtė V, Butrimė E, Vitkutė-Adžgauskienė D, Vladimirovich Fomin V, Kikis-Papadakis K (ed) *E-learning as a socio-cultural system: A multidimensional analysis*. Hershey, PA, pp. 237-252.
- [11] Planel, C. (1997). National cultural values and their role in learning: a comparative ethnographic study of state primary schooling in England and France. *Com Ed* 33(3), pp. 349-373.
- [12] Kemppainen, R. P., Ferrin, S. E., Hite, S. J., et al. (2008). Socio-cultural aspects of Russian-speaking parents' choice of language of instruction for their children in Estonia. *Com Ed Rev* 52(1), pp. 93-119.
- [13] Hogan-Brun, G. (2007). Language-in-education across the Baltic: policies, practices and challenges. *Com Ed Rev* 43(4), pp. 553-570.
- [14] Della Chiesa, B., Scott, J., Hinton, C. (eds) (2012). *Languages in a global world: learning for better cultural understanding*. OECD Pub. <http://dx.doi.org/10.1787/9789264123557-en>

- [15] Koržel, J. (2013). How minority pupils in Estonia view and cope with studying Estonian and via Estonian. *Kieli, koulutus ja yhteiskunta*. www.kieliverkosto.fi/journal. Accessed 09 Feb 2015
- [16] Metslang, H., Kibar, T., Kitsnik, M. et al. (2013). Kakskeelne õpe vene õppekeeleaga koolis [Bilingual learning in Russian-medium schools]. <http://www.hm.ee/index.php?044827>. Accessed 09 Feb 2015.
- [17] Lin, C.Y.C., Fu, V.R. (1990). A comparison of childrearing practices among Chinese, immigrant Chinese, and Caucasian-American parents. *Ch Dev* 61, pp. 429-433.
- [18] Tulviste, T., Mizera, L., De Geer, B. (2012). Socialization values in stable and changing societies: a comparative study of Estonian, Swedish, and Russian Estonian mothers. *J Cross-Cult Psyc* 43(3), pp. 480-497.
- [19] Wang, S., Tamis-LeMonda, C. S. (2003). Do childrearing values in Taiwan and the United States reflect cultural values of collectivism and individualism? *J Cross-Cult Psyc* 34, pp. 629-642.
- [20] Tudge, J., Hogan, D., Lee, S. et al. (1999). Cultural heterogeneity: parental values and beliefs and their preschoolers' activities in the United States, South Korea, Russia, and Estonia. In *Children's engagement in the world: sociocultural perspectives*, pp. 62-96. A. Göncü, ed. Cambridge: Cambridge University Press.
- [21] Tulviste, T., Ahtonen, M. (2007). Child-rearing values of Estonian and Finnish mothers and fathers. *J Cross-Cult Psyc* 38, pp. 137-155.
- [22] Tulviste, T., Mizera, L., De Geer, B. et al. (2007). Child-rearing goals of Estonian, Finnish, and Swedish mothers. *Scan J Psyc* 48, pp. 487-497.
- [23] Tulviste, T. (2013). Socialization values of mothers and fathers: Does the child's age matter? *Trames: J Hum Soc Sci* 17(2), pp. 129-140.
- [24] Eren, H. (1990). Atatürk ve milli kültür. Milli kültür unsurlarımız üzerinde genel görüşler. Atatürk kültür merkezi yayınlari.
- [25] IMF (2014) World Economic Outlook October 2014, Washington, DC. <http://www.imf.org>. Accessed 09 Feb 2015.
- [26] Turkish Language. (n.d.). <http://www.kwintessential.co.uk/resources/global-etiquette/turkey-country-profile.html>. Accessed 09 Feb 2015
- [27] Efeğil, E. (2011). Analysis of the AKP government's policy toward the Kurdish issue. *Tur Stud* 12(1), pp. 27-40. doi:10.1080/14683849.2011.563938.
- [28] Durant, W. (1980). The age of faith. In: Durant W (ed) *The story of civilization*. Sim Sch. 4, pp. 162-186.
- [29] Jacquart, D. (2008). Islamic pharmacology in the Middle Ages: theories and substances. *Eur Rev* 16(2), pp. 219-227.
- [30] Saliba, G. (1994). A history of Arabic astronomy: planetary theories during the Golden Age of Islam. New York University Press. pp. 254 & 256-257.
- [31] The Guinness book of records (1998). pp. 242.
- [32] Acar, H., Akar, S., Akdemir, G., et al. (2006). Migration, urban poverty and underclass – "Working in the garbage". *Soc Work Soc* 4(1), pp. 148-159.
- [33] Cloete, E. (2001). Electronic education system model. *Comp Ed* 36, pp. 171-182.
- [34] Efeğil, E. (2011). Analysis of the AKP Government's Policy Toward the Kurdish Issue. *Turk Stud* 12(1), pp. 27-40.
- [35] Ringvee, R. (2011). Is Estonia really the least religious country in the world? *The Guardian* September 16, 2011
- [36] Gallup Survey, The Gallup Poll, January 15-18, 2007, <http://www.galluppoll.com/content/default.aspx?ci=1690>. Accessed 13 Aug 2007.
- [37] Statistics portal. <http://www.statista.com>. Accessed 09 Feb 2015.

PAPER IV. GÜLLÜ, F., KUUSIK, R., LAANPERE, M. and SOZCU, O.F. (2015b). Using EES model-2 for comparison of e-learning activities of Estonian and Turkish biggest universities. Proceedings of 8th annual International Conference of Education, Research and Innovation (ICERI 2015), Seville, Spain, November 16-18, pp. 6333–6342.

USING EES MODEL-2 FOR COMPARISON OF E-LEARNING ACTIVITIES OF ESTONIAN AND TURKISH BIGGEST UNIVERSITIES

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Abstract

In this paper for the first time we studied and compared actions of main Estonian (University of Tartu, Tallinn Technical University and Tallinn University) and Turkish universities (Anadolu University, Sakarya University and Istanbul University) in a field of e-learning in higher education using EES Model-2. Elements of Physical layer of the EES Model-2 of Turkish and Estonian e-learning system were compared and analyzed for the first time. Qualitative and quantitative data collection tools were used in the study. For the first time we compared number of students and e-courses in three main universities in Estonia (146,067 and 5,388, respectively) and in Turkey (1,401,802 and 234, respectively).

Number of measures was offered for Turkish e-learning system in higher education. The united platform (like Moodle system in Estonia) is recommended to be implemented in Turkey. This measure is necessary to integrate students, lectures and all available for e-learning data from all the studied universities into one independent e-learning environment. Stable regulatory policies for e-learning in higher education must be implemented in Turkey to support productive development of the area. Consortium of universities is necessary to be applied in Turkey to adopt e-learning environment in higher education system on national level. Turkish e-learning system in higher education needs significant investments to supports big number of students with electronic devices, to set up reliable free internet connection for e-learning students, to provide enough computer classes and laboratories with modern techniques, to support development of number of e-learning courses for lectures and students for productive cooperation and interaction within the e-environment.

Keywords: E-learning, higher education, Estonia, Turkey, Electronic Education System Model-2.

1 INTRODUCTION

With development of information technology and internet, the main idea to convert public administration (online) was first emerged in Western countries because of their technological development. With Western countries followed by developing countries at the end of 1990's e-government gained a qualification and was applied all over the world [1]. However, distance education origins have a 150 years history [2]. At the European Council held in Lisbon in March 2000, EU15 Heads of Government set a goal for Europe to become the most competitive and dynamic knowledge-based economy in the world.

In the field of implementation of modern type of education methodology, electronic education or e-learning and other internet based services Estonia gained significant results. Today this small country is an example for almost every country in the world in e-learning systems. From other side large country Turkey with huge population is still on the low level of development. Turkey has a long experience with distance education but, at the same time, difficulties to adopt this experience to modern technologies and methods. The stagnation in the evolution of the learning methods needs good example and input of fresh ideas for the progress in this field. Therefore, Estonia as the best example of practice of e-learning in higher education was selected for this study to improve higher education system in developing Turkey.

In this paper we studied and compared activities of e-learning in higher education of three main Estonian universities (Tartu, Tallinn Technical and Tallinn Universities) and three biggest Turkish universities (Anadolu, Istanbul and Sakarya Universities) using Electronic Education System (EES) Model-2 presented in by Gullu et al. [3]. Number of e-learning courses and students, attending these courses in the main national universities of Estonia and Turkey were analyzed and compared for the

first time. The best practice of the Estonian example of e-learning development was offered as a model for Turkish universities.

1.1 Estonia

Estonia is a small country (45,226 km²) with population of 1,315,819 persons [4]. As one of European Union countries, Estonia is presented by a perfectly organized e-University consortium, founded in 2003 by eight largest Estonian public and private universities and the Ministry of Education and Research. The consortium has done a great work in this context, having the development of e-learning as a key element of the Estonian Research, Development and Innovation Strategy [5].

In May 2013 the Estonian Information Foundation, Tiger Leap Foundation merged with the Estonian Education and Research Network EENet to become the Information Technology Foundation for Education (HITSA). HITSA is a partner to the Estonian Ministry of Education and Research, educational institutions and Estonia's ICT sector in providing competitive ICT education that meets modern needs.

The main users of e-learning at higher education and its developers and inspirers in Estonia are three largest universities: University of Tartu, Tallinn Technical University and Tallinn University.

1.1.1 University of Tartu

The first activities in e-learning at University of Tartu (UT), the oldest university in Estonia established in 1632 [6], were started from 1995 at the Faculty of Mathematics by delivering for the students an e-mail based course. However, the first web-based course in the WebCT environment was developed and delivered at the UT after three years in 1998. Later, in 2000 e-learning at UT was granted the highest priority by the University Council and the Distance Education Centre, as a structural unit with the responsibility for developing e-learning at UT, was established. In 2002 the portal of the E-University of the UT was opened. This portal provides learning opportunities and technical and methodological support to learners and academic staff (creating ICT-based courses, copyright problems, etc.). From 2003 the UT is a one of the member universities of just established consortium of Estonian e-University. In 2009 the UT started to use 'Moodle' web-based learning environment [7]. In same year Adobe Connect Pro [8], a web conferencing platform for web meetings, e-learning, and webinars, became available for teachers at the UT. The video portal (Television of the University of Tartu UTTV, [9]) was launched one year later, in 2010. In 2011 the Moodle environment was connected with Study Information System (SIS). By the year 2014 the UT has approximately 2937 operating web-based courses and a lot of courses are being designed. Total number of registered students for these courses in 2014 was about 54000 [10], [11].

1.1.2 Tallinn University of Technology

Tallinn University of Technology (TUT) was founded in 1918. According to number of students it is a second in Estonia after UT. Very important role in development of e-learning at TUT plays cooperation with other institutions. Crucial place in this interplay has HITSA Innovation Center, which coordinate and support e-learning process at TUT. During 2013-2014 it was organized 869 e-courses from 1083 available at TUT (on the basis of 'Moodle') with 39614 students registered [12].

1.1.3 Tallinn University

E-learning Centre organized at Tallinn University (TU), third largest public university in Estonia, established in 2005, provides a number of technical solutions for e-learning (ICT infrastructure, videoconference services, etc.) and support of academic staff on e-learning activities. The TU reported about 1582 e-courses in 2014 and 52469 students registered [13].

The biggest Estonian universities are participating very actively in development of e-learning in higher education in Estonia, organizing and conducting different e-learning courses for university staff. Taking into account the population of the country and average number of students in higher education in Estonia, this country reached a significant result in development of e-learning, blended learning and distance education. Thus, Estonia not only achieved the aims of the EC to be an example for other European Member states, but even exceeded any expectations. E-learning in higher education and other e-services in Estonia are represented worthy and widely recognized at a global level and Estonian example of progress in these areas is playing a very important role for a worldwide ICT development.

Political attention on the problem and productive initiatives of all Estonian universities and strong cooperation with stakeholders and Estonian Government made these impressive results realistic. However, there are number of problems are still existing in Estonian R&D area [14].

1.2 Turkey

Turkey, as a country with significant population of 74 million [15] and a large territory of 783,562 km² [16] has a strong experience in a distance education, which a long history begins from early 1956.

In 1995, John Daniels describes Turkey as having one of the best known distance education programs and one of the 10 largest distance education institutions in the World [2].

Usually, the most motivated users of e-learning are part-time students. But in Turkey the part-timers is null or negligible [17]. The schooling ratio at higher education level is 43% in average at the European countries, while that in Turkey is 29%. In 1999, the ratio of total education expenditure to Gross National Product is 5% in average in the European countries, 6% in average in Organization for Economic Co-operation and Development (OECD) countries and 3.9% in Turkey. Under these circumstances, the quality of Turkish education, its international validity and acceptability is questionable. The e-learning system at higher education could not be settled up due to unstable situation in government: policies changing from one government to another and the continuity of education policies could not be ensured. These practices also caused to a great loss of resources. Changing governments have muddled the system [17]. These serious problems exist, while every year in Turkey more than 1.3 million of students apply for higher education [17], [18]. To simplify testing procedure of such huge number of students, a central test based on multi-choice questions was developed and successfully applied by Student Selection and Placement Center (OSYM). In this term Turkey could be a good example for many countries of the world.

The main players in the use of e-learning at higher education and its development in Turkey are three largest Turkish mega-universities: Anadolu, Istanbul and Sakarya.

1.2.1 Anadolu University

Anadolu University (AU) is number one in Turkey and one of the largest universities in the world. It was established in 1981 from an older institution, the EAECS, founded in 1958. In accordance with the Higher Education Act of 1981, the AU, that had a sufficient infrastructure, was also authorized to provide distance education in Turkey on a national scale. Later, in 1982, when EAECS was transformed into OEF, solid distance education system was created [17].

The AU is an institution, promoting universal higher education values and blazing trails in the Turkish higher education with its 3 distance education faculties. Successful launch of the distance education system, as well as Lifelong Learning system, focusing on expanding educational opportunities for all Turkish citizens through distance and life, ranks at the top of innovative initiatives of the AU.

Today, the number of students attending 156 e-learning in three faculties at AU is 1,365,802 [19], [20]. Anadolu University Open and Distance Education Model is the first institution in Turkey that offers higher education through contemporary education model.

1.2.2 Istanbul University

The number two institution in Turkey, taking into account the capacity of students and application of e-learning in their education system, is Istanbul University (IU).

In 2009–2010 the Distance Education Center at IU (ISUZEM) was established and has started its activities. Forty-seven e-learning programs under the supervision of ISUZEM are presented at IU. In the 2010–2011 education years, approximately 3,500 students were enrolled in ISUZEM [21].

In 2010 the Faculty of Open and Distance Education (AUZEF) was founded at IU. From this year IU started to use Electronic Document Management System (EDMS) to decrease bureaucratic processes. On basis of distance education system 18 new programs were opened at AUZEF. It provided a revolution in university education organizing different republic examinations. They gave a great chance for millions of people who did not have opportunity to apply for higher education before. The AUZEF Solution and Support Center insuring information support about e-learning. A total 450 lectures were involved in studying of 28,000 students during 5230 of hours of live lessons.

1.2.3 Sakarya University

Sakarya University (SU) became a state university in 1992. Its history starts from 1970, when SU was opened as the School (later State Academy) of Engineering and Architecture. In 2005, the Department of Informatics established the Distance Learning Research and Development Centre (UZEM) [22].

Course and courseware development follows the Analysis–Design–Development–Implementation and–Evaluation (ADDIE) model. The UZEM is also responsible for the provision of technical and learner support, marketing the e-learning programs, and training and supporting academic staff in instructional design and online teaching and learning.

One recent research project, the SU-Advancity Academic LMS Project, enabled the University's faculties, graduate schools, and vocational schools to engage more cost-effectively in e-learning delivery, tracking, and evaluation. This work grew out of the UZEM's earlier SAUIDO Server Optimization and Exam Module Project for the State Planning Organization, which investigated the infrastructure, operations, performance, and effects of LMSs, and the Server University Project in which the SU acted as a server university for other Turkish universities.

Today, about 8,000 students are taking part in 31 e-learning programs at the SU [21], [22].

2 METHODS

Data of operating web-based courses and programs, and number of attending students in three main universities of Estonia and Turkey were collected by studying databases of the universities and private collaboration with heads of national e-learning centers.

For comparative analysis was applied layered system as a most common software architecture type. The layered system was organized hierarchically, each layer providing service to the layer above it and serving as a client to the layer below. More details of layered system were described in [23].

The creation of an electronic learning system needs to have a model. The first generation of e-learning system was to manage and measure the learning process, display some kind of learning objects but they didn't deal with reusability and organization. These were the Learning Management System (LMS). The second generation electronic learning systems, based on [24], has to be able to manage searchable, reusable and platform-independent learning objects. Cloete [25] has improved the system and developed a layered model for second generation e-learning systems: Electronic Education System (EES) Model. The multilevel EES model contains four layers (Fig. 1).

These layers are strictly separated in their functions and each layer uses the services of the lower level layers [26].

The strategic development of e-learning can be carried out either on top-down or bottom-up manner, or as combination of both [27]. In Gullu et al. [3] we extended the EES model, explaining in details each layer and presented new EES Model-2 (Fig. 2). This model was used for this study because contains important elements, which must be taken into account in Turkish case. These elements are parts of lowermost Physical layer (Government purchased devices (e.g. laptops, tablets), BYOD (Bring Your Own Device, multiplatform, single platform), computer laboratories).

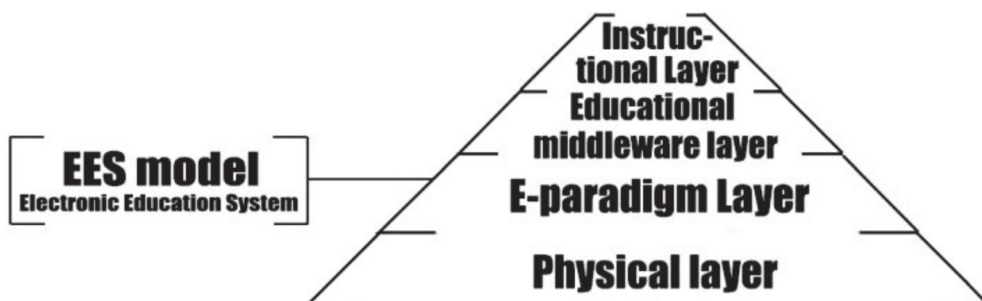


Fig. 1. Four-tier model for Electronic Education System (modified after [25]).

3 RESULTS

The activities in the field of e-learning in the three main Estonian and Turkish universities (TU, TUT, UT and AU, IU, SU, respectively) were studied and compared for the first time.

Within the period of 2004–2012, more than 4,800 fully or partly online courses were created and taught in centralized Moodle LMS and additional 4200 courses were made available through locally developed IVA LMS platform [28]. In the universities that belonged to Estonian E-university consortium, more than 40% of all courses included e-learning component by 2013 [27]. According to this study in 2013-2014 academic years in total 146,067 students were attending 5,388 web-based or e-learning courses in three main Estonian universities TU, TUT, UT (Fig. 3).

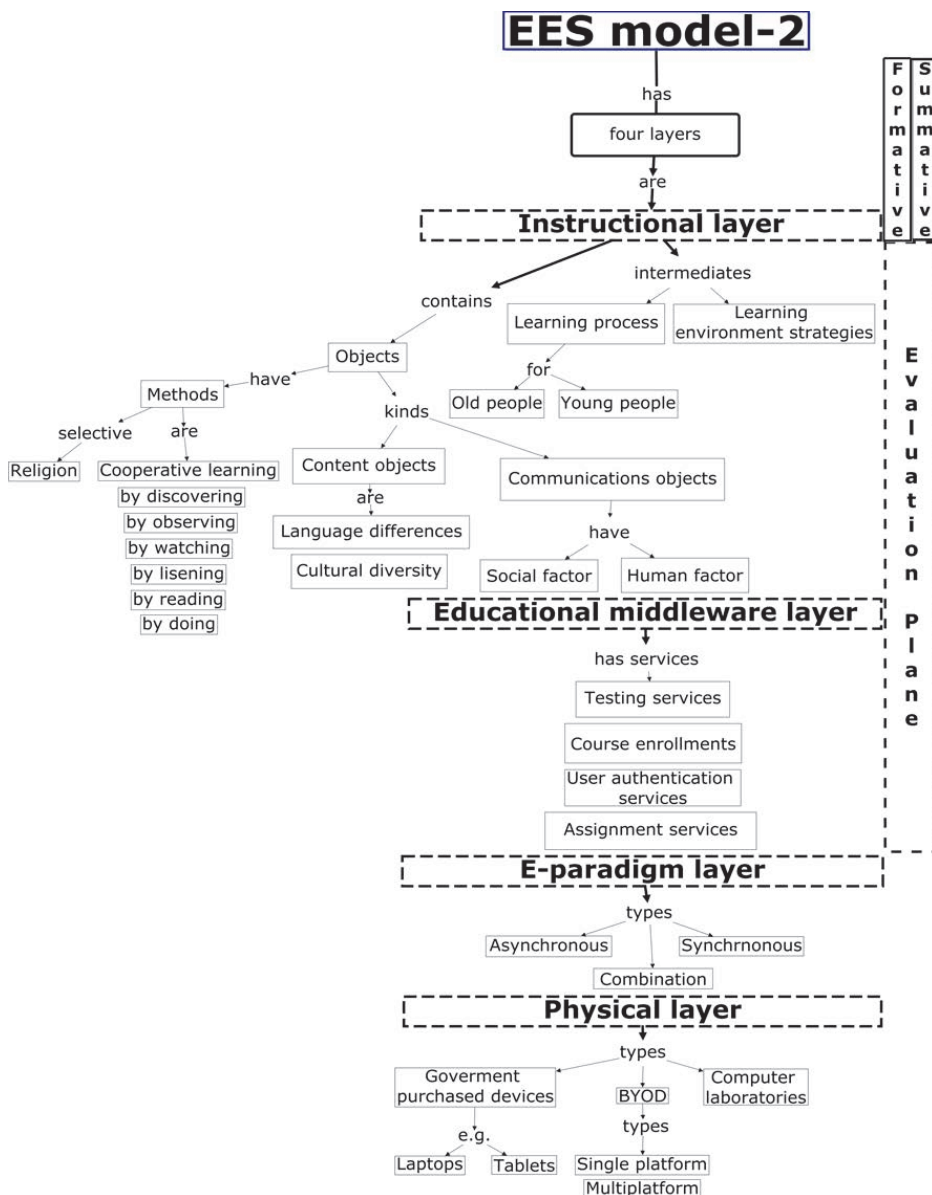


Fig. 2. Electronic Education System Model-2 (modified after [3]).

Table 1. Comparison based on qualitative analyzis of e-learning activities in the biggest universities in Estonia and Turkey using Physical layer of EES Model-2.

EES-2 Model layer		Estonian universities	Turkish universities
Physical layer		Result	
Government purchased devices	Laptops	unavailable	unavailable
	Tablets	unavailable	unavailable
BYOD	Single platform	high	low
	Multiplatform	high	low
Computer laboratories		sufficient	insufficient

Three main Turkish universities (AU, IU, SU) operating 234 e-courses with total 1,401,802 students attending these courses (Fig. 3). Activities of three main Estonian universities and three biggest Turkish universities have been analyzed and general activities in the field of e-learning were compared.

Big difference in total number of e-courses and attending students was determined in the studied universities of two countries. The Estonian institutions were presented by high number of available e-courses (5,388) and more than ten times less, in comparison with Turkish universities, number of students (146,067). At the same time quality of e-courses and educational programs were significantly higher [27], as well as opportunities for new projects proposals for Estonian universities is wider. Small number of available e-programs (234) at studied universities in Turkey, that is 25 times less than in Estonian site, have shown incredible capacity (1,401,802 students). However, number of technical, economical and pedagogical barriers was an obstructing factor for productive development of the studied area in Turkish higher education. We found that Turkish students are less equiped technically in comparison with Estonian students. Almost all students in Estonia have laptops and/tablets and therefore are ready for productive e-learning study. Also Estonian universities are better supplied with technologies. They have high level computer classes and laboratories, one of the fastest in the world Wi-Fi internet connection available in all area of universities, widespreaded free Wi-Fi spots around the country, unic educational platform that make e-learning study in higher education more easy and friendly for Estonian students. From another site Turkish students have problems with access to gadgets, as well as to a reliable and free internet connection. Also there is no united between all studied universities platform for e-learning study at higher education.

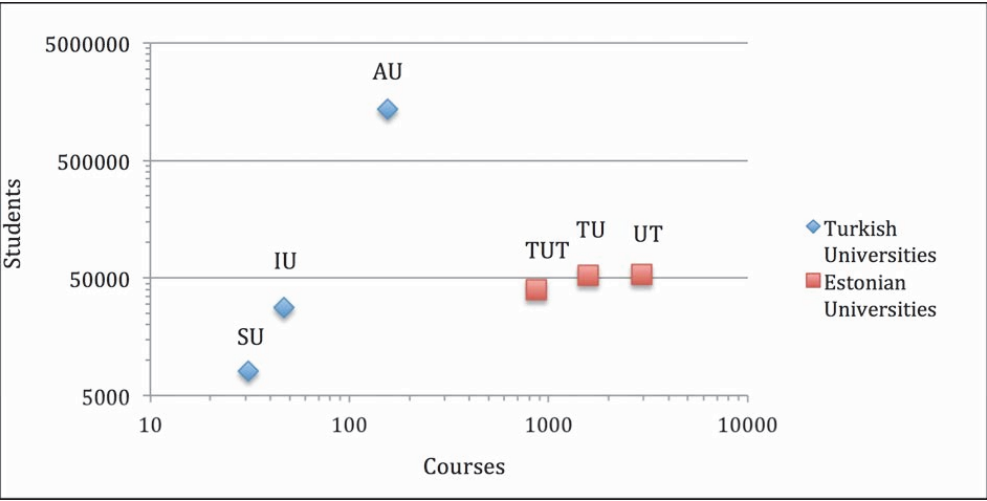


Fig. 3. Comparison of number of students versus number of e-courses in three main Estonian and Turkish universities in 2013-2014 academic years.

4 DISCUSSION

Three Turkish universities (Anadolu, Istanbul and Sakarya Universities) have been selected for the study to compare activities and financial barriers with the main Estonian Universities (Tartu, Tallinn Technical and Tallinn Universities) using EES Model-2. These universities were selected due to existence of e-learning education faculties on the bases of the universities. Due to big area and population in Turkey we have met large number of e-learning students at Turkish universities (Fig. 3). But absence of access to funding sources slowing down the development of the field of study in Turkey. There is very insignificant number of available e-courses with great capacity as a result. In a contrast, the Estonian example with small area and population, and established mechanisms for financial support of e-learning projects, is making this small European country very successful in the field of e-learning. Small number of students according to huge number of available high-quality e-courses (Fig. 3) attenuates output of the e-learning system and gives chance to students for choosing.

Analyses based on lowermost part of EES Model-2, Physical layer, shows a lack or very limited access to technical devices needed for e-learning in Turkish universities (Table 1). It was found that Estonian students have wider possibilities to use laptops and tablets in higher education.

“Government purchased devices” part of Physical layer consisting of access for students to laptops and tablets was studied and compared in selected universities in two countries. It was found that in both countries this activities are still in a step of planning for future development. For example, very ambitious initiative of supporting school pupils with electronic gadgets in Turkey a “Movement of Enhancing Opportunities and Improving Technology”, FATİH project, started in 2011. Since 2011, at least 63,000 tablets were distributed to students and 84,000 classrooms were equipped with interactive whiteboards as part of initial distributions [29]. However, number of studies [30], [31], [32] demonstrate problems that were encountered throughout the study are being not able to use the classroom management software, insufficient e-content and digital books, technical obstacles, and the lack of in-service training and inadequate technical support. Pamuk et al [30] as well presents the list of measures that should be taken into account to avoid such obstacles in a future. More trivial barriers were found on a classroom level such as, e.g., loss of student attention and contact with teacher during lessons. We suppose that this initiative met these barriers according to age groups of students supported by gadgets (from fifth to twelfth grades) and suggest implementation of similar project for higher education. This would significantly improve quality of higher education in Turkey. Estonian government approved on February 13-th 2014 the Estonian Lifelong Learning Strategy [33]. Number of ambitious goals were set up expecting to provide access to a modern digital infrastructure, supporting usage of computers, digital and mobile personal devices for every school day studies on the 100% level. It should upgrade learning for all students and teachers in general education, vocational schools and higher education institutions. Until now there is a lack but, however, a big need in such initiatives in Turkey and in Estonia.

Physical layer’s “Government purchased devices” part of EES Model-2 is strictly related to the next part “BYOD” approach. In case, if previous part is unavailable the “BYOD” can solve the problem. The “BYOD” in EES Model-2 consists of Single and Multiplatform approaches. Single platform approach set a frames for technical parameters of needed gadgets for education (explaining a strict parameters: technical options, type of gadget: laptop or tablet, PC or Macintosh, etc.). The Multiplatform approach gives wider opportunities for gadgets parameters. In this study we explored that students in higher education in Turkey are less equipped with electronic devices as Estonian students. According to this part of the model Estonian students are above the EU average.

The last part of the Physical layer that should support students in e-learning if previous parts of the EES Model-2 are unavailable is “Computer laboratories”. Here we reviewed a readiness of universities to provide stationary electronic devices in computer classes/laboratories for e-learning to students. Estonian universities were in the first positions in comparison with Turkish universities according to equipment available in the rooms and availability to provide this equipment to students. For example, Tallinn University has on its base Apple iMac computer laboratory equipped by the last word of technical development, supporting usage of powerful 21,5” Apple iMac computers, video projector and screen, and other modern and useful facilities and services. It was found that in all studied Estonian universities almost all faculties was supplied by computer laboratory. In Turkish universities we found well-equipped computer laboratory as well, but according to number of students in each university it was impossible to satisfy needs of all students. Therefore, it is strictly recommended to increase number of available computer laboratories in Turkish universities to minimize the difference between huge number of students and opportunities available for e-learning.

The Estonian example of e-learning development and use was described in this study (e.g. political and policy measures implementation, projects provided by Estonian universities, services and technology applications offered for citizens, etc.) could be offered as a model for Turkey in general and for studied Turkish universities in particular to upgrade the e-learning system. Development of united electronic environment for e-study within the Turkish institutions is suggested as a first but conceptual step for productive collaboration. Establishment of mechanisms for financial support of this strategically important area is the next but not the least step. Consortium of all institutions involved into process of higher education is necessary for Turkey to start progress in the field of e-learning education.

5 CONCLUSIONS

- EES Model-2 was used for comparative analyzes of situation in Estonian and Turkish e-learning systems.
- Elements of Physical layer of the EES Model-2 for Turkish and Estonian e-learning system were compared and analyzed.
- Estonian universities (Tartu, Tallinn Technical and Tallinn Universities) operated 5,388 e-courses with 146,067 students in 2013–2014 academic years.
- Turkish universities (Anadolu, Istanbul and Sakarya Universities) operated 234 e-courses with 1,401,802 students in 2013–2014 academic years.
- Turkish e-learning system in higher education needs significant investments to supports big number of students with electronic devices, to set up reliable free internet connection for e-learning students, to provide enough computer classes and laboratories with modern techniques, to support development of number of e-learning courses for lectures and students for productive cooperation and interaction within the e-environment.
- The united platform (like Moodle system in Estonia) is recommended to be involved in Turkey to integrate students, lectures and all available data for e-learning in higher education from all the studied universities into one independent e-learning environment.
- Stable regulatory policies for e-learning in higher education must be implemented in Turkey to support productive development of the area.
- Universities consortium is necessary to be applied in Turkey to adopt e-learning environment in higher education system on national level.
- This study is important for development of Turkish e-learning system at higher education.

REFERENCES

- [1] Chadwick, A., May, C. (2003). Interaction Between States and Citizens in the Age of the Internet: "E-Government" in the United States, Britain and the European Union Governance, 16(2), pp. 271–300.
- [2] Usun, S. (2004). Factors Affecting the Application of Information and Communication Technologies (ICT) in Distance Education. The Turkish Online Journal of Distance Education, 5(1).
- [3] Gullu, F., Kuusik, R., Laanpere, M. (2015). Electronic Education System Model-2. Proceedings of the International Conference E-Learning 2015, Las Palmas De Gran Canaria, Spain July 21-24, pp. 162-166.
- [4] Population and Social Statistics Department of Estonia: <http://www.stat.ee>
- [5] Kalvet, T. (2007). The Estonian Information Society Developments since the 1990s. Tallinn: PRAXIS Center for Policy Studies.
- [6] Times Higher Education World University Rankings 2013-14, <http://www.timeshighereducation.co.uk/world-university-rankings/2013-14/world-ranking/range/351-400>
- [7] Moodle web-based learning environment, <http://moodle.ut.ee>

- [8] Adobe Connect Pro, <http://kontakt.ut.ee>
- [9] Television of the University of Tartu UTTV, <http://uttv.ee>
- [10] University of Tartu, <http://www.ut.ee>
- [11] University of Tartu e-learning portal, <http://www.etu.ut.ee/2014/e-oppe-statistika-2>
- [12] https://v2.ttu.ee/public/s/siseveeb/dokumendid/oppetoo/oppetegevuse_aruanded/oppetegevuse_aruanne_2012-2013/OTA2012-2013PDFversiooniks29.11-30.pdf
- [13] HITSA, <http://www.hitsa.ee>
- [14] Kalvet, T. (2010). Policy Paper on Innovation: Estonia. Expert Evaluation Network delivering Policy Analysis on the Performance of Cohesion Policy 2007-2013. Brussels: DG Regional Policy.
- [15] Statistical Yearbook for Asia and the Pacific (2013). Thailand, Bangkok: United Nations publication, ESCAP. eISBN: 978-92-1-056315-4, <http://www.unescap.org/stat/data/syb2013/escap-syb2013.pdf>
- [16] UN Demographic Yearbook 2009-2010 (2011). New York, NY: United Nations publication, eISBN 978-92-1-054818-2. <http://unstats.un.org/unsd/demographic/products/dyb/dybsets/2009-2010.pdf>
- [17] Demiray, U. (Ed.). (2010). e-Learning practices: Cases and challenges facing e-learning and national development: Institutional studies and practices. Vol.1. Eskisehir, Turkey: Anadolu University. ISBN 978-975-98590-8-4 (1.c), 978-975-98590-7-7 (tk.)
- [18] Cakmakci, N. (2009). Üniversite Kapısını Doğru Tercih Açıyor. (Right Choice is opening the university door), retrieved 10/29/2009, <http://arama.hurriyet.com.tr/arsivnews.aspx?id=12057384>
- [19] Anadolu University, <https://www.anadolu.edu.tr>
- [20] Anadolu University distance education, <https://tojde.anadolu.edu.tr/tojde16/news/anadolu.htm>
- [21] Reis, Z. A., & Gulsecen, S. (2014). The Socio-Cultural Dimensions of E-Learning in Turkish Higher Education Institutions. In V. Zuzevičiūtė, E. Butrimė, D. Vitkutė-Adžgauskienė, V. Vladimirovich Fomin, & K. Kikis-Papadakis (Eds.) E-Learning as a Socio-Cultural System: A Multidimensional Analysis, 237-252. Hershey, PA: Information Science Reference. doi:10.4018/978-1-4666-6154-7.ch014
- [22] Sakarya University, <http://www.uzem.sakarya.edu.tr>
- [23] Garlan, D., Shaw, M. (1993). An introduction to software architecture. In Advances in Software Engineering and Knowledge Engineering, 1, World Scientific Publishing Company.
- [24] Ismail, J. (2002). The design of an e-learning system: Beyond the hype. Internet and Higher Education, 4, pp. 329–336.
- [25] Cloete, E. (2001). Electronic education system model. Computers & Education, 36, pp. 171–182
- [26] Dulai, T., Medve A., Muhi, D., Tarnay, K. (2013) Service discovery to create a well personalized e-learning system. In: proceedings of the 3rd European Conference on elearning (ECEL), Paris, France, November 25–26.
- [27] Gullu, F., Kuusik, R., Demiray, U., Laanpere, M. (2014). Comparing implementation patterns of e-learning for higher education in Turkey and Estonia. ECEL-2014. Denmark, Copenhagen, pp. 644-650.
- [28] Laanpere, M. (2013) Pedagogy-driven Design of Virtual Learning Environments. PhD thesis. Tallinn University, Tallinn.
- [29] Pouzevara, S., Dincer, A., Kipp, S., Sariisik, Y. (2013). Turkey's FATİH project: A plan to conquer the digital divide or a technological leap of faith? Research Triangle Park, NC & Istanbul, Turkey: RTI International & Education Reform Initiative (ERI).

- [30] Pamuk, S., Çakir, R., Ergun, M., Yilmaz, H. B., Ayas, C. (2013). The use of tablet PC and interactive board from the perspectives of teachers and students: evaluation of the FATİH project. *Educational Sciences: Theory & Practice*, 13(3), pp. 1815-1822. DOI:10.12738/estp.2013.3.1734.
- [31] Dündar, H., Akçayır, M. (2014). Implementing tablet PCs in schools: Students' attitudes and opinions. *Computers in Human Behavior*, 32, pp. 40-46, <http://dx.doi.org/10.1016/j.chb.2013.11.020>
- [32] Kuzu, A., Kurt, A., A., Dursun, Ö. Ö., Güllüpınar, F., Gültekin, M. (2013). Evaluation of the application process of fatih project: students' views. *World Journal on Educational Technology*, 5(3), pp. 395-412.
- [33] The Estonian Lifelong Learning Strategy 2020 (2014). Tallinn, <http://www.kogu.ee/wp-content/uploads/2014/05/Lifelong-Learning.pdf>

**PAPER V. GÜLLÜ, F., KUUSIK, R., LAANPERE, M., SOZCU, O.F.,
PARLAK, Z., SHOGENOV, K.** An Analysis and Comparison of Adoption
of E-learning Systems in Higher Education by Lecturers at Largest
Universities in Estonia and Turkey. *Baltic J. Modern Computing*, Vol. 4
(2016), No. 3, pp. 428–440.

An Analysis and Comparison of Adoption of E-learning Systems in Higher Education by Lecturers at Largest Universities in Estonia and Turkey

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Abstract. In this study, for the first time, we analysed and compared adoption of e-learning by lecturers in three largest universities in Estonia and Turkey. Total number of students and academic staff in the Estonian universities is 39,259 and 3,991, respectively, and 1,194,735 and 9,076, respectively, in the Turkish universities. The extended Technology Acceptance Model (TAM2) was used to analyse results of acceptance and usage of e-learning by 923 lecturers (298 from Estonia and 625 from Turkey) or 22% from the sample subject, took part in the research from the studied universities. Total number of respondents subjected to the questionnaire distribution was 4,198 (1,423 in Estonia and 2,775 in Turkey). We found and analysed strong and weak sides of e-learning and main barriers, which hinder adoption of e-learning in Estonian and Turkish largest universities. Immediate measures to support development and improvement of e-learning system at higher education in these universities were suggested.

Keywords: e-learning, Estonia, higher education, TAM2, Technology acceptance model, Turkey

1 Introduction

Every year electronic systems in higher education (e-learning) are going to be implemented more and more actively by the most reliable universities around the world. E-learning is phenomenon based on remote collaboration of students and lecturers, facilitating of access to educational resources and services, enhancing of learning quality, upgrading of teaching methods and habits using new multimedia technologies and internet. Fast development of this technology is obliged to global level of technological progress of information technologies (IT). However, balanced adoption and integration of e-learning in higher education by main users of the system, lecturers and students, is controversial. Number of barriers limiting productive implementation and utilization of e-learning in universities' everyday routine is still exists: economic, political, technical, pedagogical, absence of strategic plan and consortia between universities (Hara, 2003; Kilmurray, 2003; Saadé, 2003; Elloumi, 2004; Surry et al.,

2005; Park, 2009). Identification of the critical factors related to user acceptance of technology continues to be an important issue (Yi and Hwang, 2003; Park, 2009). Number of studies was provided to estimate adoption and integration of e-learning between students, e.g. (Koochang and Durante, 2003; Grandon et al., 2005; Park, 2009), and analysing usability of e-learning systems, e.g. (Harms and Adams, 2008; Nielsen, 2012; Genc, 2015). But the main developers and deliverers of e-learning for students are lecturers, which are in most cases accustomed to use old educational system. Therefore, there is a high importance of understanding of how lecturers perceive and react to elements of e-learning along with how to most effectively apply an e-learning approach to enhance learning. These data can help academic administrators and managers to create more effective learning environment to adopt e-learning in higher education. It is necessary to conduct research that provides personal information from lecturers about their perception of, attitude towards, and intention to use an e-learning.

Activities and strategic development of e-learning in higher education in three largest Estonian (University of Tartu-UT, Tallinn University of Technology-TUT, and Tallinn University-TU) and Turkish universities (Anadolu, Sakarya and Istanbul University) have been already studied and compared in previous studies (Güllü et al., 2014; Güllü et al., 2015b). The strongest point of Estonian e-learning in higher education is unity between all participants of e-learning educational system from all the studied universities. While, studied universities in Turkey have its own interaction platforms without links and possibility to cooperate between users from different institutions (Güllü et al., 2015b). Estonia, or “silicon valley of Europe”, as one of the most developed countries in the field of Information and Communication Technologies in the world can be a good example for Turkey.

The objectives of this study were to examine and compare quality and issues of e-learning in Estonia and Turkey at higher education, covering social, pedagogical and policy aspects. The results of the research would help e-learning systems administrators and developers to adopt and integrate better e-learning environment for lecturers.

This study proposed an integrated theoretical framework of adoption of e-learning by university lecturers based mainly on the extended technology acceptance model (TAM2). TAM is a theoretical model that helps to explain and predict user behaviour of information technology (Legris et al., 2003). TAM provides a basis with which one traces how external variables influence belief, attitude, and intention to use. Two cognitive beliefs are posited by TAM: perceived usefulness and perceived ease of use. According to TAM, one's actual use of a technology system is influenced directly or indirectly by the user's behavioural intentions, attitude, perceived usefulness of the system, and perceived ease of the system. TAM also proposes that external factors affect intention and actual use through mediated effects on perceived usefulness and perceived ease of use (Davis, 1989; Park, 2009). TAM2 appears to be able to account for 60% of user adoption (Venkatesh and Davis, 2000). As suggested in TAM2, subjective norm, one of the social influence variables, refers to the perceived social pressure to perform or not to perform the behaviour (Ajzen, 1991). It seems important to determine how social influences affect the commitment of the user toward use of the information system for understanding, explaining, and predicting system usage and acceptance behaviour (Malhotra and Galletta, 1999; Park, 2009).

In general, variables related to the behavioural intention to use information technology or to the actual use of information technology could be grouped into four categories: individual context, system context, social context, and organizational context. While social context means social influence on personal acceptance of information technology use, organizational context emphasizes any organization's influence or support on one's information technology use. Reference (Thong et al., 2002) identified

relevance, system visibility, and system accessibility as organizational context variables. They reported that the organizational context affects both perceived usefulness and perceived ease of use of a digital library. Reference (Lin and Lu, 2000) similarly reported that higher information accessibility brings about higher use of information and higher perception of ease of use. In this study, e-learning accessibility refers to the degree of ease with which a university lecture can access and use campus e-learning system as an organizational factor (Park, 2009).

In our recent studies (Güllü et al., 2015, 2015a, 2015b) we used EES model and EES Model-2. TAM2 was selected for further research due to compatibility with previously implemented models. In this study, for the first time, we analysed and compared adoption of e-learning by lecturers in three largest universities in Estonia (UT, TUT and TU), country leading in the field of IT development and integration and three largest universities in Turkey (Anadolu, Istanbul and Sakarya University), quickly technologically developing country. Estonian and Turkish universities operated 5,388 e-courses with 146,067 students and 234 e-courses with 1,401,802 students in 2013–2014, respectively (Güllü et al., 2015b). Total number of students in 2013 at UT (16,000; ¹), TUT (13,050; ²) and TU (10,209; ³) was 39,259 that is 65% of total students in higher education in Estonia (59,998; Fig. 1; ²).

Total number of an academic staff in 2013 at UT (1,800; ¹), TUT (1,731; ²) and TU (460; ³) was 3,991 (Fig. 2). Total number of students in Turkish largest universities in 2013 was 1,194,735: >1 mln. in Anadolu ⁴, 109,901 in Istanbul ⁵ and 84,834 in Sakarya ⁶. It is 24% of total number of students in higher education in Turkey (4,9 mln.; Fig. 1; ⁷). Total number of an academic staff in 2013 at Anadolu University (2,000; ⁴), Istanbul University (5,100; ⁵) and Sakarya University (1,976; ⁶) was 9,076 (Fig. 2).

We found and analysed strong and weak sides of e-learning and main barriers, which hinder adoption of e-learning in Estonian and Turkish largest universities. Immediate measures to support development and improvement of e-learning system at higher education in these universities were suggested.

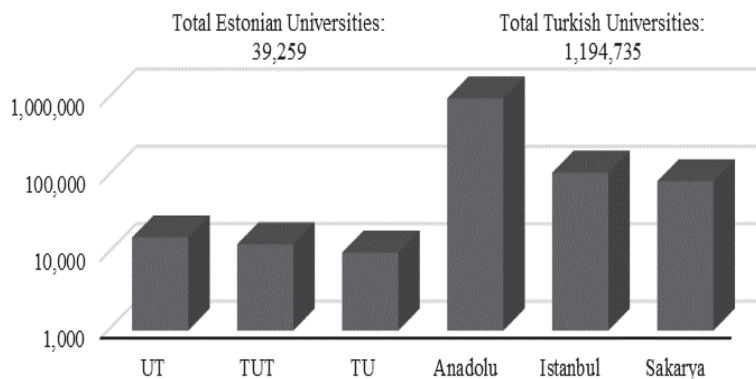


Fig. 1. Number of students in largest universities of Estonia and Turkey

¹www.studyinestonia.ee

²www.ttu.ee

³www.tlu.ee

⁴www.anadolu.edu.tr

⁵www.istanbul.edu.tr

⁶<http://about.sakarya.edu.tr>

⁷www.studyinturkey.com

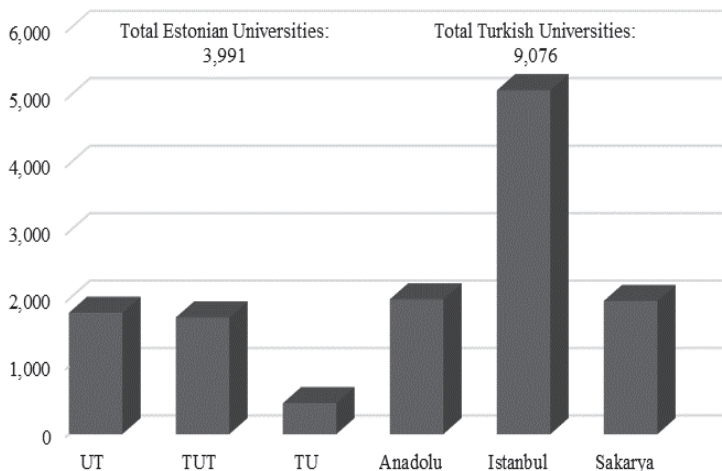


Fig. 2. Number of academic staff in largest universities of Estonia and Turkey

2 Methods

Collected data were based on questionnaire sent to participants. The questions were divided into two parts, (1) participant profile and (2) how participant feels that e-learning system adopted in his university for education environment (Table 1). Each part consists of different groups of questions. Groups in the first part contain four items (questions) to identify demographic attributes of respondents such as date of birth, gender, academic position and institution facility. Groups of the second part consist of 2-4 questions. These questions are partly based on TAM2 model (Groups: Perceived ease of use, Perceived usefulness, Attitude, Behavioural intention, E-learning self-efficacy, Subjective norm, System accessibility), consisting in total 17 questions. Groups such as Policy factor, Pedagogical level and Barriers consist in total 10 questions (Table 1) were developed for this study by author according to discussion and validation by experts (professors of e-learning study, heads of e-learning centres, developers of e-learning system, ^{8, 9, 10, 11, 12, 13}) in the field from the studied universities in Estonia and Turkey. Total item pool of the scale consisted of 31 items, four in the first part and 27 in the second one. Participants were asked to complete a seven-point Likert-type scale (1-Strongly disagree, 2-Disagree, 3-Somewhat disagree, 4-Neither agree or disagree, 5-Somewhat agree, 6-Agree, 7-Strongly agree) describing the level of agreement proposed by Vagias (2006). Items were adopted to be appropriate for participants (lecturers of e-learning) from studied universities in Estonia and Turkey.

A. Sample subjects

Participants in the study were lecturers in university (professors, associate professors, professor assistants and lecturers) who use e-learning in their practices. The number of sample subjects was set at 1423 in Estonian universities and 2775 in Turkish universities. Total number of respondents subjected to the questionnaire distribution was

⁸ <http://www.uzem.sakarya.edu.tr>

⁹ <http://auzef.istanbul.edu.tr/>

¹⁰ <https://www.anadolu.edu.tr/en/academics/faculties/2/open-education-faculty/>

¹¹ <http://www.tlu.ee/en/E-learning-Centre>

¹² <http://www.ttu.ee>

¹³ <http://www.ut.ee/en/studies/elearning/learning>

4198. Nine hundred twenty-three respondents from the selected universities in Estonia (n=298) and Turkey (n=625) voluntarily participated in the study that is 22% from the sample subject. The overall response rate of about 20% is considered to be satisfactory and accurate measurement in terms of the statistical reliability (Visser et al., 1996).

B. Statistical procedure

Data collected with the questionnaire were coded by research assistants. The data were recorded first in Limesurvey application, a free and open source on-line survey application written in PHP based on a MySQL, PostgreSQL or MSSQL database, distributed under the GNU General Public License¹⁴. This software gives opportunity to users to develop and publish on-line surveys, collect responses, create statistics, etc. Collected data were transferred to MS Excel program for further analysis.

Collected data show that respondents in Turkey were predominantly males P2(1) (n=354) than females P2(2) (n=265) (Fig. 3). Six respondents from Turkish universities did not identify their gender. Gender balance of respondents in Estonian universities was almost equal, but however females predominated (n=150 females vs n=148 males). Major respondents were Lecturers P3(4) in both countries (58% of respondents in Estonia and 36% in Turkey, Fig. 4). Assistant professors P3(3) represented 32% of all respondents in Turkish universities, when in Estonian universities only 15%. Associate professor option P3(2) was selected by 20% and 17% of respondents in Estonian and Turkey, respectively. Professors P3(1) composed only 7% of questionnaire participants in Estonian universities and more than two times in percentage professors participated in Turkish universities (15%, Fig. 4). Fig. 5 shows how respondents answered in average for presented questions in total. It is showing a general feeling/intention/satisfaction of users-lecturers of e-learning in their practice. These data shows users adaptation level. According to presented questions (Table 1), positive answers show how users accept this technology, or how it was adopted in their environment.

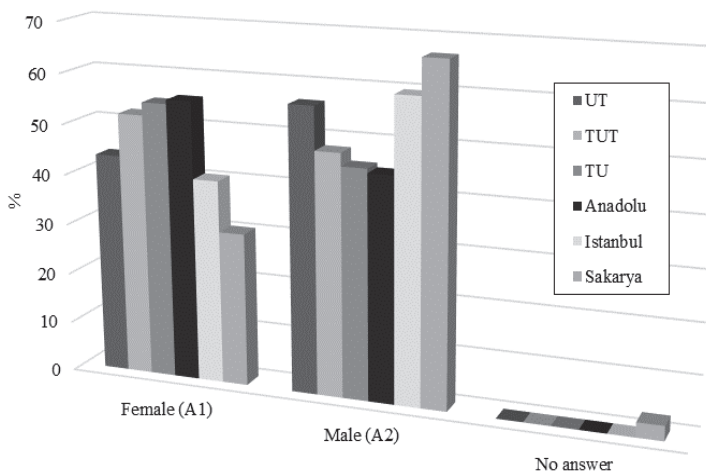


Fig. 3. Participants profile (gender, P2)

¹⁴ www.limesurvey.org

Concept	index	Group	index	Measurement instrument	index
Participant profile	P	Date of Birth	P1	Year	-
		Sex	P2	Male Female	1 2
		Academic position	P3	Professor Associate Professor Assistant Professor Lecturer	1 2 3 4
		Your Faculty	P4	For each university different lists of faculties were applied	
Adoption of e-learning system	AS	Perceived ease of use	PE	I find e-learning system easy to use Learning how to use an e-learning system is easy for me It is easy to become skilful at using an e-learning system	E ₁ E ₂ E ₃
		Perceived usefulness	PU	E-learning would improve my teaching performance E-learning would increase my academic productivity E-learning would make it easier to teach course content	U ₁ U ₂ U ₃
		Attitude	AT	Teaching (studying) through e-learning is a good idea Teaching (studying) through e-learning is a wise idea I am positive toward e-learning	A ₁ A ₂ A ₃
		Behavioural intention	BI	I intend to post announcements, assignments and learning materials via e-learning systems frequently I intend to be an active user of e-learning system	B ₁ B ₂
		E-learning self-efficacy	SE	I feel confident finding information in the e-learning system I have the necessary skills for using an e-learning system	S ₁ S ₂
		Subjective norm	SN	What e-learning stands for is important for me as a university academic staff I like using e-learning because academic society values it In order to prepare students for their future jobs, it is necessary to provide them e-learning courses	N ₁ N ₂ N ₃
		System accessibility	SA	I have no difficulty accessing and using an e-learning system in the university	SA
	AS	Policy factor	PF	My university has adopted policies for productive implementation of e-learning at higher education in my country	PF ₁
				Security aspects of e-learning at higher education are covered by policies in my country	PF ₂
				Financial support mechanisms of e-learning at higher education are involved in policies in my country	PF ₃
				E-learning policies in higher education are well implemented through productive cooperation between universities in my country	PF ₄
		Pedagogical level	PL	E-learning is the main source of pedagogical innovation in higher education in my country	PL ₁
				My university provides academic staff trainings to develop innovative pedagogical approaches for e-learning	PL ₂
				Academic staff in my university needs today more training in pedagogical aspects of e-learning and less in technological skills	PL ₃
	AS	Barriers	BR	The main barrier that hinders adoption of e-learning in my university is poor technological infrastructure and outdated e-learning systems	BR ₁
				The main barrier that hinders adoption of e-learning in my university is poor readiness of academic staff to use e-learning system	BR ₂
				The main barrier that hinders adoption of e-learning in my university is absence of clear vision and policy for e-learning development	BR ₃

Table 1. Summary of means, concepts and indexes

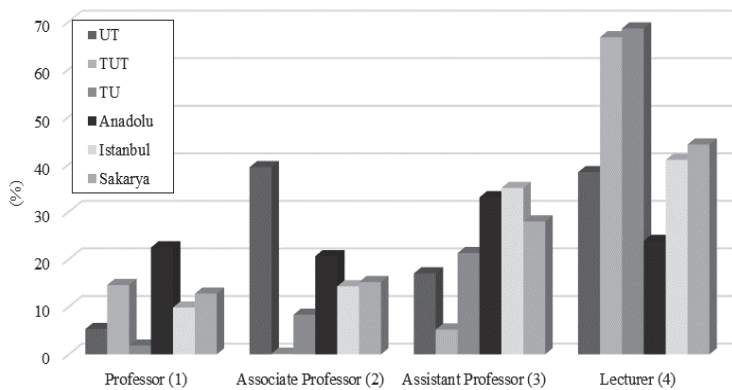


Fig. 4. Participants profile (Academic position, P3)

3 Results

Our study showed that the highest satisfaction of usage and adoption of e-learning system in higher education between studied largest universities of Estonia and Turkey was demonstrated by respondents from UT. About 87% of lecturers in average from this university were satisfied-“strongly agree”, “agree” and “somewhat agree”, when answered for proposed questions. Only 13% in average of all respondents from this university were dissatisfied-disagree with different levels of confidence (“neither agree or disagree”, “somewhat disagree”, “disagree”, “strongly disagree”) with statements in questionnaire (Fig. 5). TU is the next Estonian university and next between all studied universities according to satisfaction of e-learning. About 84% of respondents in average from TU were agree and 16% in average were disagree with different levels of confidence when answered for our survey (Fig. 5).

We found that TUT has third place between Estonian largest universities according to satisfaction of usage and adoption of e-learning system in higher education. About 74 and 26% of respondents in average answered with different levels of confidence in satisfaction and dissatisfaction mode, respectively (Fig. 5).

According to our research the highest satisfaction of usage and adoption of e-learning between largest Turkish universities has Istanbul University (average 77 and 23% of answers in satisfaction and dissatisfaction mode, respectively). Lower satisfaction showed Anadolu University with average 73 and 27% of answers with satisfaction and dissatisfaction mode, respectively. The most dissatisfied atmosphere of usage and adoption of e-learning by lecturers between Turkish largest and all studied universities was found in Sakarya University (average 64 and 36% of answers were satisfied and dissatisfied, respectively, with different levels of confidence) (Fig. 5). Estonian lecturers in total more satisfied with usage and adoption of e-learning at higher education in their everyday work (82% in average of satisfied answers, Fig. 5). Their Turkish colleagues in average 10% less satisfied of this technology usage and adoption in higher education (71% in average of satisfied answers, Fig. 5).

We found that respondents from both countries don't find usage of e-learning system in their work difficult and agree in importance of implementation of the system in higher education to improve academic productivity and teaching performance. In general they were positively related to e-learning system in higher education and mentioned them self as active users of the system. However, according to received answers Estonian lecturers were more active in this practice. Respondents from both countries equally answered about their good skills and confidence in e-learning.

The biggest difference in answers was found for Policy factor (PF), pedagogical level (PL), barriers (BR) groups of questions (Table 1). According to policy adaptation, security, financial support mechanisms and productive cooperation we found that between Estonian universities TUT respondents showed lower satisfaction than TU and UT. The lowest satisfaction with questions of policy factor was showed by respondents from Istanbul University.

Lecturers from TUT less than others support opinion that e-learning system is the main source of pedagogical innovation in higher education in Estonia. The highest satisfaction of e-learning staff trainings that proposed at universities was expressed by Estonian respondents. Istanbul University lecturers showed maximum dissatisfaction in this question. Respondents from all universities expressed need in pedagogical training of academic staff.

Poor technological infrastructure and outdated e-learning systems were noted as the main barrier that hinders adoption of e-learning (BR₁, Table 1) in UT and Istanbul University. Lecturers from TUT, Anadolu and Sakarya universities were disagree and strongly disagree with this statement. Poor readiness of academic staff to use e-learning system (BR₂, Table 1) was noted as the main barrier by lecturers from Istanbul University and UT. We found that absence of clear vision and policy for e-learning development (BR₃, Table 1) is the main barrier that hinders adoption of e-learning in Istanbul University. Also big percentage of respondents from TU has noticed about this problem.

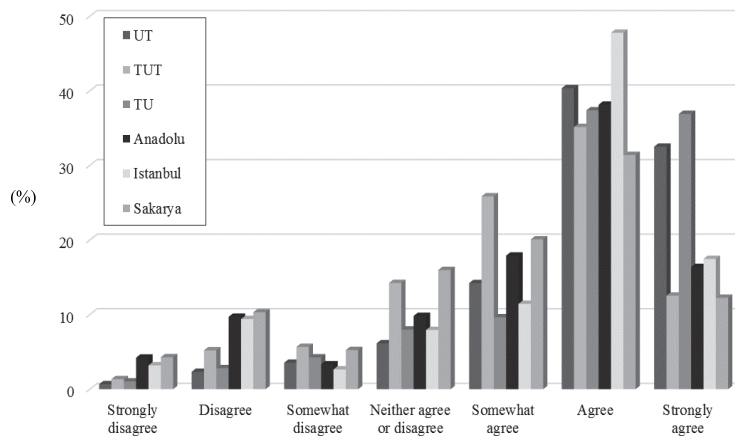


Fig. 5. Summary table of all answers by respondents from six universities from Estonia and Turkey

4 Discussion

As expected, we found that lecturers from the largest universities in Estonia are more satisfied of usage and adoption of e-learning system in their universities than their colleagues from Turkey (Fig. 5). This is due to Estonian e-learning system in higher education is advanced and united in the context of technical, pedagogical and economical aspects, and activities provided by this universities, when Turkish e-learning needs improvements and unification. United platform (like Moodle system in Estonia) was recommended to be involved in Turkey to integrate students, lecturers and all available data for e-learning in higher education from all the studied universities into one independent e-learning environment (Güllü et al., 2014, 2015b). In this study we explored weak and strong sides of e-learning system in higher education in Turkey and Estonia and which aspects need to be improved. Immediate measures for improvement process were suggested.

Strong sides of e-learning in both countries are total acceptance and understanding of importance of implementation of the modern educational system by lecturers of largest universities. Good skills and confidence in e-learning are next strong sides of the system. These make adaptation process easier. As expected, Estonian respondents showed more activeness in this practice due to excellence of the country in IT development and integration.

Problems in policy adaptation, security, financial support mechanisms and productive cooperation between institutions in Estonian universities were found. Lower success of these aspects in respondent's answers, as expected, was found at TUT. Answers for questions of Policy factor group of questions by lecturers from TUT, we suppose, shows that respondents are less informed by TUT governance than lecturers from TU and UT. We found weak side of e-learning system or barrier that hinders adoption of e-learning at TU - the absence of clear vision and policy for e-learning development (BR₃, Table 1). We suggest to both universities governance take measures to eliminate these gaps. Improving productive cooperation between institutions aspect only can solve consequently other existing problems due to positive experience of UT in these fields. United e-learning environment (Moodle) that supports productive cooperation between all participants of e-learning at higher education in Estonian universities is already exists and successfully implemented in the studied universities. This environment can be used as prospective tool to rich this aim. (i) Poor technological infrastructure and outdated e-learning systems and (ii) poor readiness of academic staff to use e-learning system were noted as barriers which hinder adoption of e-learning at UT. Those, we suggest to UT administration to renovate technological aspect of e-learning system, taking as example infrastructure at TUT and TU. The second (ii) barrier, we suppose, is due to age of lecturers. Using a personal experience, we know that there is big number of experienced lecturers in the studied universities, whose experience based on old educational technologies and principles. More experienced lecturers often are less flexible to accept new technologies than younger ones and prefer old methods in education. We can suggest a way to solve this problem: to use a systemic change approach, that is effective measure according to previous studies (e.g. Su, 2009). One solution for making qualitative change in effective technology integration in the daily teaching and learning process is to use a systemic change approach. A systemic change is doable as there are successful cases in the literature (e.g. Fullan, 1993). If educators use a systemic approach to deal with both first- and second-order barriers,

success will ultimately come. Reigeluth (1994) points out that systemic change is a paradigm shift that “entails replacing the whole thing” because “a fundamental change in one aspect of a system requires fundamental changes in other aspects in order for it to be successful”. Education as a social enterprise is a very complex system that involves many stakeholders such as teachers, students, parents, administrators, business partners and policy makers. To effectively integrate technology, these people will either affect or be affected by the change (Su, 2009).

Main barriers, which hinder adoption of e-learning in Turkish largest universities, were found in Istanbul University: (i) poor technological infrastructure and outdated e-learning systems, (ii) absence of clear vision and policy for e-learning development, (iii) poor readiness of academic staff to use e-learning system. These results confirmed our expectations. The suggestion, first of all for Istanbul University, and other Turkish universities governance (Anadolu and Sakarya University) is to take as example model of development of e-learning system in Estonian universities. We recommend to begin with establishment of strong and stable policy, to build consortia between all universities in the field, significantly finance technological infrastructure, regulate financial support of projects related to development of e-learning system, support security measures to provide safe usage of e-learning and develop training system for new and existing specialists.

We strongly suggest the implementation of measures in a complex. Selection of suggested tools separately will not guarantee stable, productive result of e-learning architecture. Wenger et al. (2002) demonstrated that the adoption of e-learning is actually influencing learning strategy, and that the simple delivery through technology cannot be sustained as a separate form of training, an appendix to traditional instructor-led activities. To be successful, it has to be seen as a part of a complete learning architecture that includes a variety of tools, approaches, and a coherent learning culture. The analysis shows two emerging phenomena: a different degree of success of the e-learning initiative depending upon its coherence with the organizational culture, and the learning strategy; a changing balance of classroom training and e-learning in relationship to the adoption of the Learning Management System in each department (Kok, 2013). Similar results were also presented in many studies, e.g. in (Al-Adwan and Smedly, 2012; Chokri, 2012; King and Boyatt, 2015, etc.).

We believe that results of this study will be helpful for improving e-learning system in higher education in Estonia and Turkey, as well as in other countries that meet similar barriers.

5 Conclusion

In this study for the first time we analysed and compared adoption of e-learning by lecturers in three largest universities in Estonia (Tartu University, Tallinn University of Technology and Tallinn University) and three largest universities in Turkey (Anadolu University, Istanbul University and Sakarya University). The extended Technology Acceptance Model (TAM2) was used to analyse results of acceptance and using of e-learning by 923 lecturers (298 from Estonia and 625 from Turkey) or 22% from the sample subject, took part in the research from the studied universities. Total number of respondents subjected to the questionnaire distribution was 4,198 (1,423 in Estonia and 2,775 in Turkey). We found and analysed strong and weak sides of e-learning and main barriers, which hinder adoption of e-learning in Estonian and Turkish largest universities.

It was found:

- that lecturers from the largest universities of Estonia are more satisfied of usage and adoption of e-learning system and showed more activeness than lecturers from Turkey
- that lecturers from both countries largest universities completely accept and understand importance of implementation of the modern educational system, such as e-learning is and showed good skills and confidence in e-learning
- gaps in policy adaptation, security, financial support mechanisms and productive cooperation between institutions in Estonian universities. Less success of these aspects in respondent's answers were found at TUT
- absence of clear vision and policy for e-learning development at TU
- poor technological infrastructure and outdated e-learning systems and poor readiness of academic staff to use e-learning system at UT
- that main barriers, which hinders adoption of e-learning in Turkish largest universities are in Istanbul University (poor technological infrastructure and outdated e-learning systems, absence of clear vision and policy for e-learning development, poor readiness of academic staff to use e-learning system).

We provided suggestions for Estonian and Turkish universities governance to take into consideration results of our study and to improve current situation in e-learning. We recommend:

- to improve productive cooperation between Estonian institutions. It can solve existing problems at TUT and TU
- to renovate technological aspect of e-learning system at UT, taking as example infrastructure at TUT and TU; and to use a systemic change approach that is effective measure to implement new technologies
- to take the model of development of e-learning system in Estonian universities as example for all Turkish universities, beginning with establishment of strong and stable policy, to build consortia between all universities in the field, to finance significantly technological infrastructure, guarantee financial support of projects related to development of e-learning system, support security measures to provide safe usage of e-learning and develop training system for new and existing specialists
- to implement measures in a complex. Selection of suggested tools separately will not guarantee stable, productive result of e-learning architecture.

Suggested measures are important to support development and improvement of e-learning system in higher education in studied universities, as well as in other countries who meet similar barriers.

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179–211.
- Al-Adwan, A., Smedly, J. (2012). Implementing E-Learning in the Jordanian Higher Education System: Factors Affecting Impact. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 8, 121–135.
- Chokri, B. (2012). Factors influencing the adoption of the e-learning technology in teaching and learning by students of a university class. *European Scientific Journal December edition*, 8(28), 165–190. (2012)
- Davis, F.D. (1989). : Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–339.

- Elloumi, F. (2004). Value chain analysis: A strategic approach to online learning. In A. Anderson., F. Elloumi (Eds.), *Theory and practice of online learning*, Athabasca, Canada: Athabasca University, 61–92.
- Fullan, M. (1993). *Changing Forces: Probing the Depths of Educational Reform*. London: Falmer Press.
- Genc, Z. (2015). Usability of a web-based school experience system: opinions of it teachers and teacher candidates. *Proceedings of 9th International Conference on e-Learning (MCCSIS)*, 81–89.
- Grandon, E., Alshare, O., Kwan, O. (2005). Factors influencing student intention to adopt online classes: A cross-cultural study. *Journal of Computing Sciences in Colleges*, 20(4), 46–56.
- Güllü, F., Kuusik, R., Demiray, U., Laanpere, M. (2014). Comparing implementation patterns of e-learning for higher education in Turkey and Estonia. *Proceedings of ECEL-2014*, 644–650.
- Güllü, F., Kuusik, R., Laanpere, M. (2015a). Electronic Education System Model-2. *Proceedings of the International Conference E-Learning*, Las Palmas De Gran Canaria, Spain, July 21-24, 162–166.
- Güllü, F., Kuusik, R., Laanpere, M. and Sozcu, O. F. (2015b). Using EES model-2 for comparison of e-learning activities of Estonian and Turkish biggest universities. *Proceedings of 8th annual International Conference of Education, Research and Innovation (ICERI 2015)*, Seville, Spain, November, 16-18, 6333–6342.
- Güllü, F., Kuusik, R., Laanpere, M., Sozcu, O. F. (2015c). Socio-cultural differences of e-learning in Estonia and Turkey. *Proceedings of 8th annual International Conference of Education, Research and Innovation (ICERI 2015)*, Seville, Spain, November 16-18, 6325–6332.
- Hara, N. (2000). Student distress in a web-based distance education course. *Information, Communication and Society*, 3(4), 557–579.
- Harms, M., Adams, J. (2008). Usability and design considerations computer-based learning and assessment. *Meeting of the American Educational Research Association (AERA)*
- Kilmurray, J. (2003). E-learning: It's more than automation. The Technology Source archives. Retrieved from <http://technologysource.org/article/elearning>
- King, E., Boyatt, R. (2015). Exploring factors that influence adoption of e-learning within higher education. *British Journal of Educational*, 46(6), 1272–1280.
- Kok, A. (2013). How to Manage the Inclusion of E-Learning in Learning Strategy: Insights from a Turkish Banking Institution. *International Journal of Advanced Corporate Learning (iJAC)*, 6(1), Kassel University Press GmbH, 20–27.
- Koohang, A., Durante, A. (2003). Learners' perceptions toward the web-based distance learning activities/assignments portion of an undergraduate hybrid instructional model. *Journal of Information Technology Education*, 2, 105–113.
- Legris, P., Ingham, J., Colletette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management*, 40, 191–204.
- Lin, J.C., Lu, H. (2000). Towards an understanding of the behavioral intention to use a Web Site. *International Journal of Information Management*, 20, 197–208.
- Malhotra, Y., Galletta, D.F. (1999). Extending the technology acceptance model to account for social influence: Theoretical bases and empirical validation. *Proceedings of the 32nd Hawaii International Conference on System Sciences*, 1.
- Nielsen, J. (2012). Usability 101: Introduction to usability. Retrieved from <http://www.nngroup.com/articles/usability-101-introduction-to-usability>.
- Park, S.Y. (2009). An Analysis of the Technology Acceptance Model in Understanding University Students' Behavioral Intention to Use e-Learning. *Educational Technology, Society*, 12 (3), 150–162.
- Reigeluth, C.M. (1994). The imperative for systemic change. In C.M. Reigeluth., R.J. Garfinkle (Ed.), *Systemic Change in Education*. Englewood Cliffs, NJ: *Educational Technology Publications*.
- Saadé, R.G. (2003). Web-based education information system for enhanced learning, EISL: Student assessment. *Journal of Information Technology Education*, 2, 267–277.
- Su, B. (2009). Effective technology integration: Old topic, new thoughts. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*. California State University Monterey Bay, USA, 5(2), 161–171.
- Surry, D.W., Ensminger, D.C., Haab, M. (2005). A model for integrating instructional technology into higher education. *British Journal of Educational Technology*, 36(2), 327–329.

- Thong, J.Y.L., Hong, W., Tam, K. (2002). Understanding user acceptance of digital libraries: What are the roles of interface characteristics, organizational context, and individual differences? *International Journal of Human-Computer Studies*, 57, 215–242.
- Vagias, Wade M. (2006). Likert-type scale response anchors. Clemson International Institute for Tourism and Research Development, Department of Parks, Recreation and Tourism Management. Clemson University.
- Venkatesh, V., Davis, F.D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46, 186–204.
- Visser, P.S., Krosnick, J.A., Marquette, J., Curtin, M. (1996). Mail Surveys for Election Forecasting? An Evaluation of the Colombia Dispatch Poll. *Public Opinion Quarterly*, 60, 181–227.
- Wenger, E., McDermott, R., Snyder, W. (2002). *Cultivating Communities of Practice*. Boston, Mass: Harvard Business School Press.
- Yi, M., Hwang, Y. (2003). Predicting the use of web-based information systems: Self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International Journal of Human-Computer Studies*, 59, 431–449.

Received April 26, 2016, accepted May 26, 2016

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2. Hariduskäik

Õppeasutus (nimetus lõpetamise ajal)	Lõpetamise aeg	Haridus (eriala/kraad)
Tatari Riiklik Humanitaar-Pedagoogiline Üikool, Tatarstan-Kazan (Venemaa)	1996–2001	Bakalaureuse- ja magistrikraad arvutiteaduses

3. Keelteoskus (alg-, kesk- või kõrgtase)

Keel	Tase
Türgi	emakeel
Inglise	kõrgtase
Vene	kõrgtase
Tatari	kõrgtase
Eesti	põhioskused

4. Täiendusõpe

Õppimise aeg	Täiendusõppe korraldaja nimetus
2013-2014	EL riigid tervise uuringu kvaliteedi ja tulemuslikkuse kriteeriumide raamistikus ja nende Türgile ülekantavus EQAVETi Projekti nr: 2013-1-tr1-leo03-49771
2013-2014	ELi riikide töö-põhise õppe kvaliteedi tagamise süsteemi uurimine EQAVETi Projekti nr: 2013-1-tr1-leo03-50060
2012-2015	Eesti - Türgi kultuurifestival (2012, 2013, 2014, 2015)
2012-2016	Eesti - Türgi äriforum (2012, 2013, 2014, 2015, 2016)
2012	Hizmet liikumise Akadeemiline paneel (Tallinna Tehnikaülikool & Eestürk Mtü 2012)
2012	Seminar "Interneti turvalisus koolis" (Tallinna haridusamet & Eestürk Mtü)

5. Teenistuskäik

Töötamise aeg	Tööandja nimetus	Ametikoht
2010	Eestürk Mtü	Tegevjuht
2009–2015	Gulluoglu Food Company	Juhatus liige
2006–2009	Avrupa Kopru Company, Istanbul	Juhatus liige
2001–2006	Bugulma, Tatar-Türgi Keskkool, Tatarstan-Bugulma (Venemaa)	Õpetaja, arvutikursused

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2. Education

Educational institution	Graduation year	Education (field of study/degree)
Tatar State University of Humanities and Education, Tatarstan-Kazan (Russia)	1996–2001	Bachelor & Master of Sciences/Departments of Computer Science

3. Language competence/skills (fluent; average, basic skills)

Language	Level
Turkish	Mother language
English	Fluent
Russian	Fluent
Tatar	Fluent
Estonian	Basic skills

4. Special courses

Period	Educational or other organization
2013-2014	EU Countries within the framework of health study on the quality and performance criteria and Turkey transfer eqavet Project no: 2013-1-tr1-leo03-49771
2013-2014	Investigation of work-based learning systems for quality assurance in eu countries equavet Project no: 2013-1-tr1-leo03-50060
2012-2015	Estonian Turkish culture festival (2012, 2013, 2014, 2015)
2012-2016	Estonian Turkish business form (2012, 2013, 2014, 2015, 2016)
2012	Academic panel about Hizmet movement (Tallinn Universty Of Tecnology & EESTURK, 2012)
2012	Seminar, about internet security in the school (Tallinn Department of Education & Eestürk)

5. Professional employment

Period	Organization	Position
2010	Eesturk Mtu	Chairman
2009–2015	Gulluoglu Food Company	Member of the board
2006–2009	Avrupa Kopru Company, Istanbul	Member of the board
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