A ROAD MAP PROPOSAL FOR TRANSITION TO LARGE SCALE E-LEARNING IN OPEN UNIVERSITIES: CASE OF ANADOLU UNIVERSITY OPEN EDUCATION SYSTEM

Prof. Dr. Ali Ekrem Özkul

Ass. Prof. Dr. M. Emin Mutlu

Anadolu University, Turkey

aeozkul@anadolu.edu.tr

memutlu@anadolu.edu.tr

Prof. Dr. Ali Ekrem Özkul

Ali Ekrem OZKUL is a professor and vice rector of Anadolu University-Turkey. After receiving BS and MS degrees in Industrial Engineering from Boğaziçi University of Istanbul he completed his Ph.D. study at Anadolu University of Turkey in the field of Quantitative Business Analysis. After working in the industrial engineering department of Anadolu University, he was transferred to the Open Education Faculty where he served as Dean between 1998 and 2004. Dr.Özkul's current research interests include management of distance education, design and implementation of large-scale e-learning project, and e-transformation in education.

Ass. Prof. Dr. M. Emin Mutlu

Mehmet Emin Mutlu, PhD, is an assistant professor at the Open Education Faculty of Anadolu University where he also serves as one of the vice-deans. In addition, Mr. Mutlu is the director of the Computer Aided Instruction Center of the university. After receiving his master's degree in the Industrial Engineering Program of the Anadolu University, he has completed his PhD degree in Osmangazi University, Operations Research Program. Since Mr. Mutlu has been focusing more on e-learning development, his research interest is in general related to design and development processes of computerized instruction and online learning.

Abstract

This study proposes a multiphase road map including steps such as e-Exam, e-Facilitator, e-Book, e-Television, e-Audio Book, e-Practice and e-Course for transition to very large scale e-learning applications in open universities taking e-learning experiences gained at Anadolu University between 1999-2006 as the starting point. The suggested road map is discussed in terms of skills, organizational characteristics, e-learning teams, resource content, development-presentation and access technologies, production time and budget necessary for transition to e-learning, and the application at Anadolu University are evaluated. A multiphase road map approach for transition to e-learning and a pilot project approach are compared.

Key word: Open and distance education, large scale e-learning

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Introduction

Four different levels are observed in e-Learning applications in higher education:

a) Instructors teaching at universities offering formal education develop online courses as a result of their own individual efforts.
b) Internet-based distance education programs are opened at universities offering formal education.
c) Internet-based courses are developed at universities offering distance and open education using traditional methods.
d) Virtual universities are established in order to offer distance education via the Internet.

The focus of this study is transition to e-learning at universities offering distance and open education using traditional methods.

Open universities have been established in1980's following the Open University of England in order to meet the mass education needs of countries. Book and television based distance education methods are used in those universities. Open universities having more than 100,000 are called 'mega university' (Daniel, 1996). The number of mega universities was 11 in 1996 and it increased to 20 in 2005 (UNESCO, 2005). Thousands of students are enrolled in courses in mega universities. Activities such as the production and distribution of instructional materials, advisory services, holding examinations are carried out from a center, and one of the most important decision criteria is the low level of cost of unit per student.

The importance of the use of information and communication technologies (e-learning) in education has increased since the second half of 1990's. In open universities having a large number of students and acting as central institutions, transition to e-learning applications has not been occurred as fast as expected. When the web sites of the 20 mega universities in the list of UNESCO are examined, it is seen that except for some universities such as Korea National Open University (Hoon, 2006), university of Phoenix, Athabasca University and Anadolu University, those universities continue to use traditional distance learning methods (Jung, 2005).

Most of the traditional e-learning projects are designed so that an instructor offers distance education to a limited number of students using the virtual class approach. Instead of using the virtual class approach in open universities having thousands of

students, designing course sites that include comprehensive course contents including multi-media techniques that students can use while they are studying on their own and putting those sites into students' service without making their use compulsory for the students is a more practical method. These types of e-learning applications developed for the use of a large number of students are called "large scale e-learning practices". (Ataç, 2005; Paulsen, 2005; Weller, 2004,).

Designing and putting into practice the e-learning systems in open universities is difficult because there many programs, courses and students. For this reason, various approaches are used (Bullen and Janes, (Eds.), 2006). For example, a frequently used approach is that comprehensive e-learning practices are developed for limited number of courses and this e-learning content is practiced over a limited number of students. At the end of this approach, which can also be called a pilot project approach, we are not so optimistic for the generalization of this practice to the whole university because the development of e-learning content is complex and very hard. Even if the pilot practice is very successful, that the number of programs, courses and students are very high decreases the motivation for the continuity of the project. The risk of e-learning investments is very high. Bates (2005) asserts that there are many unsuccessful e-learning practices in distance education. Deciding to create a very comprehensive and complex e-learning platform may even cause private universities to go bankrupt (Garret, 2004).

Another approach to design and put into practice the e-learning system in open universities is the multiphase approach which will be practiced starting with simple e-learning practices for large number of people and then transition to complex e-learning practices. In this way, many academic personnel and students are included in the project starting from the first steps, and planning and controlling processes gets easy as the results of the investments for each phase are obtained in the same phase.

In this study, a roadmap for the multiphase approach will be established and its advantages and disadvantages compared to pilot project approach will be discussed.

A road map for transition to e-learning

A multiphase development plan consisting of seven steps is suggested for transition to e-learning in open universities.

Phase	Name of the Phase	Action
1. Phase	e-Exam	Preparing and publishing Internet based trial exams that include questions randomly withdrawn from a question bank for all possible courses.
2. Phase	e-Facilitator	Publishing an asynchronous questioning and answering system among academic facilitators and students for all possible courses via the Internet.
3. Phase	e-Book	Starting the distribution of electronic copies of course books on the Internet for all possible courses.
4. Phase	e-Television	Starting the Internet publication of digitized video files of television programs for all possible courses

5. Phase	e-Audio Book	Starting the distribution of dramatized voice files of course books in the Internet starting from the courses having the highest number of students.
6. Phase	e-Practice	Starting from the courses having the highest number of students, preparing voiced course software that include components such as many questions with answers, interactive examples, test and content summaries
7. Phase	e-Course	Starting from the courses having the highest number of students, preparing e-learning software that aim to teach the course using video/voice and interactive animations in the Internet

Table 1. A Road Map for Transition to e-Learning

In determining those phases, the traditional classification system of CAI (Computer Aided Instruction) software such as testing software, drill and practice software, tutorial software and reference software are adapted to e-learning and taken as the basis. (Alessi and Trollip, 1991). An e-learning practice is started in each phase and this practice continues in the following periods. Hence, when the seventh phase is reached, seven e-learning practices that are parallel to each other will be in practice. In this way, all the options necessary are offered so that students having different learning styles can benefit from the most appropriate learning environments for them. (Honey and Mumford, 1992).

The following criteria are used in determining the order of those phases.

- Complexity of the design, development and application of the service. (Searching, learning and adaptation of technologies necessary for each e-learning service takes more time than the time necessary for previous phases)
- The level at which the service meets the needs of the students and the demand of students for the service. (Students give priority to the content, such as trial exams, that can directly affect their success in the exams.)
- The human resources and infrastructure costs necessary for the design, development and practice of a service. (Each phase includes more cost factor than the previous steps)
- Factors affecting the students' access to the service and the conditions of the national Internet infrastructure. (More bandwidth and computer power are needed in each phase compared to previous phase)
- The time period necessary for the design, development and practice of the service. (More time is needed in each new phase)
- Producibility of the service for many courses (Phases that can be applicable for more courses than the others have priority)
- The existence of the resource content necessary for the design and development of the service. (Finding/providing resource content at the beginning phases is easier than the following phases)

The determination of these phases and their order may change depending on the countries or on the sources of the open universities in a country. If the Internet infrastructure in a country is developed and a large proportion of students access the Internet, a decision to whether or not practice more than one phase of the roadmap simultaneously depends on the resources of the university. If the copyright rules of a

university does not allow the practice of services such as e-Book, e-Television or e-Audio Book, those phases can be excluded from the roadmap.

The main factors that affect the design and implementation of the e-learning system in open universities can be listed as (a) skills necessary for transition to e-learning, (b)organizational structure, e-learning teams and institutional resource content, (c) infrastructure for e-learning development and presentation – the Information Technologies (IT) infrastructure owned by students, and (d) the cost of transition to e-learning.

The roadmap for transition to e-learning suggested for open universities will be analyzed in terms of those factors.

Skills Necessary for the Phases of e-Learning

Each of the e-learning phases suggested in the roadmap have different levels of complexity in the design, development and practice processes. The minimum and maximum time periods necessary for the transition to each e-learning phase are stated in Table 2. These time periods are the periods necessary to develop the e-learning services individually. These periods may diminish as a result of the experience obtained by phases that are put into practice consecutively. The skills mentioned in the table are the skills necessary for the development and implementation of only the e-learning services; it does not include the skills necessary for the production of resource content such as the development of television programs or course book writing.

Phase	Transition Period	Skills Necessary for the Development and Implementation of the e-Learning Service (Degree of Complexity)
e-Exam	3-6 months	Web application development, arranging organizations for the updating of questions of many courses
e-Facilitator	3-6 months	Web application development, moderator support, facilitation skills
e-Book	3-6 months	Web application development, transforming various index formats into PDF and Flash Paper, arranging organizations for updating a large number of course books
e-Television	3-6 months	Web application development, transforming various video formats into WMV, arranging organizations for updating the television programs of many courses.
e-Audio Book	3-6 months	Web application development, transforming various voice formats into MP3, arranging organizations to update the audio book of many courses
e-Practice	1-2 years	Web application development, scenario development, developing template units using Flash, developing animations using Flash, transforming various voice formats into MP3, arranging organizations for updating the practice software of many courses
e-Course	1-2 years	Web application development, scenario and storyboard development, developing template units using Flash, Developing animations using Flash, transforming various voice formats into MP3, transforming various video formats into Flash video, ensuring audio, video and animation synchronization, arranging organization to update the practice software of many courses

If a university has sufficient resources, more than one of those services can be designed and implemented simultaneously. The criteria for the ordering of the e-learning phases will apply for also at this point.

The e-Course phase, which is the last phase is implemented in 39 months when the skills fort he e-learning phases are successfully gained at the minimum time periods and in 78 months when those skills are gained at the maximum time periods.

Organizational Structure, e-Learning Teams and Resource Content

Mega Universities need an e-Learning Development Unit where e-learning content will be developed in a planned way. Teams involving staff specialized in various fields and who are responsible for the development and implementation of the e-learning content work in the e-Learning Development Unit. e-Learning teams involve (a) e-Learning designers, (b) IT specialists who can support the development and publishing infrastructure, (c) subject matter specialists and editors who will be the source for the development of the course content, (d) image, voice , video and animation designers and developers.

Each phase of transition to e-learning needs a development team that involves more personnel than teams working for previous stages.

Phase	Team Structure	Necessary Team/Source
e-Exam	Programmer – Data Entry Operator – System Administrator	Questions asked in previous examinations
e-Facilitator	Programmer – Facilitator – System Administrator	Facilitators
e-Book	Programmer – Support of the typography operators –Scanner Operator- System Administrator	Published course books
e-Television	Programmer – Digital video operators- System Administrator	Broadcasted television programs
e-Audio Book	Programmer – Vocalization personnel – Digital audio operators – System Administrator	Published course books
e-Practice	Programmer – e-Learning designer – Subject matter specialist – Voice-Video-Animation designer – Vocalization personnel - Editor – System Administrator	Instructional and development scenario for original product
e-Course	Programmer – e-Learning designer – subject matter specialist –Voice-video-image-animation designer – Vocalization personnel – Television artist - editor –System Administrator	Instructional scenario, development scenario, storyboard for original product

Table 3. Organizational Structure and Enterprise Content in Transition to e-Learning

If course books, television programs and exam questions can be developed centrally and the copyrights of those products belongs to the university, then enterprise content will

be used as a source for e-learning easily. In a mega university, the availability of resources such as subject specialists, television developments, IT specialists, artists, e-learning designers will affect the time and cost of the e-learning team formations.

The existence of units that provide resources such as Test Research Unit, which enables the preparation of exam questions in a center; TV Production Unit, which prepares the television programs; Book Design Unit, which arranges the preparation of books provide important supports to the processes conducted in the e-Learning Development Unit.

Transition to a new e-learning phase from the previous one requires a research and development study which will enable the search and learning of new instructional technologies and their adaptation to open education. For this reason, the establishment of the e-Learning Development Unit as a learning organization is very important.

At the end of the last phases of the road map, the management of the e-learning practices that were parallel to each other and implemented in previous phases should belong to separate teams. The team which is specialized in this area will make the budget of the implementation, maintenance, control, benchmarking and investments for the service.

e-Learning Development and Production Infrastructure – The Infrastructure of IT Owned by Students

In an e-learning development unit, workstations, intranet servers and necessary software are used in the development process. Audio-video production studios are needed for further phases. In addition, web servers are needed in the web publishing phase.

The level of students' use of the e-learning services is related to whether students o-possess a computer or not, their availability of access to the Internet and the bandwidth of the Internet infrastructure provided by the country.

The IT infrastructure used in the development, publishing and access to the e-learning practices gets more complex and hard in each step compared to the previous steps. An evolutionary expansion is achieved by strengthening the infrastructure used in the previous phase for a new phase.

Phase	Development and Presentation Infrastructure	Software (Used at Anadolu University)	Access Infrastructure of Students	Software Necessary for Access
e-Exam	Desktop computer – small server– web application– at least 2 Mbps network connection	At the beginning (Apache - CGI – Visual Basic – Access), at the end (IIS - .NET – SQL Server) Web application	At least 64 Kbps Dial-up network connection	Web Browser (Text)

e-Facilitator	Desktop computer – small server– web application– at least 2 Mbps network connection	(IIS - .NET – SQL Server) Web application	At least 64 Kbps dialup network connection	Web Browser (Text)
e-Book	Desktop computer – small server– web application– at least 8 Mbps network connection	(IIS - .NET – SQL Server) Web application	At least 64 Kbps dialup network connection	Web Browser (PDF)
e-Television	Workstation – middle server – web application – at least 32 Mbps network connection	(IIS - .NET – SQL Server) Web application	At least 128 Kbps ADSL network connection	Web Browser (Media Player)
e-Audio Book	Workstation– middle server – web application – eat least 32 Mbps network connection	(IIS - .NET – SQL Server) Web application	At least 128 Kbps ADSL network connection	Web Browser (Media Player)
e-Practice	Workstation – big server – LMS – at least 100 Mbps network connection	(IIS - .NET – SQL Server) Web application	At least 256 Kbps ADSL network connection	Web Browser (Flash Player)
e-Course	Workstation – big server– LMS – at least 200Mps network connection	(IIS - .NET – SQL Server) Web application	At least 512 Kbps ADSL network connection	Web Browser (Flash Player)

Table 4. Development-Presentation Infrastructure and Student Access Infrastructure in Transition to e-Learning

In an open university like Anadolu University, 10.000 students simultaneously and 100.000 different students per day try to access the e-learning portal particularly before the examinations at the e-Practice phase. In order to establish an infrastructure that can meet such a high demand and to manage it effectively, know-how, organizational arrangements and continuous development become more important. For example, the e-learning servers at Anadolu University are installed out of the Information Processing Center and is monitored by a team specialized in this area, and a system which is 10 times bigger than the previous infrastructure was established in every three years.

Cost Projection

When the design, development and implementation costs of the e-Learning services are taken into consideration, the investments in the infrastructure refer to fixed cots, and copyright payments, staff and implementation expenses refer to variable costs.

Each phase that has been implemented can be considered as a separate continuous project. The cost of the first phase in the first period is one unit; but, the cost of the following periods will increase because of the factors such as increase in the number of courses to be developed, the number of students who can access to the services, and updating the previously developed courses. The Table 5 shows the cumulative total cost in one period if the cost increase one unit in a phase compared to the previous period in each period.

In each new phase, since the cost of previous stages cumulates as the number of courses increases, the cost of transition to e-learning will increase arithmetically. In the long term, a slowdown in the increase in costs can be seen when development of most of the courses is completed. Yet, implementation of new e-learning services as a result of updates on courses will eliminate this slowdown.

Phase	Copyrights	Personnel (In e-Learning Development Unit)	Personnel Outside the Unit	Infrastructure (Production and publishing)	Cumulative Total Cost
e-Exam	It is not necessary for the exam questions asked in the past. Copy right payments of new exam questions must be paid	1-10	Question writers, editors	Small	1
e-Facilitator	Facilitation fee must be paid.	1-10	Facilitators	Small	3
e-Book	The copyright costs of the books are zero since the copyright of the books belong to the university.	1-10	Book writers, editors, index operators	Medium	6
e-Television	The copyright costs of the television programs is zero since the copyright of the programs belong to the university.	10-50	Scenario writers, speakers, TV production team	Medium	10
e-Audio Book	Audio-visual development copyrights must be paid.	10-50	Vocalization staff, voice technician	Medium	15
e-Practice	CAI development copyrights must be paid.	50-100	Subject specialists, editors	Large	21
e-Course	CAI development copyrights must be paid.	50-100	Subject specialist, editors	Large	28

Table 5. Cost Projection in Transition to e-Learning

Protecting the copyrights of the instructional content developed in the e-Learning projects, approving the copyrights of the designers who were involved in the original productions, and paying them sufficient amount of copyrights have an effect on the motivation of the staff involved in the projects.

In each e-Learning phase, the development of a course takes more time than the previous steps. The main reason of this is that more complex development processes appear in the following phases. In addition, it is necessary to wait for the development of resource content such as course book and television program that is essential for the e-learning in order to begin the development of the e-learning content. Because of this restriction, the development of e-learning components of a course such as e-practice and

e-course can be begun at least one academic year later than the writing of the course book.

Phase	Development Process	Resource Content and Production Period	Development Period as e-Learning Content
e-Exam	Question entrance	Exam question / 3 weeks per course	1 day per course
e-Facilitation	Answering the questions		
e-Book	Transformation	Book text / 1month per unit	1 day per course
e-Television	Transformation	Television program / 1 week per unit	1 day per course
e-Audio Book	Transformation	Vocalization scenario / 1 week per unit	1 day per unit
e-Practice	Original product design	Instructional scenario / 1 week per unit	2 weeks per unit
e-Course	Original product design	Instructional scenario / 1 week per unit	3 weeks per unit

Table 6. Course Development Periods for e-Learning Phases

As the e-learning phases gets complex the time necessary for their development and implementation will get longer. The publishing of new services will become slower, but the target population will enlarge because the number of courses completed for each service item increases.

As the e-Learning content and services vary, the number of students using the system will increase. The increase in the number of students and their number of use will be in an arithmetic form because it will accumulate.

If the increase in the cost of transition to e-learning is slower than the increase in the number of students using the e-learning services and their number of use, the e-learning cost per student will decline.

The number of students using the e-learning services and their number of use must be increased to a certain extent so that what is mentioned above is achieved. For this reason, promotion is needed. Sending an e-learning brochure to every student, hanging e-learning posters to places where students go often and presenting the e-learning practices to students in television has lead to positive results. On the other hand, each of these activities is also a cost item.

The expectation must be that the e-learning content leads the students to reach their educational objectives. In order to achieve this aim, the quality of the production process of the e-learning content and services is necessary. Technical and instructional inspection must be done in the production process and the effect of the usage profiles on student success must be observed continuously during the practice process. In order to evaluate the students' feedbacks and meet their help demands in an appropriate time period during the practice process, an effective help desk must be established.

The inspection of the e-Learning system is necessary also for production planning. Investments in human resources, infrastructure, and research and development must be

made so as to meet the students' demands for e-learning. Investments must be made neither too early because it may cause the costs to increase due to idle investments, nor investments should be made too late because it may cause not to meet the demand. Web site using statistics must be evaluated continuously in order to observe the students' demands.

Case of Anadolu University

In Turkey, the central open higher education is executed by Anadolu University, which has a dual mode education system. Today, more than 1 million students are involved in the open education system, which began in 1982. There are important improvements in 2000's in the open education system, which was designed as a system which was based on book, television programs, central examination system and face to face academic facilitation components.

e-Learning materials in Anadolu University Open Education Faculty are developed in Computer Aided Instruction (CAI) Unit, which was established in 1989. The e-learning Project that was begun with the internet based trial exams in 1999-2000 academic year in the Computer Aided Instruction at Anadolu University Open Education system has been improved with the start of services such as design and distribution of multi-media cd-roms, opening of an Internet-based associate degree program, production and publishing of Internet-based practice software, distribution of course books, television programs and audio books via the Internet, and the start of a widespread Internet-based academic facilitation service. Those services that were developed at different times were combined under the Open Education e-Learning Portal in May 2005 (Aydın et. al., 2006). The Open education e-Learning portal was used 5.4 million times by 261.444 different students during the first six months of 2006 and it has become the largest e-learning practice of Turkey.

Transition to e-learning was established in 87 months in Anadolu University case without a roadmap. This period does not include the e-learning experience gained by Anadolu University since the beginning of 1990's. These periods are explained in Table 7 under the column "previous experiences".

Phase	Development Period	Date of Putting into Practice	Previous Experiences	Amount of Presentation	Usage Information (first six months of 2006)
e-Exam	6 months	1999/12	Academic studies in 1997-1998 about developing test software in the Internet environment	124 courses, 11216 questions	180.502 different students took 7.937.775 trial examinations
e-Practice	6 months	2003/3	Design applied for 1993-1999 LAN, 2000-2001 CD-ROM	50 courses, 738 units	120.421 different students studied 3.866.446 units
e-Book	3 months	2003/9	e-Book practices in 2000-2001 CD-ROM	2724 units for 211	116.321 different students read

			and 2003 e-Practice designs	courses	987.767 units
e-Television	3 months	2004/4	e-Television practices in 2000-2001 CD-ROM and 2003-2004 e-Practice designs	1196 programs for 163 courses	122.306 different students 1.023.665 units
e-Facilitator	3 months	2005/5	e-Facilitator practice in Information Management Program in 2001-2005	This service is for 50 courses	2937 questions were asked
e-Audio Book	3 months	2005/9	Audible screen video CD-ROMs in 2001-2005 Information Management Program	220 units for 12 courses	56.561 different students listened to 370.315 units.
e-Course	8 months	2006/12	e-Learning Project (Figure 1) developed for the Ford/Otosan project in 2006/1-2006/8 period	26 courses are under construction	Not available for publishing for the time being

Table 7. The Development of e-Learning Phases at Anadolu University

Figure 1. An e-Course Design Sample

The amount of presentation and usage information given in the table belongs to July 2006. For recent information that is published monthly, see http://www.bde.aof.edu.tr/BDE_K/bde_bultenler.aspx.

The order of e-Facilitator and e-Practice services has not occurred as suggested at Anadolu University. The reason for this difference is that Anadolu University has the necessary experience for the preparation of e-Practice for a long time whereas the financial method to be applied for e-Facilitator service has recently developed.

In transition to e-Learning at Anadolu University, not only experiences owned by the CBE unit but facilitations stemmed from the organizational structure has also affected the transformation of content into e-learning (Mutlu et.al., 2005).

Applicability of the Road Map

The source of the model is the e-learning experiences gained in the higher open education system of Turkey between 1999-2006. This road map can be applied in developing countries that have recently reached to similar socio-economic conditions without making so many adjustments. It will not be possible to apply the same road map in less developed or developed countries that do not have similar socio-economic conditions. In this case, new road maps should be prepared using the basic criteria, approaches and dynamics used in the preparation of the road map.

On the other hand, the suggested road map can be used in a time line by shifting. For example, the information technologies and the number students in the open education system of Bangladesh are quite similar to Turkey's case in 1999 (Islam & Selim, 2006). In this case, the road map can be easily applied in Open University of Bangladesh today.

The Comparison of Pilot Project Approach and Road Map Approach in Transition to e-Learning in Open Universities

There are important factors between the pilot Project approach and road map approach for transition to e-learning in Open Universities. These differences are compared in Table 8 according to some criteria.

Criteria	Pilot Project Approach	Road Map Approach
Dimension of the target population	Limited number of students is targeted because of limited number of courses.	The largest population is targeted because all the courses are developed in each phase.
Teaching Staff	Teaching staff other the ones involved in the pilot practice will not be affected by the practice.	All the teaching staff in the system will be involved in each phase and their experience will increase parallel to the phases.
Students	Students other than the ones involved in the pilot project will not be affected by the practice.	All the students will use the system in each phase and students' experiences will increase parallel to this.
Cost	Marginal utility of the money spent will be low.	Marginal utility of the money spent will be high. (The number of students benefiting from one unit of expense is high)
Technology	For practices of small size, it will	Establishment of a fully equipped

	be impossible to develop and sustain a fully equipped server environment and support system, and this will hinder the quality of the service provided.	server environment and support system will be necessary even in the initial phases, and for this reason, the quality of the service will reach to high levels.
Planning	It may not be possible to predict the behavior of whole population by looking at the data collected from small sample populations.	Planning for the future can be more reliable by collecting data from the whole population.
Standardization	Using different approaches in each of the pilot projects will be indispensable as time goes on. This will cause difficulties for students in using the services.	It will be possible to create standard designs because many productions for a course will be ready.

Table 8. The Comparison of Pilot Project Approach and Road Map Approach in Transition to e-Learning

Conclusion

In this study, a road map that open universities can use in transition to large scale e-learning was prepared taking the e-learning practices developed in 1999-2006 at Anadolu University, which is a mega university. The suggested road map requires the development of the e-learning services from simple to complex practices in an evolutionary manner and its implementation by involving larger populations in each phase. Factors such as costs, organizational structure, students' IT use characteristics, availability of the resource content that can be used in e-learning are the factors that determine the road map. The transition to e-learning road map can be adapted by universities in different countries and having different resources. It was found that using a road map for transition to e-learning in open universities has significant superiorities to pilot project approach.

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