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Contribution of Leonardo Projects to Education in Technical Fields

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Abstract

Since its beginning from 1995, Leonardo da Vinci programme has been significantly contributing to engineering and vocational education. This paper comprises of four Leonardo projects which authors involved between 2006 and 2012 in different technical fields with primarily engineering applications. The common feature of these projects is the use of e-learning platforms that integrate the functions of systems such as LMS (Learning Management System) and LCMS (Learning Content Management System). The project products were produced by international partnerships, and hence satisfied the needs of target groups in many European countries. The WASTE-TRAIN and PROWAT project's training materials were designed as blended learning. ACES project's training materials were designed only for e-learning. PM4WAT project's training materials are primarily designed for e-learning. However, the simulator training in PM4WAT was performed with face to face concept. As part of each project a pilot testing were performed in order to get an evaluation and feedback of the user groups and experts about the training materials and the training approach. The responses of Turkish participants were presented and discussed here. The results showed that participants are interested in especially about blended learning approach.

Key Words: *Leonardo da Vinci Projects, WASTE-TRAIN, PROWAT, ACES, PM4WAT*

Leonardo Projelerinin Teknik Alanlardaki Eğitime Katkısı

Özet

1995 yılındaki başlangıcından beri Leonardo da Vinci programı mühendislik ve mesleki eğitime önemli katkılarda bulunmuştur. Bu çalışma yazarların 2006 ve 2012 yılları arasında yer aldıkları ağırlıklı olarak mühendislik uygulamalarını içeren farklı teknik alanlardaki dört Leonardo projesini kapsar. Projelerin ortak özelliği, Öğrenme Yönetim Sistemi ve Öğrenme İçeriği Yönetim Sistemi gibi sistemler ile e-öğrenme platformlarının beraber kullanımıdır. Proje ürünleri uluslararası ortaklıkla üretilmiş ve dolayısıyla çoğu Avrupa ülkesindeki hedef kitlenin ihtiyaçlarını karşılamıştır. WASTE-TRAIN ve PROWAT projelerinin eğitim malzemeleri karma eğitime uygun olarak tasarlanmıştır. ACES projesinin eğitim malzemeleri ise yalnızca uzaktan eğitime uygun olarak tasarlanmıştır. PM4WAT projesinin eğitim malzemeleri ise ağırlıklı olarak uzaktan eğitime uygundur. Ancak simülatör eğitimi yüz yüze konseptine uygun olarak tasarlanmıştır. Her bir projenin bir parçası olarak, kullanıcı grupları ve uzmanlardan eğitim malzemeleri ve eğitim yöntemi hakkında değerlendirme ve geri bildirim almak üzere deneme eğitimi yapılmıştır. Burada Türk katılımcıların cevapları sunulmuş ve tartışılmıştır. Sonuçlar, katılımcıların özellikle karma eğitim yaklaşımına daha ilgili olduklarını göstermektedir.

Anahtar Sözcükler: *Leonardo da Vinci Projeleri, WASTE-TRAIN, PROWAT, ACES, PM4WAT*

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Introduction

This study presents the results of four different EU projects completed between 2006 and 2012. The projects were related to production of educational materials on topics which are not typically covered by formal engineering and vocational education. The project acronyms and titles are as follows: i) WASTE-TRAIN: Vocational Training, Education, Conveying Information on up-to-date Waste Management Practices to Decision Makers/ Staff involved in Waste Management, ii) PROWAT: Planning and Implementing a Non-Revenue Water Reduction Strategy Improves the Performance of Water Supply and Distribution Systems, iii) ACES: Archaeology and Construction Engineering Skills, iv) PM4WAT: Preventive Maintenance for Water Utility Networks.

The materials were prepared in formats compatible with e-learning or blended learning. WASTE-TRAIN, PROWAT and PM4WAT projects utilized Moodle whereas ACES used Edumatic as e-learning platform. As part of each project a pilot testing were performed in order to get an evaluation and feedback of the user groups and experts about the training materials and the training approach. For this purpose, questionnaires were prepared and given to the participants after the testing. The response of the participants were provided and evaluated herein.

The projects fell under the category of pilot projects and multilateral projects, respectively in the second and third phase of Leonardo Programme. The Leonardo da Vinci programme, one of EU programs, funds a wide range of actions, notably cross-border mobility initiatives; co-operation projects to develop and spread innovation; and thematic networks. The potential beneficiaries are similarly wide – from trainees in initial vocational training, to people already in the labour market, as well as VET professionals and private or public organizations active in this field. Leonardo da Vinci enables VET organizations to work with European partners, exchange best practices, increasing the expertise of their staff and respond to the teaching and learning needs of people. It therefore supports efforts to make vocational education more attractive to young people. By helping European citizens to acquire new skills, knowledge and qualifications, the programme also aims to foster the competitiveness of the European labour market (European Commission, 2012).

The aim of the pilot training testings performed in the WASTE-TRAIN, PROWAT, ACES, PM4WAT projects were to get opinion and feedback of user groups and experts in Turkey about the training material prepared as part of the projects. The results of the testings were intended for use to improve the training materials and finalize them before the end of the projects. Also these testings gave useful information differences between various distance learning methods.

In the first part of the paper, the Leonardo da Vinci programme is introduced. After that, the information about the four projects and their pilot testing results are given. Then, the experience of authors about the contribution of these projects to formal and informal education is discussed.

Leonardo da Vinci Programmes

The first Leonardo Programme ran from 1995 to 1999 with a budget of 620 million ECU and was open to the 15 Member States at the time (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom) as well as the three states of the European Economic Space (Norway, Lichtenstein and Iceland), and progressively to Greek Cyprus, the Czech Republic, Estonia, Hungary, Lithuania, Latvia, Romania, Poland and the Slovak Republic.

Drawing on experience from the first phase, the second Leonardo da Vinci Programme ran from 2000 to 2006 with a budget of 1.9 billion Euros. It focused on the EU Commission's overall aim to create a "Europe of knowledge". The programme was open to 31 participating countries: Austria, Belgium, Bulgaria, Greek Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lichtenstein, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Turkey and the United Kingdom. The following types of actions were carried out under the

programme (Aa et al., 2008): mobility projects; pilot projects; language competences projects; transnational networks; reference material. WASTE-TRAIN and PROWAT projects fell in the pilot projects group. Pilot projects action provide support for transnational pilot projects to develop and transfer innovation and quality in vocational training, including actions aiming at the use of information and communication technologies (ICT) in vocational training.

Within the third Leonardo program covering the period from 2007 to 2013, the following actions are available (http://ec.europa.eu/education/leonardo-da-vinci, 2012): mobility; partnerships; multilateral projects. ACES and PM4WAT projects fell in the multilateral projects group. Multilateral projects group consists of larger-scale actions, with organizations from different countries working together to develop working practices in the vocational education and training sector:

- „Development of innovation" projects improve training systems by producing innovative approaches to vocational education and training such as teaching materials, courses and methodologies;
- „Transfer of innovation" projects help to spread the most promising new developments;
- Thematic networks work on priority areas;
- Accompanying measures promote the results of other projects funded by the programme.

Since it was created in 1995, the Leonardo da Vinci programme has enabled 860000 people to travel abroad for training or work experience, for professionals to gain new skills and develop VET tools, methods and systems (European Union, 2012). As a result of Europe-wide cooperation in this area, a number of initiatives have been developed to support the recognition of training and qualifications that improve people's ability to move around to train, study and work. These include:

- The European Qualifications Framework (EQF), which enables students to use a qualification gained in one country when they move to another country to work or study;
- The Europass – five documents to make skills and qualifications clearly and easily understood in Europe: Curriculum Vitae, Language Passport, Europass Mobility, Certificate Supplement and Diploma Supplement;
- The European Credit system for Vocational Education and Training (ECVET), which allows students to have learning outcomes acquired in one country recognized in another country;
- The European Quality Assurance in Vocational Education and Training (EQAVET) system, which provides a consistent approach to monitoring and improving the quality of vocational training.

Methodology

The four Leonardo projects and the pilot testings performed for each project are given below.

WASTE-TRAIN Project

Solid waste management is very important issue for people and institutions all over the world related to solid waste. The WASTE-TRAIN, with its full name as "Vocational Training, Education, Conveying Information on up-to-date Waste Management Practices to Decision Makers/Staff involved in Waste Management", project was a Pilot Project and developed specific training tools in the field of Modern Solid Waste Management which was based upon the new main principles of European Environmental Policy and European Waste Management Policy. It is a known fact that, solid waste management is a problem all over the world as decision makers working at strategic levels and executives/staff having to deal with wastes in their every-day life cannot get enough information and training about what they have to do. So this program was designed for the target group: i) The decision makers at the strategic levels, and ii)

Executives and staff having to deal with solid wastes in their every-day life, who are working in municipalities and public/governmental organizations.

Twelve institutions from 8 European countries were partners of the Project (Ağdağ et al., 2007). The project web site can be reached from http://www.waste-train.com/. As a project tool, an overview on the status of waste management in the 9 countries (including one silent partner) presented in national reports of the project. It helped the participants of countries with conditions considerably differing in respect to the subject (waste management) to put their countries in relation to each other – in order to learn about what some of them have in common, and where differences can be found. Thus transfer of information and knowledge in what-so-ever form as the project´s final product can be tailored according to a single country´s actual demand of knowledge.

The project ended with an international conference in Ankara (e.g. Toprak et al., 2008a). The products of the project were a book (Steiner and Wiegel, 2008) and training course. Book entitled "Book of Rubbish" is a comprehensive handbook on all aspects of waste. It holds brief information concerning kinds and origin of waste, hazards of inadequate handling, collection systems, treatment options, regulatory and legal frameworks, and waste management concepts. 140 plentiful illustrated pages come in eight languages: English, Spanish, Turkish, Polish, Italian, Greek, Slovenian, and German. The course is an online system for non-formal learning in waste management exploiting blended learning methods and social interaction among participants in multiple languages. Multilingual training courses in the field of waste management were organized in an e-learning tool and designed for heterogeneous target groups, who have to deal with solid wastes in their every-day life. The Moodle (Modular Object-Oriented Dynamic Learning Environment) platform had been adopted as a flexible environment to organize the didactic resources and supporting appropriate learning activities for the different target users. The training gave the opportunity to update some basic skills and also provided learning opportunities for professional development through continuous discussions with other practitioners in the same sector. This non-formal learning activity helped to improve the quality of the services provided to the customers. The structure of the course was based on a modular concept, meaning that the section and units of the course can be used independently, according to the participants' needs and wishes. This training was considered as a forerunner to training in the field as it combines technical knowledge with social interaction and learning.

Pilot Testing of WASTE-TRAIN Project

The testing group consisted of 16 participants from environmental engineers from the Environmental Office of the Denizli Municipality, undergraduate and graduate students of Civil Engineering Department of Pamukkale University, academic teachers from Civil Engineering and Environmental Engineering Departments of Pamukkale University. Female and male participant numbers were 3 and 13, respectively. 6 of them were below 25 years old, 6 of them between the 25 and 35 years old, 4 of them were older than 35 years. 7 of them were students, 7 of them were executive staff/ super visor/ manager and 2 of them were municipal engineers.

The testing included a face to face section followed by the e-learning section. The face to face section had general presentations about: i) Waste-train project, PPT file, ii) the Basic Trash Book, with some information about other languages and DVD, which was attached to each book, PPT file, iii) the http://corsi.elearninglab.org/ website and information about how to login, iv) the blended learning system of education, and v) the MOODLE system and chapter 7 – intro, PDF files along with the courses in other languages. A few weeks were given to participants to complete the e-learning section. After the testing, the questionnaires were distributed to participants.

PROWAT Project

In recent years there has been a growing realization that the increasing demands for water throughout the world are not

sustainable. As a result of increased understanding of the problem there has been a move away from the traditional approach of just increasing supply, through developing new resources and transfer schemes, to demand management. Demand management focuses on the more efficient use of water, reducing losses, less wasteful use of water, more efficient appliances and water recycling. In many cases it is cheaper and more effective to improve water use efficiency than it is to increase water supplies (Pilcher et al., 2009). On the supply side, water losses or Non-Revenue Water (NRW) from the distribution system are estimated to amount to an average of around 30 to 40% water introduced into the networks (e.g., 45% in Turkey). In some of the former eastern European countries it is not uncommon to find water loss exceeding 50% of the total amount of water put into the system. As Liemberger (2003) pointed out many public water utilities suffer from high levels of Non-Revenue Water (NRW).

In colleges and universities engineering students mostly learn how to design new systems but not to manage and improve existing ones. There is a lack of knowledge in the field of NRW and this gap was expected to be filled by PROWAT Project. This expectation was to be fulfilled by applying and transferring the new methods and techniques of the Water-World to the users via modern training approaches. Hence, the products of the project contributed to decrease the loss-of-water in water distribution systems (Toprak et al., 2007; 2008b). With these aims, a vocational education and training (VET) project under Leonardo da Vinci programme with 10 partner institutions from Turkey, Greece, Italy, Finland, the Netherlands and Belgium started in February 2007. The multinational partnership included private companies from industry, universities and training organizations. The project is entitled "Planning and Implementing a Non-Revenue Water Reduction Strategy Improves the Performance of Water Supply and Distribution Systems" and its acronym is PROWAT. The web address for the project is http://www.pro-wat.com. The project duration was two years. The title of this project is also a slogan of the modern water-world where "Non-Revenue Water" is the difference between the volume of water put into a system and the volume of water paid by the customers.

The objective of the PROWAT project was to provide engineers and technicians with the skills that are necessary for the implementation of international best practice on all aspects of water loss reduction and control. Central in the course is the participant which is an active learner who builds knowledge through social interaction with others (students and trainer) within a context driven by own motivation. The courses can be delivered with a mixture of face to face learning (in the class room or distant learning, online via the internet). This is commonly known as blended learning (e.g., Bonk and Graham, 2006). The composition of which depends on the training provider. PROWAT training materials are presented in a Moodle environment which is one of the commonly used platforms for distance learning. The web site of the project and course is: http://www.pro-wat.com/moodle/.

The training materials were presented in 6 languages using Moodle platform. The training languages are: English, Finnish, Greek, French, Italian and Turkish. Each partner institution assigned one person as a teacher of the course and their names can also be seen in the initial page of the training. They have the authorization to change the content and design of the courses by using Moodle features. The trainees can choose the language of the training and are directed to appropriate page.

The structure of the course was based on a modular concept, meaning that the section and units of the course can be used independently, according to the participant's needs and wishes. This training course is created primarily in Modules as follows:

- Introduction
- Module A - A basic guide to the assessment, reduction and control of losses from water distribution systems
- Module B - Introduction to the technical issues of water loss
- Module C - Water and water distribution systems
- Module D - Assessing water loss

and the application of performance indicators
- Module E - Developing and implementing a water loss reduction strategy and introduction to the economics of leakage
- Module F - Requirements for ensuring the sustainability of water loss reduction programmes
- Module G - Key components of leakage reduction, control and pipe maintenance, rehabilitation and replacement
- Module H - Key components of apparent or commercial losses
- Module I - Demand management and water efficiency plans
- Module J - Case Studies
- Poseidon Water Balance Software - Example Calculations
- Glossary of terms
- Final Assessment
- Links and resources

As a supplementary tool, an online software tool was developed in the project to design and assess water loss reduction strategies. The tool is named POSEIDON which stands for "Professional PROWAT Performance of On-Line Instrument on How to Manage Water Losses of Networks".

Pilot Testing of PROWAT Project

25 participants joined the pilot training testing in Turkey. The background, status and experience of participants cover a wide spectrum from managerial staff of water utilities, engineers and technicians to academicians and students from universities. Their gender and age distribution is as follows: 6 participants female and 19 participants male; 17 participants below 25 years age, 7 participants between 25 and 35 years, 1 person above 35 years.

The evaluation of the participants was collected through a questionnaire at the end of the pilot testing phase. There were a total of 30 questions in the questionnaire, 17 of which are quintet Likert type, 7 were yes-no, 4 were open-ended and 2 were multiple choice. For all quintet Likert type questions, 1 corresponds to the answer of "disagree" and 5 is "agree". There are two other questions regarding age and gender.

ACES Project

The main aims of this project which is entitled "Archaeology and Construction Engineering Skills (ACES)" are to deepen and broaden professional understandings between two professional sectors – construction engineers and archaeologists (Toprak et al., 2010). While there are large amounts of standards, guidance and reports available, these are disparate, difficult to access and do not offer an overview aimed at improving best practice within the construction and archaeology industries. ACES project addressed this gap, from both the engineering and archaeological perspectives, and the development and delivery of training based upon that guidance- ensured that practitioners' skills could be updated. Throughout, the project was enhancing the employability of archaeologists and engineers by setting learning in the context of work, linking the application of theory to practice.

The specific aims of the ACES project were to:

- identify interdependent skills requirements between construction engineers and archaeologists,
- review current best practice for archaeologists and engineers in each partner state,
- identify relevant occupational standards,
- prepare best practice guidance material for engineers and archaeologists in all four partner states,
- design training materials,
- design e-learning delivery mechanisms,
- elaborate guidelines necessary for appropriate conversion of traditional training material into e-learning modules,
- testing of the e-learning material and mechanisms.

Main goal for the project was to recognize logistic and legal procedures relevant to the archeological findings at construction sites in Partners countries (United Kingdom, Norway, Poland, Turkey) and preparation of the e-learning education systems for: i) Archeologist who run the field research, courses in the area of basic construction

technologies (mostly earthworks), and ii) Construction engineers, potential "explorers" of archeological "treasures", courses in the area of protection of national heritage.

The course is conducted in an assisted distance training mode (http://www.aces-project.eu/). It means all training materials are provided online and the training process is supervised by a teacher. The training process is composed of a lecture and discussion forum. All distance learning activities in the training was provided on the e-learning platform available at www.aces-project.eu. The e-learning platform refers to learning management system Edumatic available at the address above (Fig. 1). Training materials were provided in the following way: i) as multimedia and interactive e-learning courses available in the Edumatic system in e-learning platform trainings for each part of the training, ii) as pdf documents available in auxiliary documents space "teacher's documents" in the Edumatic system in e-learning platform trainings.

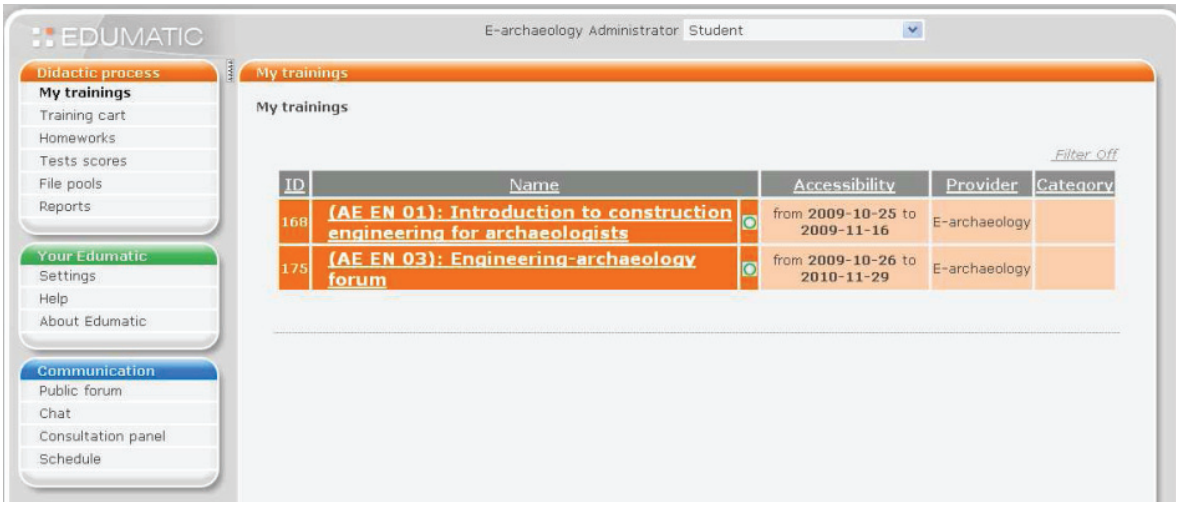


Figure 1. Training materials in the Edumatic system

Pilot Testing of ACES Project

Two different testing groups were used for the evaluation of e-learning materials. The archaeological training materials were tested by engineering participants (19 participants) and civil engineering training materials were tested by archaeological participants (4 participants). The trainings were entitled, respectively as "introduction to archaeology for construction engineers" and "introduction to engineering for archaeologists".

The trainee needed be equipped with the following elements to participate at the training: Computer with internet connection; Web browser: Internet Explorer (version 6.0, or higher) / Mozilla Firefox (version 2.0 or higher) with Adobe flash player plug-in (version 8.0 or higher); Personal e-mail account (recommended); Word processor (MS Word / OpenOffice); PDF documents reader i.e. Acrobat Reader.

The training was composed of the asynchronous distance. This comprised individual work of the trainee with multimedia and interactive e-learning course. It was supplemented by asynchronous distance conversation, which was a collective work of trainees at the discussion forum. E-learning courses for asynchronous distance lectures were provided through e-learning platform, Edumatic system". Asynchronous distance conversation i.e. collective participation in the discussion forum was held on three the "Engineering-archaeology forums". A successful completion of the training involved: Study of e-learning course including the exercises and preparation of at least two entries into the discussion on the "Engineering-archaeology forum" positively evaluated by the teacher.

PM4WAT Project

Preventive Maintenance for Water Utility Networks (PM4WAT) is a European Project which develops an innovative web-based platform and courseware for Vocational Education and Training (VET) on state of the art practice on preventive maintenance of urban water utility networks. The project aimed at improved maintenance, increased reliability and decreased disruption of service. The proposed training programme involved: (a) a theoretical part, which included web-based courseware that covers the principles of preventive maintenance for water utilities including the benefits, the limitations and the organizational aspects, and (b) a practical part, which involved a system that integrates a Geographical Information System, Reliability Analysis and Database Queries to compute how ageing and natural hazards affect the reliability of a network under different environmental conditions. The system offers the trainee suggestions on the best way to rehabilitate the network under study. Among the objectives of the above VET Multilateral Project were: (a) to transfer state of the art preventive maintenance methodologies to personnel of urban water utility networks from domain experts from the participating countries, (b) to develop a simulation platform that advises the trainee on the reliability of the overall network and examines various 'what-if' scenarios, and (c) to develop courseware for web-based as well as off-line training on preventive maintenance of urban utility networks which can be tailored to urban networks from all participating countries (Greece, Italy, Cyprus, Turkey). PM4WAT is a project for the Development of Innovation, convened in the framework of Lifelong Learning Programme Leonardo da Vinci of the Education, Audiovisual and Culture Executive Agency of the European Commission (Tsakiris et al., 2011; Toprak et al., 2011). The project web site is http://www.teg.cti.gr/pm4wat/index.php?lang=en.

Pilot Testing of PM4WAT Project

According to discussion carried out with the project partners before the start of the pilot testing, the number of about 10-15 trainees were found to be appropriate for the purposes of this project. 14 trainees took the testing of Turkish training material. 3 participants were graduate students at Pamukkale University; 11 participants were employees of Denizli Municipality. The following procedure was used for the testing:

1. A two hours face to face training about the project, its objectives and how to use the web site for the training were conducted. Passwords were sent to trainees' e-mails.
2. The participants were given about a month to complete the pilot training.
3. Another two hours of face to face training were provided on the simulator.
4. The participants were given about two weeks to complete the simulation studies.
5. The participants were asked to complete the questionnaires.

Findings

The data obtained from the participants of pilot projects for four projects and their evaluations are presented in this section. Tables 1, 2, 3, and 4 present the response of the participants about the pilot testing of the WASTE-TRAIN Project.

Table 1.Questions about the online aspects of the course

Question	Options	Percent (%)
Dynamics and Access		
What is the optimal frequency of access necessary for success in the course?	*once per term*	6
	once per month	13
	once per week	38
	2-3 times a week	43
	daily	0
Assessment		
How much of the assessment is done online?	*little*	0
	almost half of it	6
	more than half of it	19
	most of it	62
	all of it	13
How do you estimate the available methods of the assessment as a support for your learning process?	*excellent*	6
	well	44
	satisfactory	50
	deficient	0
	insufficient	0
Communication		
How much of the communication happens online?	*little*	6
	almost half of it	6
	more than half of it	13
	most of it	62
	all of it	13
How much the possibilities of the communication lead to the desired aim?	*little*	0
	almost half of it	31
	more than half of it	19
	most of it	37
	all of it	13

Table 2. Questions about the content, richness and independence of the training materials

Question	Options	Mean / Percent
(Likert scale is between Low 1 and High 5 and their means were calculated).		
Content		
How much of the course content is available online?	Each chapter of a book	3.75
	Course information,	3.69
	Course administration,	3.75
	Lecture notes,	3.81
	Study objectives.	3.56
The course met my needs / expectations of (continuous) training	Yes	25%
	No	13%
	Yes, with some remarks	62%
The content of the courses is easy to understand and useful.	Yes	56%
	No	0%
	Yes, with some remarks	44%
Did you get the support that you needed?	Yes	56%
	No	0%
	Yes, with some remarks	44%
Richness		
How do you assess the usefulness of the chosen courses elements:	a computer system,	4.13
	graphical layout of the information,	3.56
	java applets	3.44
	slide presentations	3.38
	video clips, sound clips in effect, more than text communication,	3.06
Independence		
How independent is success in the course from face-to-face contact?	Fully Contact lecturer and tutorial driven, website an add-on	6%
	Contact lectures but web-based tutorials or assessment	43%
	Limited regular contact	38%
	Sporadic contact	13%
	No face-to-face contact	0%

Table 3. Questions about the Handling/Layout

Question	Mean
(Likert scale is between Strongly agree: 5, Agree: 4, Neutral: 3, Disagree: 2, Strongly disagree: 1 and the mean values were calculated)	
Adequacy Layout of the course as a whole	3.49
Easiness of the navigation	4.00
Visualization (application and quality)	3.39
All the information on the courses is sufficient, relevant and useful.	3.56
Sources and materials are clearly identified	3.56
Course facilitators / tutors provided enough support and feedback	4.26
The quizzes and assessments were relevant to the objectives of the courses	4.12

As shown in Table 4, three quintet likert type questions about the learning platform and methodology were directed to participants.

Table 4. General questions about learning

Question	Mean
(Likert scale for the first two questions as Excellent: 5, Well: 4, Satisfactory: 3, Deficient: 2, Insufficient: 1; and for the last question as Strongly agree: 5, Agree: 4, Neutral: 3, Disagree: 2, Strongly disagree: 1; and the mean values were calculated)	
How do you appraise your success of learning by the offer of e-training	3.19
How do you appraise the relation of spending time and achieving of learning results? (efficiency of learning)	3.24
I am willing to join such kind of blended learning courses in the future	3.93

Table 5 shows the questions and response results for the relevant questions of the PROWAT project pilot testing for this paper.

Table 5. Results of the some selected questions from the PROWAT project pilot training

Question	Options	Mean/Percent%
Background Information		
Have you taken computer-based or Web-based training courses before?	Yes	52%
	No	48%
Are you familiar with blended learning approach?	Yes, I have experience	19%
	Yes, only at knowledge level	50%
	No	31%
Did you use MOODLE before?	Yes	12%
	No	88%
Is the content of the PROWAT Moodle manual sufficient and useful?	Yes	79%
	No	0%
	Partly	21%
If you have taken computer-based or Web-based training courses before, how does this course compare?	1. Worst 5. Best	4.0
Learning Objectives		
The objectives of the course were stated clearly.	1. Disagree 5. Agree	4.44
The objectives of the course are relevant to my job	1. Disagree 5. Agree	4.40
Design		
Is the content of the programme/module clearly structured?	Yes	96%
	No	4%
Content		
Do you find the number and quality of exercises related to each module satisfactory?	Yes	74%
	No	26%
General		
I am willing to join such kind of blended learning courses in the future.	1. Disagree 5. Agree	4.84

Tables 6 and 7 show the responses for the selected questions of the pilot training of the ACES project.

Table 6. Results of the archaeologist's questionnaire

Question	Options	Percent (%)
Does the module user friendly?	Yes	100
	No	0
Does the module served in a logical order?	Yes	100
	No	0
Did you find the quizzes useful? Were they related to the topic?	Yes	75
	No	25
Does the module give you useful information?	Yes	100
	No	0
Does the level of information fit to you?	Yes	25
	No	75

Table 7. Results of the civil engineer's questionnaire

Question	Options	Percent (%)
Does the module user friendly?	Yes	100
	No	0
Does the module served in a logical order?	Yes	100
	No	0
Did you find the quizzes useful? Were they related to the topic?	Yes	100
	No	0
Does the module give you useful information?	Yes	100
	No	0
Does the level of information fit to you?	Yes	90
	No	10

In the PM4WAT project's pilot testing, background and experience of the trainees were examined with 10 questions and the results of the selected 4 questions are given in Table 8. Opinions of the trainees about the training course were investigated with 8 questions and result of the question about overall course is given in Table 9. Trainees were also evaluated the course pedagogically. 3 questions were asked to them and the results of these questions are given in the Table 10.

Table 8. Background and experience

Question	Options	Percent (%)
If you are already involved in water network maintenance, what is your function?	management	73
	maintenance engineer	18
	maintenance technician	9
Have you ever participated in a water network maintenance training program?	never	49
	once	13
	more than once	38
Have you previously been aware of Preventive Maintenance?	Yes	29
	No	47
	No answer	24
Have you previously received training through an e-learning system?	never	70
	once	12
	many times	18

Table 9. Training course evaluation

Question *(Likert scale is as not at all: 1, not much: 2, somewhat: 3, quite a lot: 4, very much: 5, and their means were calculated).*		Mean
Rate the overall course	Straightforward	4.1
	Complete	3.8
	Adequate	4.0
	Interesting	3.9

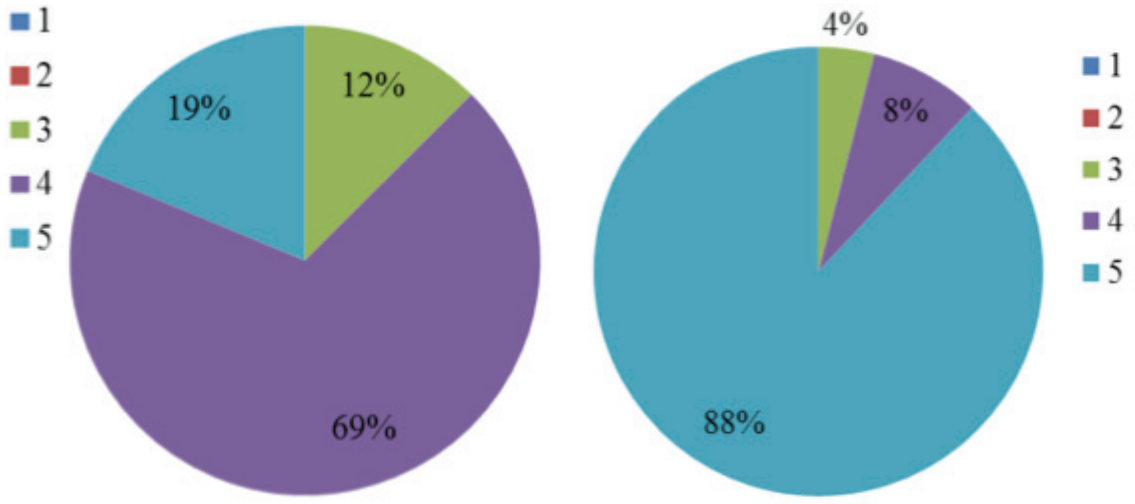
Table 10. Pedagogical aspects

Question *(Likert scale is as not at all: 1, not much: 2, somewhat: 3, quite a lot: 4, very much: 5, and their means were calculated).*	Options	Mean
To what extent was the courseware appropriate for this type of training?	not at all	3.63
To what extent is e-learning appropriate for training on preventive maintenance for water networks?	not at all	3.64
To what extent is traditional teaching methods (e.g. with the presence of a trainer) more appropriate for training on preventive maintenance for water networks?	not at all	4.01

Discussion and Conclusions

The Leonardo projects described herein provided invaluable opportunity to produce and assess training materials on topics not covered by formal education at universities and technical schools. The four projects covered different technical fields with extensive applications. The project products were produced by international partnerships. Hence, they satisfied the needs of target groups in many European countries. The WASTE-TRAIN and PROWAT project's training materials were designed as blended learning. ACES project's training materials were designed for e-learning. PM4WAT project's training materials are primarily designed for e-learning. However, the simulator training was performed with face to face concept. Although the projects were international and testings were performed at each partner country only the response of Turkish participants were presented and discussed here. A particular interest was the response of participants to learning approach. Also not all of the items in the questionnaires were presented and discussed here because of the space limitations.

A substantial majority of participants in WASTE-TRAIN and PROWAT pilot testings appreciated blended learning concept. Respectively about 88 % and 96 % of the participants of WASTE-TRAIN and PROWAT project expressed interest in future blended learning courses. However, 88 % of participants responded with strongest approval (5 in quintet likert type question) in PROWAT project whereas 69 % responded with less strong approval (4 in quintet likert type question) in WASTE-TRAIN project (Fig. 2). As can be seen in Tables 1-5, responses to PROWAT project are generally more positive than the ones to WASTE-TRAIN project. This may be partly related to the experience and composition of project partners in each project. WASTE-TRAIN was one of the first Leonardo projects in Turkey as well as the first one of the authors of this paper. In both projects, the coordinator of the project was a Turkish organization. Also there were more Leonardo experienced partners in the PROWAT project.



o WASTE-TRAIN project

o PROWAT project

Figure 2. Response of participants to "I am willing to join such kind of blended learning courses in the future" question graded with Likert Scale as Disagree: 1 and Agree: 5

For the ACES project, the questionnaires were related to modules and quality of the products. As can be seen in Tables 6 and 7, there were no questions about the preference of e-learning or blended learning. As mentioned before, Edumatic was used for e-learning in ACES project. Edumatic is an e-learning platform that integrates the functions of systems such as LMS (Learning Management System) and LCMS (Learning Content Management System). Edumatic aims to aid the management of online teaching processes, particularly in projects, which depend on the support of teachers and on the use self-taught models of education. This has been achieved via advanced mechanisms of gathering, processing and publishing materials saved as e-learning courses in the SCORM standard. Edumatic is one of the only systems in Poland, which offers not only the SCORM standard, but also its' new version – SCORM 2004. This enables many innovative possibilities, such as individualizing the teaching process - that is adapting it to the personal progress level of each learner. The functions of the LCMS system allow Edumatic to be a system, which can enhance the management of e-learning courses and learning objects (http://www.eduserwis.pl/en). According to the responses, both groups agreed fully that the training modules were user friendly and organized in a logical order. Also both groups stated that the module gave them useful information. Engineering and archaeologist groups found the quizzes useful and related to the topic with 100 (%) and 75 (%) approval, respectively. The main difference between the two groups was for the last question (Does the level of information fit to you): Archaeology group found the engineering information a bit more technical and strange to them.

Regarding PM4WAT project, it was found out that almost three quarters of participants did not participate in any e-learning course before (Table 8). This shows most probably the current situation in water sector in Turkey. Interestingly, about 64 % of participants graded this type of learning positively as they marked 4 and 5 in quintet likert type question (Table 10). However, they also stated strongly that traditional teaching methods (e.g., face to face) is appropriate for some parts of the training. In other words, by approving both options, participants were pointing the need for blended learning approach. This is expected because application in the field with examples is expected most of the time in water sector trainings. The participants rated the overall course about 4 on a quintet likert scale which showed above average satisfaction.

Leonardo projects presented and discussed here produced several useful products for target groups such as books, training materials, simulators, etc. They also used the most recent technologies for learning purposes. Although the significant number of participants met with the technologies and approaches used in these projects the first time they appreciated the quality of the products and methodology. In this sense, the products of the project illustrated the future of the training. Blended learning system was graded positively in most of the cases. One major advantage of Leonardo projects is to bring expertise from the several countries together in a response to the need of target groups (e.g., students and professionals) in many countries. Hence the products are crucially useful nationally and internationally.

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Giriş

Bu çalışma 2006 ve 2012 yılları arasında tamamlanmış olan dört farklı Avrupa Birliği projesinin (WASTE-TRAIN, PROWAT, ACES, PM4WAT) sonuçlarını sunmaktadır. Projeler alışılmış resmi mühendislik ve mesleki eğitimde bulunmayan konular hakkında eğitim malzemeleri hazırlamakla ilgilidir. Eğitim malzemeleri uzaktan öğrenime veya karma öğrenime uygun olarak tasarlanmıştır. WASTE-TRAIN, PROWAT ve PM4WAT projelerinde uzaktan eğitim platformu olarak Moodle, ACES projesinde ise Edumatic kullanılmıştır. Her bir projenin bir parçası olarak, kullanıcı grupları ve uzmanlardan eğitim malzemeleri ve eğitim yöntemi hakkında değerlendirme ve geri bildirim almak üzere deneme eğitimi yapılmıştır. Bu amaçla katılımcılara eğitimden sonra cevaplamak üzere anketler hazırlanmıştır.

Yöntem

Katı atık yönetimi bu konuyla ilgili kişi ve kurumlar için önemli bir konudur. WASTE-TRAIN projesi, Avrupa Çevre Politikası ve Avrupa Atık Yönetimi Politikalarının temel prensipleri doğrultusunda geliştirilmiş özel eğitim araçlarını içerir. Projede 8 Avrupa ülkesinden toplam 12 kuruluş yer almıştır. Test gurubunda farklı kuruluşlardan gelen 16 katılımcı yer almaktadır. Katılımcılara uzaktan eğitim bölümünü tamamlamaları için birkaç hafta verilmiş ve sonrasında anket uygulanmıştır.

Son yıllarda su kaynaklarının artan ihtiyacı karşılamaması nedeniyle kaynak artımından ziyade mevcut kaynakların verimli kullanımı yani su kayıplarının azaltılması ön plana çıkmıştır. Türkiye'de ortalama kayıp %45'tir. Üniversitelerde mühendislik öğrencilerine yeni sistemleri nasıl tasarımlandıracakları öğretilmekte ancak, mevcut sistemlerin nasıl geliştirileceği öğretilmemektedir. Bu eksikliğin PROWAT projesi ile doldurulması amaçlanmıştır. Türkiye'deki eğitime farklı alanlardan 25 kişi katılmıştır. Eğitimin sonunda katılımcılara 17'si 5'li Likert türünde, 7'si evet-hayır, 4 tanesi açık uçlu ve 2 tanesi çoktan seçmeli olmak üzere 30 sorudan oluşan bir anket uygulanmıştır. ACES projesinin amacı uygulamada birbiriyle çatışan iki meslek grubu olan arkeologlar ve inşaat mühendislerinin birbirini anlamalarını sağlamaktır. Her iki meslek grubunun perspektifinden uygulamacıların becerilerini arttırmak amacıyla eğitim malzemeleri hazırlanmıştır. Toplam 19 mühendis katılımcıya arkeoloji eğitim malzemeleri ve 4 arkeolog katılımcıya mühendislik eğitim malzemeleri uzaktan eğitim yöntemi ile iletilmiştir.

PM4WAT projesi su dağıtım sistemlerinin bakımını geliştirerek güvenilirliğini arttırmayı ve arızaların azaltılmasını amaçlamaktadır. Türkçe eğitim malzemeleri 14 katılımcıya uygulanmış ve eğitimlerinin sonunda uygulanan anketlerle önceki deneyimleri, kurs hakkındaki genel görüşleri ve kursun pedagojik olarak değerlendirmesi yapılmıştır.

Bulgular ve Tartışma

WASTE-TRAIN ve PROWAT projelerinin eğitim malzemeleri karma eğitim için, ACES projesinin eğitim malzemeleri uzaktan eğitim için ve PM4WAT projesinin eğitim malzemeleri öncelikle uzaktan eğitim için tasarlanmıştır. Ancak PM4WAT projesinde simülatör eğitimi yüz yüze eğitime göre tasarlanmıştır. Her ne kadar projelere katılan tüm ülkelerde eğitimlerden sonra testler ve anketler yapıldıysa da bu çalışmada sadece Türk katılımcıların cevapları sunulmuş ve tartışılmıştır. Ayrıca anketlerdeki tüm sorular yer kısıtı nedeniyle bu çalışmada sunulamamıştır. WASTE-TRAIN ve PROWAT projelerinde katılımcıların sırasıyla %88'i ve %96'sı gelecekte benzer bir karma eğitim kursuna ilgi duyacaklarını belirtmişlerdir. ACES projesinde uygulanan ankette ise modüllerin ve ürünlerin kalitesiyle ilgili sorular vardır, ancak uzaktan veya karma eğitimle ilgili soru yoktur. Genel olarak hem mühendisler hem de arkeologlar eğitim modüllerinin kullanıcı dostu olduğunu ve mantıklı bir şekilde düzenlendiğini belirtmişlerdir. İki grup arasındaki fark arkeologların mühendislikle ilgili bilgileri fazla teknik bulması olmuştur. PM4WAT projesinde ise katılımcıların dörtte üçü daha önce uzakta eğitim kursu almadıkları halde %64'ü bu tür eğitim hakkında olumlu görüş bildirmiştir. Ancak eğitimin bazı bölümleri için geleneksel yüz yüze eğitimin

gerekli olduğunu da belirtmişlerdir. Diğer bir deyişle katılımcıların karma eğitime ihtiyaçları vardır. Katılımcılar kursun tümüne 5 üzerinden 4 puan vermişlerdir. Burada bahsedilen Leonardo projeleri hedef kitlelerine yönelik kitap, eğitim malzemesi, simülatör gibi ürünleri ortaya çıkarmak dışında öğrenmede yeni teknoloji ve yaklaşımların denenmesine de fırsat vermiştir. Katılımcıların önemli bir kısmı bu teknoloji ve yöntemlerle ilk kez karşılaşmalarına rağmen takdir etmişlerdir. Karma eğitim sistemi olumlu olarak değerlendirilmiştir.