E-Learning Platform for Student Recruitment and Retention

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1. Introduction

The advances in technology changed our lifestyle and tend to interfere in all everyday processes. In a hi-tech era there is compelling to have modern tools even in the educational process. Networks expansion and Internet provide a good platform for e-learning in the ideea of connecting learners with educational resources.

Nowadays almost every bibliographic source can be found on the Internet, or on certain educational networks and people are getting used with interacting with computers for everyday tasks, but furthermore they start to use mobile devices to read books, store or even edit documents. Therefore the study process can be performed “on the move” by means of mobile technology. Our approach is a testing platform that empowers mobile devices through web-services to help students to improve skills and trainers (academic or industrial ones) to asses and guide students on specific topics of their interest.

The various systems that are already implemented consider the learning process as a remote task to gather knowledge in order to pass some exams. In the learning process evaluation represents a final step for a course. In general, two parties are involved: the learner and the instructor.

Our approach introduces a third party, the industry and the university (or faculty) seen as a industry component, playing an important role in the learning process by setting the trends and motivating the learner by pre-recruiting tests. The development of the platform is based on arising technologies including those on mobile devices, provided that a major part of students use this kind of technology. Web services represent an added (middle-)layer on the traditional client-server architecture for a better expansion and scalability, delivering content for all kinds of traditional or mobile clients.

The tool can also be used by faculty staff to perform test in the ideea of identifying possible candidates for retention in the academic environment (for PhD, or post-graduate programs).

2. Technology and Learning today

Technological progress, the rapid development in the romanian and even european industry and the request of highly qualified specialists increases the number of students each year, consequently learning today is no longer performed exclusively in classrooms with lectures as the only learning method. Educational methodics using modern technologies based on a

communication network and electronic presentation tools has made learning possible from anywhere at any time by using the Internet, wi-fi networks, or local area networks. Lately mobile learning even allows people to learn any time they can using portable devices, such as cell phones, personal digital assistants (PDAs), or laptops.

The Internet had an overwhelming impact [12] on a number of industries [Evans and Wurster 1997] and the growth in Internet usage has created much interest in Web-based learning [Fong and Hui 2002]. The acceptance of the Internet within tertiary institutions has seen the surfacing of an endless amount of resources for students at any level[Sheard *et al* 2000]. [Tian 2001, Fong and Hui 2002] agreed with this statement and argued that students can access resources globally through the Internet to assist them in their learning and that it has become an attractive alternative to traditional modes of communication. The most important, it allows the already employed postgraduates to continue the professional development on their spair time, interacting with a virtual (or not) teacher on the subject he wants to improve the skills.

Technology-delivered e-Learning [12][19], is where the learner audience are never in physical proximity to the trainer and may be delivered via a blend of asynchronous and synchronous technologies. Its also know as “Distance Education”, “Distributed Education” or “Distance Learning”. For our proposed architecture we can relax the condition by stating that audience can be or not in physical proximity to the trainer and may be delivered via a blend of asynchronous and synchronous technologies as described in what follows.

With the increased number of students in our University and mainly at Economics Faculty, it is compelling that we build an early relation between the 3 actors in the education process: the school, who is the trainer and sets the academic level, the student who learns and the industry who sets the trend and offers continuity by employing the graduates. So we propose an involvement of the companies in the learning process, especially in the E-Learning one by means of a portal with special functionalities for 2 types of trainers: academic and industrial ones. The full functionalities and architecture of the system will be explained.

3. Testing as an E-Learning Component

To make e-learning successful, the technology must have several characteristics [13] that make the learner's and the instructor's experience enjoyable.

On-line learning is not a “fancy add-on” but is certain to be an integral part of higher education for years to come. Several faculties report that administrators who previously ignored e-learning are now giving it their attention and full support.

As one online teacher from a virtual school in the Southeast states [09], “In the last two years, acceptance has grown, and many former skeptics believe that e-learning is here to stay and they might as well jump on the wagon.” To consider the overall growth of distance learning, the Sloan Consortium study cited “an annual compound growth rate of over 25% for the three year period,” when considering enrollment data from Fall 1999 and Fall 2002 .

Testing represents an important part of distance learning. Student evaluation process can have two forms: formative test, meaning that a student performs this type of testing to improve his knowledge and expertise by understanding the correct answers and possible confusions that were made; summative tests that have the role of benchmarking the level of the student in a certain moment in time.

In this paper we will focus on the second type of testing and underline its importance in the case of student – company relation where company wants to recruit a student observing the evolution in time not only as school performance but having results from some “real case” tests.

4. System architecture

E-learning system is based on client/server architecture. The client applications can be run on cell phones, PDAs, or laptops, and the server application can be on desktops or laptops. The communication media between the client and the server is Bluetooth, WI-Fi, Internet, WAP. Figure.1 shows the 3 tier client/server architecture of the system.

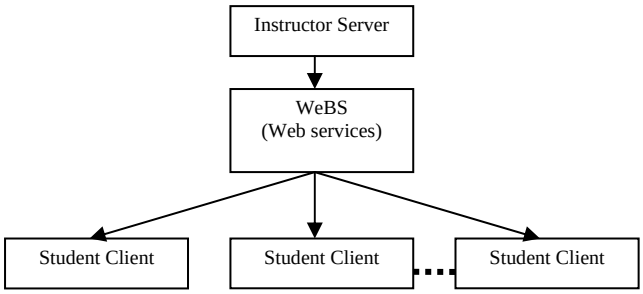

Figure 1 An E-Learning System

Usually, the trainer works on the server side. After initialization, the trainer will advertise the e-learning service by registering the e-learning service in the service discovery database and wait for client's connections. The students can use various portable devices to communicate with the trainer. To enter the e-learning system, students first need to run the client side application. After the application is started, it will automatically search the available e-learning services. Then the student can select one trainer (corresponding to one e-learning server) from the discovered trainer list. Chosen a specific trainer, the student can login the system with username and password. Once the student successfully logs in, the Bluetooth connection is setup between the client and the server. The client and the server will be disconnected when the student exits the application or the trainer stops the e-learning service.

Our e-learning system mainly provides five functionalities for the trainer:

- Assists the academic trainer to lecture. The system provides the trainer a visualized graphic user interface GUI). Through the GUI, the trainer can easily know how many students are currently in the system. He/she can upload the lecture notes or questions and navigate between them. The system also presents visualized feedback information and statistic information, which can help the trainer adjust his lecture according to the responses of the class instantaneously.
- Allow industrial trainer to propose some summative test on some predefined directions of study (the main directions the students can take classes at the university)
- Interactions between academic trainer and students. These interactions include two parts: get students' answers to the questions and response back the results to students right away. In addition to that, the trainer can also get instant comments from students.
- Provide statistic information for the academic trainer. The statistic information can help the trainer to know how well the students perform in the class.
- Automatic evaluation to provide results for summative tests so that the employer can set the employment test levels for the new generation of graduates.

Table 1. Summary of functionalities

Server	Assist academic trainers to lecture
	Interact with students
	Provide statistics for academic trainers
	Propose summative tests
	Automatic evaluation and statistics
Web services	Connection for different platforms
Client	Submit answers
	Send comments for the lecture

5. Web services for e-learning

A Web service is a collection of remote procedure calls (RPCs) hosted on a Web site and exposed via SOAP over HTTP and can be made securely accessible over the public Internet.

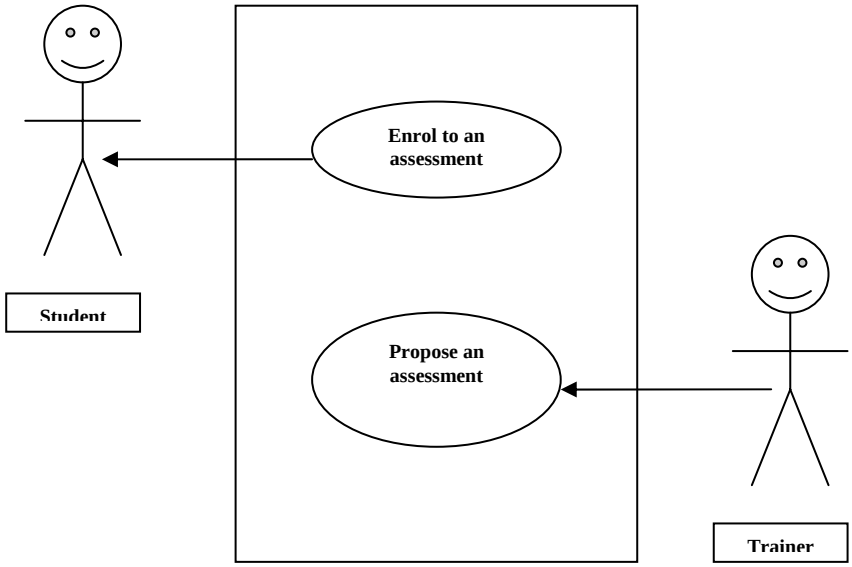

Figure 2 Enrollment system

Web services are application components, which communicate using open protocols, are self-contained and self-describing, can be discovered using UDDI, can be used by other applications, XML representing the basis for Web services.

Web services platform [10] elements:

- SOAP (Simple Object Access Protocol) which is a communication protocol, used for communication between applications, a format for sending messages, designed to communicate via Internet, platform and language independent, based on XML, allows you to get around firewalls
- UDDI (Universal Description, Discovery and Integration) is a directory service where businesses can register and search for Web services.
- WSDL (Web Services Description Language) is used to describe Web services, are written in XML, is an XML document and is also used to locate Web services.

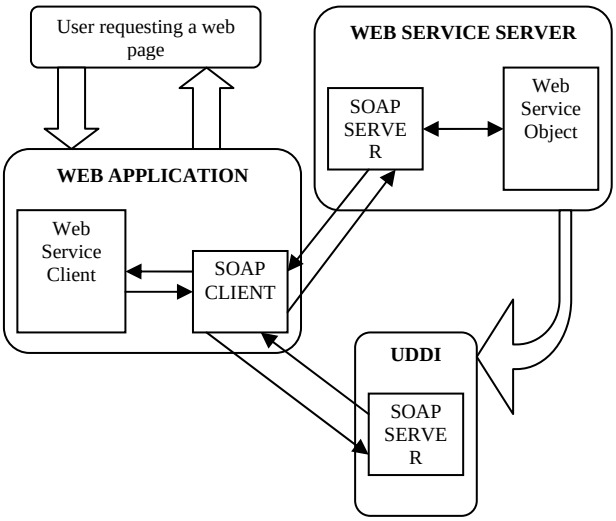

Figure 3 Web Services for E-Learning

- A Web service provider registers a Web service. This can be done either manually or automatically through code.
- A user requests a Web page as in Figure 3.
- The Web application accesses a Web service. If the service client already knows about the Web service, it directly accesses the Web service. However, if the Web service cannot be found, the service client can query to discover/rediscover an appropriate Web service to use. Once done, the client can re-query a Web service with the revised information.
- The Web service processes the request.
- The results of the execution of the Web service are sent back to the requesting client.
- The Web service results are incorporated into the final page.
- The client receives a Web page, not realizing that the application ever used a Web service.

Our E-learning system is built on an Office Microsoft SharePoint Server 2007 and the security is provided by Microsoft ISA Server 2006 (Internet Security Acceleration) [18]. We have chosen Office Microsoft SharePoint Server 2007 for four main reasons:

- The first, we chose this platform because our university has an agreement with Microsoft.
- Second is the price around 25.000 Euro. Other platforms, with better facilities would mean additional and substantial costs. For example, if we talk about Oracle (#1 Database [15]) the costs for this platform is 100,000$/processor and 2,000$/user for business version. We have 2508 students, 30 E-trainers, 18 Expert-companies and a dual processor server. The resulting cost will thus be 5.3 mil USD - because we are an Educational Institute we could buy an educational version for 2.6 mil USD. For IBM Lotus® Workplace Web Content Management (LWWCM)[16] the price would be more or less the same as Oracle's [23]. Because the university has limited funds Office Microsoft SharePoint Server 2007 is the right choice from this point of view.
- Another reason is the fact that Microsoft products are widely spread across Romania and especially in Romanian universities business field.
- The last but not least is the fact that everybody is familiar with the brand "Microsoft".

It is important to know that Office SharePoint Server 2007 [14] is built on a scalable architecture, with support for Web services and interoperability standards including XML and Simple Object Access Protocol (SOAP). Office SharePoint Server 2007 also has rich, open

application programming interfaces (APIs) and event handlers for lists and documents. This enables integration with existing systems and provides the flexibility to incorporate new non-Microsoft IT investments. LDAP integration support for other pluggable authentication providers makes it easier to work with non–Active Directory sources. Out-of-the-box WSRP Consumer Web Part enables integration with other WSRP-compliant portal solutions.

The advantages for using Office Microsoft SharePoint Server 2007 are that all users can create sites, initiate workflows, self-provision applications, access back-end data, define security at a per-item level, restore deleted items, and complete other tasks without involving IT. This reduced user dependence on IT improves productivity of all parts implicated in the educational process and also enables the IT department to focus on providing real value-added services to the organization. With the Business Data Catalog, we can define and deploy business application configurations to access data residing in back-end systems. This feature can be reused by users to create personalized views of business data without having to develop any custom code.

6. Statistical Study of the correlation among e-trainers – e-learning graduates – expert companies

As to the previously described e-learning platform, the courses are provided both by e-trainers and by expert companies. In the following we shall demonstrate[22] by statistical analysis that the presence of experts companies alongside e-trainers is vital in student training because it plays an essential role in their being employed both in private sectors and in educational settings. A study of the correlations of several variables[20],[21] (study characteristics), among which e-trainers, expert companies, students employed in educational area, as well as private business and other activity areas, will be put forth. To determine these correlations, the data in the following table has been used:

Table 2 Number of students 2003-2006

Academic year	Number of students enrolled	Graduates	Drop outs
2003	451	320	131
2004	660	394	266
2005	732	556	176
2006	665	565	100

The data in the above table presents the number of students enrolled in the time interval 2003 and 2006 whereby the graduates outnumber the dropouts – this proves the success of the e-learning platform which is also presented in Figure 4.

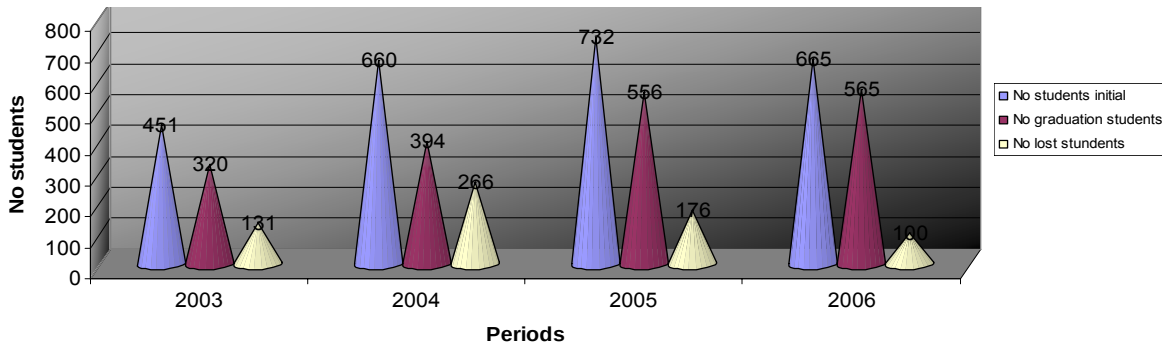

Figure 4 Number of students using the e-learning platform

The number of e-trainers and expert companies varied as to the 2003-2006 time interval.

Table 3 Number of e-trainers and expert companies between 2003-2006

Academic year	E-trainers	Expert Companies
2003	**9**	**3**
2004	**10**	**2**
2005	**7**	**5**
2006	**4**	**8**

Between 2003 and 2006 the graduates of the e-learning platform answered a questionnaire wherefrom we have selected the data presented in the following table:

Table 4 Distribution of students on the job market

Academic year	**E-trainers**	**Expert Companies**	**Private sector**	**Education**	**Other activity areas**
2003	**9**	**3**	**114,56**	**96**	**108,8**
2004	**10**	**2**	**14,184**	**118,2**	**261,616**
2005	**7**	**5**	**83,4**	**111,2**	**361,4**
2006	**4**	**8**	**378,55**	**56,5**	**129,95**

The first step to determine a correlation between e-trainers and students employed in the education sector on the one hand and between expert companies and students employed in the private sector, on the other, uses the calculation of covariation on the basis of the formula:

$$Cov(X,Y) = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{n}$$

The results are presented in the following table:

Table 5 Covariation of the number of graduates on the job market

	E-trainers	Expert Companies	Private sector	Education	Other activity areas
E-trainers	5,25				
Expert Companies	-5,25	5,25			
Private sector	-289,831	289,831	19087,747		
Education	46,5375	-46,5375	-3265,0114	570,75875	
Other activity areas	45,42875	-45,42875	-7937,9448	1655,1338	10529,295

Data shown in table 5 is going to be used in the calculation of correlations among Theoreticians-Professionals-Graduates employed in the private sector, education and other activity areas. These correlations are determined according to the Bravais-Pearson coefficient as it follows:

$$r = \frac{COV(X,Y)}{Sx \cdot Sy}$$

where S_X and S_Y represent the standard deviation for X and Y series. The results are presented in table 6:

Table 6 Correlations Theoreticians-Professionals-Graduates

	E-trainers	Expert Companies	Private sector	Education	Other activity areas
E-trainers	1				
Expert Companies	-1	1			
Private Sector	-0,915562957	0,915562957	1		
Education	0,850154429	-0,850154429	-0,98919472	1	
Other activity areas	0,193219751	-0,193219751	-0,559926623	0,67516414	1

The conclusions based on the previous calculations are as follows:

1. The employment of graduates in the private sector depends to a large extent on the presence of expert companies in their education. However, e-trainers also play an important part in this process, as shown in the following graph:

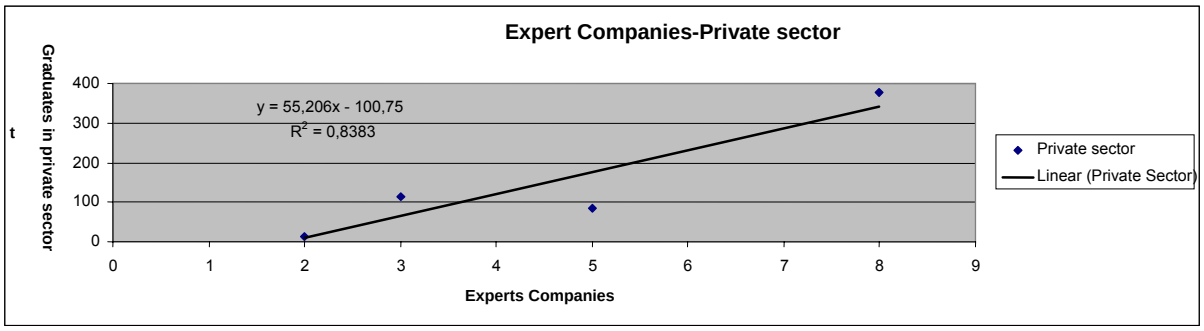

Figure 5 Linear regression

The linear regression which approximates the tendency of the Scatchard plots is: y = 55,206x - 100,75 whereas the square of the Pearson coefficient is 0,8383.

2. Students employment in the educational sector depends to a large extent on the e-trainers' involvement in their education. Expert companies' presence is also necessary, as shown by the following graph:

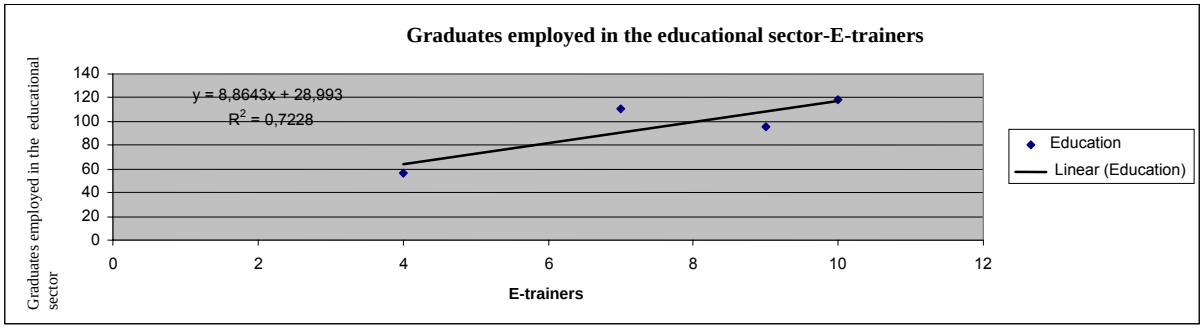

Figure 6 Linear regression

The linear regression which approximates the tendency of the scatchard plots is: y = 8,8643x + 28,993 whereas the square of the Pearson coefficient is 0, 07228.

3.The positive correlation between students employed in other sectors both with theoreticians and with expert companies is weak.

The next step in determining the correlation among theoreticians-professionals-graduates is calculating the Spearman's rank correlation based on the Bravais-Pearson coefficient as previously calculated for the rank series according to the following formula:

$$r_s = 1 - \frac{6\sum_{i=1}^{n} \mathbf{d}^{i^2}}{n(n-1)}, \text{where } d_i = R_{x_i} - R_{y_i}$$

Table 7 Spearman's rank correlation factor

	E-trainers Rank	Expert Companies Rank	Private Sector Rank	Education Rank
E-trainers Rank	1			
Expert Companies Rank	-1	1		
Private Sector Rank	-0,8	0,8	1	
Education Rank	0,8	-0,8	-1	1

Values in Table 7 suggest a strong positive correlation between:

1. Graduates employed in private sectors and their having been trained mostly by expert companies as to the e-learning platform; e-trainers play an important role as well.
2. Graduates employed in the education sector and e-trainers; expert companies also play an important role in their formation.

Values in Table 7 suggest a weak positive correlation between graduates' being employed in other activity sectors and e-trainers as well as expert companies.

7. Conclusions

We consider that e-learning is critical to the success of the faculty but also of the students. It is a strong belief that a Learning Content Management System will improve academic results and the direct involvement of the industry will bring a higher rate of employment for graduates in the first 3 months of graduation. The more qualified the student, the less money and time investments in professional training are necessary after employment.

Also the possible candidates for PhD studies or research groups can be identified in a incipient phase. Academic research with good results means higher level of development for future student, with direct access to latest trends in their specific domains.

The success of a college can be very well measured not only by academic results on the research and publication side but also on the success rate of its students.

As result of the tight cooperation between Faculty of Economics and associated companies, we observed that the main opportunities on the job market on mid and short term are: IT on economics, accounting, banking and stock markets and marketing.

These observations can help both to develop a good strategy for the educational process regarding the number of accepted students on each department and to enforce the curricula with optional courses prepared together with high qualified consultants from industry.

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