

Distance Assessment System for Accreditation of Competencies and Skills Acquired through In-company Placements.

Juan-Miguel Martínez, Carlos Dominguez, Ángel Perles, José Albaladejo, Houcine Hassan

Departamento de Informática de Sistemas y Computadores (DISCA)

Escuela Universitaria de Ingeniería Técnica Industrial (EUITIV)

Universidad Politécnica de Valencia (UPV)- Spain (<http://www.upv.es>)

Tel: (+34)96-3877570, Fax: (+34)96-3877579, e-mail: {jmmr, carlosd, aperles, jalba, husein}@disca.upv.es

Abstract: Nowadays the formation of engineers requires more and more an active model well adapted to the necessities of the current global society. This premise is forcing universities to modify their traditional curricula in order to incorporate innovative aspects for the formation, so students can get an extra added value on their degree formation. As example, we can mention two cases currently in development in most of the universities of the European Union:

?? Physical mobility on the basis of the international exchanges

?? In-company training placements.

These activities that have a benefit in the formation of the student, sometimes presents the problem of how to perform the evaluation in the evolution of the student's knowledge while they carry out these activities. In the case of international exchanges, it is easier, since the student incorporates to another university in which an evaluation model exists. However, in the case of in-company placements, it becomes more difficult to know the student's technical advance when he carries out a stay in a national or foreigner company.

We are members of a group of European institutions (Università di Perugia (IT); TUCEP Consortium (IT); Universidad Politécnica de Valencia (E); University of Huddersfield (UK); Technological Educational Institution of Athens (GR)) that are working in the remote evaluation of in-company placements during the last two years. This work has been done under a project financed by the European Commission through the Leonardo da Vinci program. In particular, this pilot project is called DASP (Distance Assessment System for accreditation of competencies and skills acquired through in-company Placements).

In this paper, we describe our experience obtained working on this group and our advances in order to know the evolution of the students that have carried out in-company placements compared with those that have followed a more traditional methodology of teaching. The developed tool allows us to carry out the evaluation by using Internet. In a first phase, we have considered Computer Engineering, Electronic Engineering and Economy disciplines. Depending of the final results, we will extend our work to other disciplines.

Keywords: In-company placements, distance assessment, Internet.

1. Introduction

Nowadays, placements for young people during or after University are becoming more common in the European Union. More and more, the curricula in the European Universities include a compulsory placement during or after the finalization of the studies. This placement can be in other University or in company [1,2,3]. On this paper we will focus on the internship placements on which the advantages are for both, students and enterprises, for the SMEs in particular.

The objective of our project has been to set up a system for validation of in-company placements, with the possibility of comparison with the formal education procedure. To performing this task is not easy, because there are different factors that should be considered. Firstly is assuming the difference between the University and the Industry on which there are no procedures for the quantitative evaluation of the skills acquired through the work. On the other hand, student is out of the University campus during the placement, some times far away from it, so it is

necessary to consider the use of new technologies based on ODL (Open and Distance Learning). Finally, the system should combine easily three agents: University-Company-Student. All the design should have this in mind in order to guarantee the right interaction.

With these factors, our system is based on the use of new technologies through Internet and is fully automated. We have built an interactive web page accessible via Internet used to set up a knowledge base. These permits remotely to perform a test for the valuation of the increment on students' knowledge. Each test is composed by questions assembled in a random way. According to the answers returned scores are assigned.

To the best of our knowledge, at the present time it does not exist an objective system for the evaluation of the students' knowledge progress through their experience on in-company placements. In order to perform a pilot experience, we have chose three disciplines: Computer Engineering, Electronic Engineering and Economy. This can give us enough information of how the system works and if it is possible to extend the project to other fields.

The rest of the paper is structured as follows: In Section 2 we briefly describe the framework of the project with all the partners involved on it. Section 3 describes the methodology used to produce the test, with all the implications. Section 4 presents the implementation of the system through a www page. Section 5 gives the results obtained in the project at the moment. Finally, some conclusions are drawn in Section 6.

2. Framework of the project

The project described on this paper has been co-financed by the European Union (EU) under the *Leonardo da Vinci* program [6]. The project is called DASP (*Distance Assessment System for accreditation of competencies and skills acquired through in-company Placements*) and was presented to EU on April 1997 [4]. The group of institutions involved on the project is the following:

- ?? Università di Perugia (Italy)
- ?? TUCEP Consortium (Italy)
- ?? Universidad Politécnica de Valencia (Spain) [7]
- ?? University of Huddersfield (United Kingdom)
- ?? Technological Educational Institution of Athens (Greece)

CASI, of the Perugia University has build up the infrastructure, while the rest of European partners had built the set of questions as described as follows:

- ?? *Computer Engineering*: Universidad Politécnica de Valencia
- ?? *Electronic Engineering*: University of Huddersfield
- ?? *Economy*: Technological Educational Institution of Athens

Along the duration of the project, the full group has met only three times, hence we had cooperated using teleworking technologies: A mailing list and the world wide web site.

All partners believe on the importance of in-company placements for the formation in modern universities, so the innovative tool developed under DASP project will be used in the future for this and other purposes.

3. The Methodology

As was described above, the main idea is to have an interactive tool accessible through a web page via Internet, on which it is dynamically built the knowledge base permitting the appreciation of the progress on the student knowledge doing a in-company placement. The system will permit to make a test composed of different questions that are assembled on a random way depending on the answers returned and for the assigning scores.

The system engine is a RDBMS product available through Internet on a WWW site, allowing an easy maintenance and given the possibility of a dynamic adding of new disciplines and/or increasing of the number/type of questions available for each field.

The project is based on the use of a test composed by a set of questions in order to evaluate the progress of the student. For comparison purposes we consider that student should perform three tests. The first at the beginning, just before to starting the placement in the company. The second one, when the student has spent half of its period in the company. The last one, once the student has finished. Comparing the results obtained for the student can be easy to

determine how the placement has affected to their knowledge. Moreover, if we want to have a correct result in the evaluation, is important to be precise on the design of the different questions.

For the three fields selected (Computer Engineering, Electronic Engineering, Economics) we have designed a pool of tests using the technique of multiple choices. Each question has their own keyword permitting the system to select different fields inside a discipline. This will allow differentiating kinds of stages, depending on the inherent characteristics of the company (SME). For example in the discipline of Computer Engineering we have different fields as Databases; Internet; Networking; Operating Systems; Programming; Hardware; etc. Also it can be possible to select a "Null" keyword, meaning that the system can choose between all fields. Moreover, depending on the level of complexity, the questions are classified in two types:

- ?? General Knowledge (GK): It is the first level of complexity and is used to determine the level of basic knowledge on that field. This first level is divided into four levels: GK1 to GK4
- ?? Specific Knowledge (SK): It is the second level of complexity and is used to determine how deep is the knowledge on the specific field. This second level is divided into six levels: SK1 to SK6

With the database containing all questions, the system will randomly select each one for compose the test. It is important to have a high number of questions in the database in order to proceed fair with the random selection and making the test more accurate.

The whole test will be composed of different questions varying according to the answers returned and for assigning scores. Each test has a total of ten questions, four of GK and six of SK. At the beginning the system presents to the student on a consecutive way the four GK questions, one of each level from GK1 to GK4. After that, the six SK questions are also sequentially presented. The selection of the SK questions is made depending on the answer obtained with the GK.

Concerning the score that students must obtain at the end of the test, will be on the range from 0 to 100 points. In order to obtain this final score, the rules are:

- ?? At the beginning, the student must answer four questions of group GK, one of each complexity level (GK1 to GK4). The answers of the questions GK1 to GK4 are evaluated from 0 to 40 points.
- ?? Afterwards, student must answer six questions of group SK. The selection of these questions will depend on the score obtained with the GK questions:
 - ✂✂ If score obtained on group GK is lower than 70% (< 28 points) then SK questions are selected from the first complexity levels, one question from each level (SK1; SK2; SK3; SK4; SK5; SK6). The scoring for each question with right answer is 8 points.
 - ✂✂ If the score obtained on group GK is great or equal to 70% (>= 28 points) the SK questions are selected from the following levels of complexity: SK4; SK4; SK5; SK5; SK6; SK6. The scoring for each question will be 10 points.

This procedure permits differentiating the students by their knowledge depending on the answers obtained in the first level of complexity (GK). If this first level is passed at least with the 70% of the score, it can mean that the general knowledge of the student is satisfactory, so we should investigate in depth with their specific knowledge. This is the reason of presenting questions of high complexity questions (SK4; SK4; SK5; SK5; SK6; SK6). In the other case, the second part of the test is composed by one question of each level (SK1; SK2; SK3; SK4; SK5; SK6) but the scoring is a little bit lower and student can not get the maximum mark (100 points).

In this pilot phase, we have estimated that 3 minutes per question can be enough in order to answer. This gives us a limit of 30 minutes for the all test. The only consideration is that this time should be measured for each question. If the student answer a question faster than 3 minutes, time does not accumulate for other questions, each time student starts with a new question the counter of time is reset.

Moreover, each question is designed as multiple response type, students should select one of the four possible answers. Only one of the answers is true. This procedure is easier for the student because he knows that only one answer is the correct.

Another point of interest is how to determine the identity of the student who is making the test. In order to guarantee the validity of each test, the system uses a different login and password for each student. This information will be given to the student just before making the test. In addition the test will be make in presence of recognized person who validates the identity of the student.

4. The System

The system has been built up by CASI of the University of Perugia and consists of an interactive web accessible via Internet, giving the opportunity to perform the test in an electronic way. As was described above, the system composes the test in a random mode from a pool of questions.

The application uses a Database Structured Query Language (SQL) and manages the following files:

- ✂✂ A file with the entire questions classified according their level of complexity. The different questions will be selected from here in order to compose the whole test.
- ✂✂ A file with general information about the arguments used by the test classified by fields. Also there are some examples of the different types of questions.
- ✂✂ A file with all the information about the institutions and authorized persons for the supervision when the student make the test. This will guarantee the validity of the test.
- ✂✂ A file keeping all the results of each different tests done. The information used is the personal data of the student, the different questions of each test with their results, location of realization, person who validates the test with their digital sign, etc.

The interaction with the user is performed through a Graphical User Interface (GUI) made by a Common Gateway Interface (CGI) using a JAVA language and used for all the transactions with a World Wide Web (WWW) Browser.

Access to the system is through the web address: <http://www2.krenet.it/dasp/dotest/index.php3> [5]. This main page is used by the student for introducing its personal data and the selection of other necessary parameters as language, discipline or field. Figure 1 shows this page including the part corresponding to login and password.

Domenico Gervasi'."/>

Distance Assessment System for accreditation of competencies and skills acquired through in-company Placements

First name:

Middle name:

Last name:

Select the language: English

Select the discipline: Computer

Select the keyword: Full

Do the test

Nombre de usuario:

Contraseña:

Aceptar Cancelar

Last update: June 3, 2000
For any information, please contact: [Domenico Gervasi](#)

Fig. 1. Main web page of DASP system

After the validation of the student, the system continues presenting sequentially the ten questions for the test. Figure 2 displays one of the questions of the database. As can be seen, at the top-right part of the question box appears a counter that gives the student some information about the time still available in order to answer the question. At the beginning, when the question is displayed, this counter is set up to 180, meaning that the time available is 3 minutes, after that the counter is decreased every second. Each time the answer of a question is submitted, the counter stops and it is set up again for next question. If the answer of the question is not validated and the counter arrives to 0, the system will skip the present question and starts automatically with the next one.

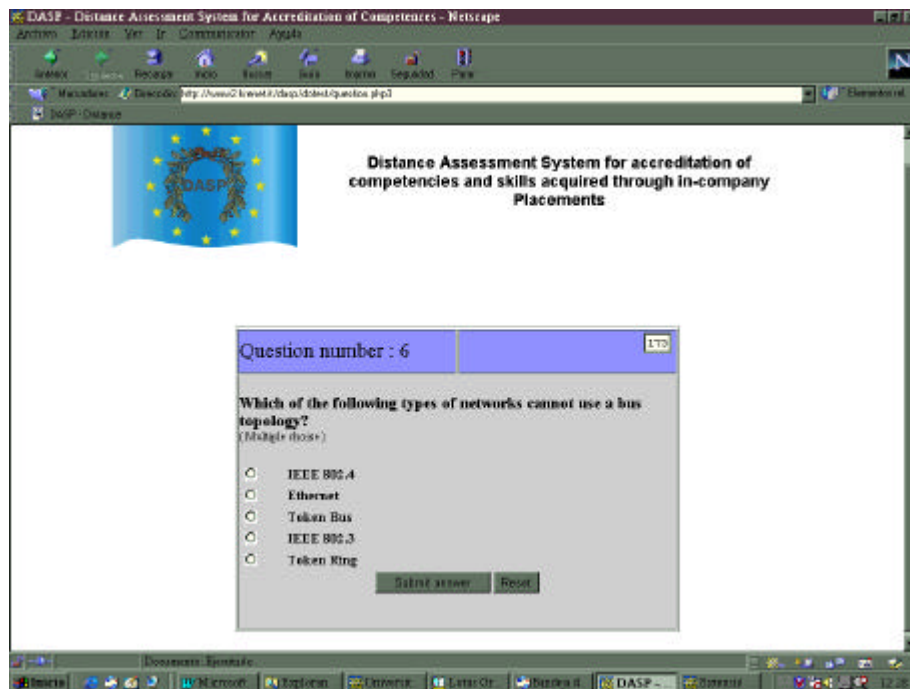


Fig. 2. Example of test question

Finally, after the presentation of the ten questions, the system shows to the student their final score, and all the information is saved into a file. Figure 3 gives an example of the final score obtained by a student at the beginning of a six months in-company placement.

As can be seen, the test can be done world wide only using a computer with Internet connection and any commercial navigator. The only restriction is concerning the validation of the student identity that must be done by one authorized person. As was mentioned before, student should pass three tests, one before the placement, other during the placement and the last at the end of placement. The information of the final score will be useful not only for the University, but also for the company and of course for the student.

Moreover, the system has a private part only accessible for the system administrator. Using this part it is possible to modify the database of questions and also gives access to other private information. This will permit future actualization because after the pilot phase the system will be extended to other fields. The final idea is to have an open system with the possibility of adaptation to different Universities, Companies and methodologies. We expect to improve the system while we use it.

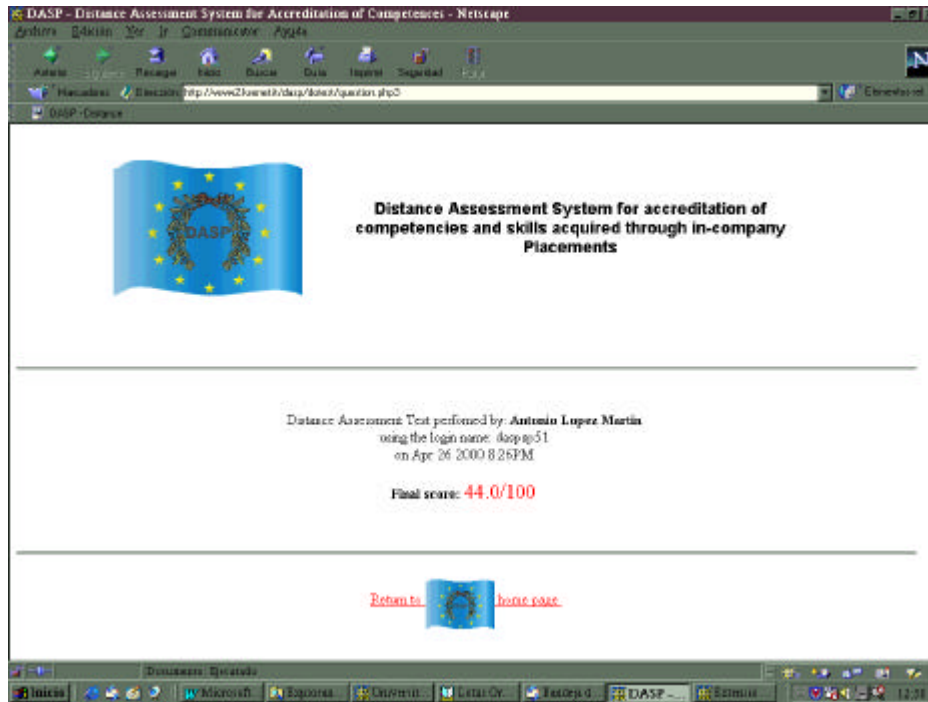


Fig. 3. Example of the test final score

5. The Results

At present time we are finishing the first evaluation phase of the whole system. In order to obtain precise results, the system has been validated on around 200 European students from Spain, United Kingdom and Greece. These students come from different specialties, so they have been chosen trying to have a similar number of students from each of the fields evaluated (Computer Engineering, Electronic Engineering, Economics). All of them have in common that the duration of their placement has been between six and nine months.

Firstly, we have analyzed the behavior of the Internet network while students were connected performing the tests at different hours, days and locations. After the obtained results, we can conclude at this point that no problems appeared while the students were working with the system.

On the other hand, the rest of the evaluation has been focused on the analysis of the scores obtained by the students. This information is useful for us in order to determine quantitatively the percentage of progress in the knowledge of the student after its in-company training. After comparing the results achieved at the beginning, during the training period and at the end, more than 93% of the students obtained some increment on their scores after the finalization of their in-company training placement. Table 1 shows a comparison of the different results obtained, comparing for each student the score obtained at the beginning of the placement and the one achieved at the end.

Table 1. Comparison of the results obtained.

Score Increment	Num. of Students	% Num. of Students
0% to 10%	21	10.5
10% to 20%	62	31
20% to 30%	51	25.5
30% to 40%	21	10.5
40% to 50%	19	9.5
Up to 50%	26	13

The results of Table 1 show that for the total number of students (200), more than 55% achieve an increment on the score of the test between 10% and 30%. The rest is distributed as follows. Only few students have obtained an increment lower than 10%. Also, 32% of students have achieved an increment greater than 40%. With this results we can confirm our expectation concerning the benefits obtained for the students in their knowledge after an in-company-training period.

Next step in the evaluation will be to compare these results with the traditional formal educational system on which there are no in-company training. This evaluation will permit to determine in a quantitative way the student progress for the in-company placements. Also it should be notice that there are other factors that the student obtains during his placement that are difficult to evaluate. For example: the possibility of working in groups; to resolve real problems; to learn how the company works; to be competitive in a real market with competence; etc. All of these factors contribute to the personal development of the student.

6. Conclusions

In this paper, we have presented the work done under a European project called DASP. This project has focused on an automatic system aimed to validate in-company placements, giving also the opportunity to compare against the traditional formal education system. This allows the optimization, rationalization and the standardization of the evaluation of the competencies and skills acquired through in-company placements.

The methodology presented on this paper is extremely innovative and easy to access because it is based on the use of Internet. The automation of the process assumes a rigorous definition of the evaluation criteria, accompanying a rationale and impartial realization of the test. The subdivision on different levels gives the opportunity to better determine the grade of compression and knowledge of the candidate.

The group of partners involved in the project has been working on different tasks. CASI of the University of Perugia has developed all the software for the system and the rest of Universities have worked on the elaboration of the different tests and the validation of the system. In a pilot phase, three fields have been covered: Computer Engineering, Electronic Engineering and Economics. Once the evaluation of this part will be finished the idea is to extend the project to other fields (Medicine, Architecture, other Engineering, etc).

We have validated the system with 200 European students from Spain, United Kingdom and Greece. Each of the students has passed three tests: before, during and after the in-company placement. The results acquired show that in almost all cases, there is an increment on the student knowledge after the realization of in-company training. Now, we are working on the comparison of these results with the traditional way of teaching without internships.

7. References

- [1]. J.M. Martínez, J.F. Juliá, E. Ballester, "International Educational Programmes: An Added Value for Technical Degrees", Proceedings of the VI Spanish Congress of Teaching Innovation for Technical Degrees, vol.3, pp.185-196, September 1998.
- [2]. J.M. Martínez, "International Educational/Formation Programmes", Proceedings of the 1st Bienal Iberoamericana de Arquitectura e Ingeniería a Civil, October 1998.

- [3]. J.M. Martí nez, "To a Global World from the University Formation," Proceedings of the 1st Workshop about Teaching Methodology at Universidad Politécnica de Valencia vol.1, pp.73-74, December 1998.
- [4]. DASP project, <http://www.krenet.it/dasp/>
- [5]. DASP system, <http://www2.krenet.it/dasp/dotest/index.php3>
- [6]. Leonardo da Vinci programme, <http://europa.eu.int/comm/education/info.html>
- [7]. Universidad Politécnica de Valencia, <http://www.upv.es/>.