

# WEB APPLICATION FOR COMPARISON OF LEARNING OF STUDENTS FROM DIFFERENT UNIVERSITIES

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## Abstract

The ERAMIS project (European-Russian-Central Asian Network of Master Degrees "Informatics as a Second Competence") is an international project funded by the European Tempus programme. The main objective of this project is to create a network of master degrees in computer science as a second competence intended for specialists in social sciences, exact sciences, and engineering. The objective of this master degree is to give specialists coming from other disciplines, a training enabling them to master computer techniques and programming languages in order to create, develop, manage and maintain new software tools for their specific domains.

One of the secondary objectives of the project is to develop an own culture of quality assurance between the different partners of the project. The assessment of students is one of the most important elements of the quality assurance method of the project.

Student assessment procedures are designed to measure the achievement of the intended learning outcomes. The assessment procedure also provides valuable information for universities about the effectiveness of teaching and learners' support. Moreover, the assessment procedure allows the partners to compare the results between subjects, programmes, and universities, and leads to an exchange of experiences of best practices. The main goal of the assessment procedure is to compare educational results between the universities of the project.

Unfortunately, due to the international and heterogeneous nature of this project (14 universities from 8 countries), developing and applying comparable criteria and methodologies are difficult tasks.

In the frame of this project, a web application has been developed to help the partners to assess and compare learning outcomes. This web application provides an online testing system. The results and knowledge obtained from the testing system will allow to improve the educational process, to change the syllabuses of the master programs, to change the teachers or provide additional training to some teachers, to find the educational gap between the universities and propose areas to be improved, and to check the level of knowledge of students from one university before moving to another university.

Keywords: assessment, evaluation, international, project.

## 1 INTRODUCTION

During the last few years, Russian, Kazakh, and Kyrgyz higher education systems have been reformed and are progressively evolving within the context of Bologna Process (also known as the European Higher Education Area) [1, 2], towards a common higher education framework. The opening of Russian, Kazakh and Kyrgyz universities has been encouraged by many international projects, notably European ones [3].

In the beginning of 2010, the European Tempus project *European-Russian-Central Asian Network of Master Degrees "Informatics as a Second Competence" (ERAMIS)* started to set up a network between a group of universities from Europe, Russia and Central Asia. The members of the project are: five universities from Europe (Finland, France, Germany, Poland, and Spain), four universities from Russian Federation, three universities from Kazakhstan, two universities from Kyrgyzstan, and three enterprises from Russian Federation, Kazakhstan, and Kyrgyzstan.

The main objective of this project is to create a network of master degrees in computer science as a second competence intended for specialists in social sciences, exact sciences, and engineering. The objective of this master degree is to give specialists coming from other disciplines, a training enabling them to master computer techniques and programming languages in order to create, develop, manage and maintain new software tools for their specific domains.

One of the secondary objectives of the project is to develop an own culture of quality assurance between the different partners of the project. Our assessment procedure allows the partners to compare the results between subjects, programmes, and universities, and leads to an exchange of experiences of best practices. In our quality control system, the assessment of students is one of the most important elements of the quality control method of the project.

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In the frame of this project, a web application has been developed to help the partners to assess and compare learning outcomes. This web application provides an online testing system (exam software) for administering, scoring, and reporting tests. The results and knowledge obtained from the testing system will allow to improve the educational process, to change the syllabuses of the master programs, to change the teachers or provide additional training to some teachers, to find the educational gap between the universities and propose areas to be improved, and to check the level of knowledge of students from one university before moving to another university.

The rest of the paper is organized as follows. In Section 2, all the partners of the project are presented and we briefly describe the main objectives of the project. In Section 3, the quality control of the project is explained. In Section 4, the assessment of students as a fundamental mechanism of our quality control system is described. In Section 5, our online testing system is presented. Finally, in Section 6 the main conclusions are presented.

## **2 THE ERAMIS PROJECT**

In a previous work [4], the general objectives of the ERAMIS project were presented, as well as the different syllabuses that have been developed. In this section, a brief summary of the project is included.

The ERAMIS project is based on the good experience the Kyrgyz State National University had with the creation of the master "Double Degree in Computer Science and Social Sciences", within the framework of Tempus project CD\_JEP-26235-2005. This master was designed following the example of the professional master "Computer Science and Social Sciences" that exists since 1985 in the University Pierre Mendès-France University [5]. The aims of this project were:

- To modernise the higher education in computer science in Kyrgyzstan.
- To increase the level of competence of computer science teachers by training Kyrgyz teachers and building a modern teaching infrastructure.
- To meet the European standards by Kyrgyz higher education system.

The current ERAMIS project aims to set up a network of masters in "Computer Science as a Second Competence" between four Russian universities, three Kazakh universities, two Kyrgyz universities and five European Union universities. This master will be based on the framework of the master degree program "Double Degree in Computer Science and Social Sciences", which was created within the context of Tempus III project in the Kyrgyz State National University.

New syllabuses will be defined in order to adapt this master for the application of computer science to exact science and to engineering science. The master "Computer Science as a Second Competence" will be composed of two specific profiles: "Computer Science for Human and Social Sciences" and "Computer Science for Exact Sciences and Engineering Sciences". The existing syllabus will be adapted to Russian and Kazakh requirements. The master will be introduced in the universities of four big industrial regions of Russia and in the universities of three important regions of Kazakhstan. These universities expressed their particular desire to set up such a training that would give the theoretical fundamental basis in computer science (algorithmic, programming, systems network architecture) and the use of modern tools which are essential in the fields of databases, information systems, multimedia technologies (Internet, Web) and of structured document processing (XML technologies).

This master is principally intended for students having a bachelor level, but the master will also offer further education for persons already in working life but wishing to learn a new job or to widen the field of their competences. The objective of the master is strictly professional, it is intended to train versatile persons, combining good competences (acquired in the bachelor level) in a first discipline with theoretical and technical competences, enabling them to create, develop, and implement tomorrow's software tools in a better way. This is also a way to participate in the development of Russian and Central Asian Information Society. The high level in Computer science combined with the initial competence will help the recent graduates to find a job. A multidisciplinary career profile will enable the students to be headed for a career in the creation and the development, the adaptation or the use of software tools that meet the needs of society, economy, industry, and cultural life of the three countries involved in this project.

There, the specific objectives of the project are:

- Disciplinary and geographical extension of the master already existing in Kyrgyz State National University (Informatics for Social Sciences as a Second Competence) to exact and applied sciences, and expansion to Russian and Kazakh Universities.
- Setting up of a continental network between Europe, Russia and Central Asia of master "Informatics as a Second Competence".
- Fulfilment of the necessary conditions to set up a double diploma's master.
- Bringing together concepts of professionalization of the education of ERAMIS network partners.

In a project of this size and importance, quality control and monitoring should be an integral part of all project activities and results. In the following section, the mechanism for quality control is explained.

### **3 QUALITY CONTROL SYSTEM**

One of the secondary objectives of the project is to develop an own culture of quality assurance between the partners [6]. The quality control system that has been created in the frame of the ERAMIS project is mainly based on the guidelines from the "Council Recommendation of 24 September 1998 on European Cooperation in Quality Assurance in Higher Education (98/561/EC)" [7]. Due to the international and heterogeneous nature of this project (14 universities from 8 countries), one of the most difficult tasks has been to develop a set of comparable criteria and methodologies. The quality control method can be briefly summarized in:

- Establishing a policy and procedures for quality assurance.
- Monitoring and periodically reviewing subjects and syllabuses.
- Assessment of students.
- Quality assurance of teaching staff.
- Quality assurance of learning resources and student support.

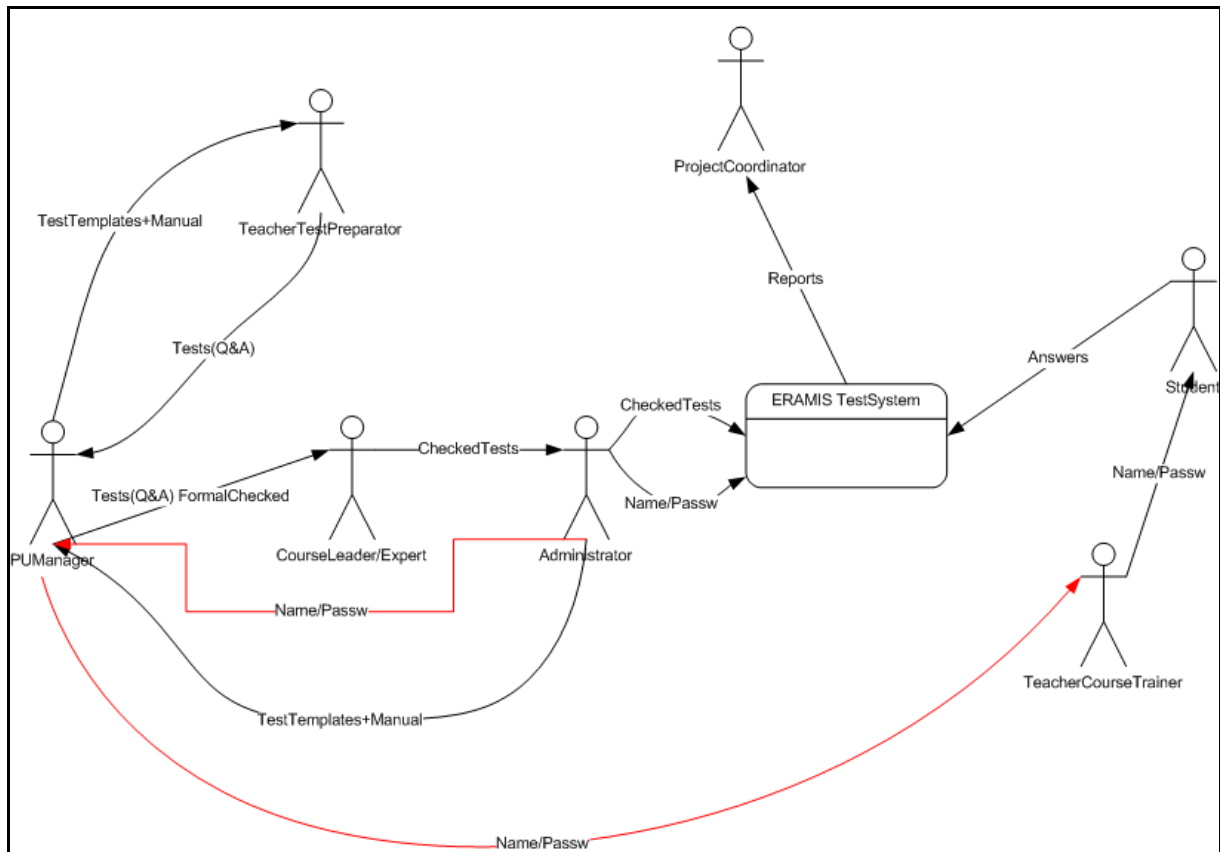
In this paper, we present the web application we have developed for the assessment of students as a fundamental mechanism to measure the quality of the learning process.

### **4 ASSESSMENT OF STUDENTS**

In the application form of the ERAMIS project, one of the quality control and monitoring activities is "*Creation of a virtual poll to assess the education*". In order to fulfil this activity, an online testing system has been created to assess the knowledge of students.

Student assessment procedures are designed to measure the achievement of the intended learning outcomes. Assessment also provides valuable information for universities about the effectiveness of teaching and learners' support. Our assessment procedure allows the partners to compare the results between subjects, programmes, and universities, and leads to an exchange of experiences of best practices.

In Fig. 1, a graphical description of the ERAMIS Testing System is displayed. This figure shows the different actors involved in the preparation and performing of tests.



**Fig. 1 ERAMIS Testing System**

The functioning of the system is very simple:

1. Teachers from each university prepare a set of tests.
2. Tests are sent to the project manager of each university.
3. The project manager checks that tests satisfy the formal requirements. For example, a good test must be acceptable to those using it, feasible, valid, and reliable.
4. All the project managers send the tests to the course leader.
5. The course leader checks that content of the tests is correct.
6. The course leader sends the tests to the system administrator.
7. The systems administrator loads the tests into the ERAMIS Testing System.

The main goal of the testing system is to compare educational results between the universities of the project. It is very important to understand that the goal of the system is to compare universities, not students. The system will help to check the educational outcome from each partner university.

The results will allow to:

- Improve the educational process.
- Change the syllabuses of the master programs.
- Change the teachers or provide additional training to some teachers.
- Find the educational gap between the universities and propose areas to be improved.
- Check the level of knowledge of students from one university before moving to another university.

## 5 ONLINE TESTING SYSTEM

We have developed our own online testing system because the existing testing systems, such as Moodle [8], could not fulfil all the requirements of our quality control system. Moodle offers the “Quiz Activity Module”, which allows the teacher to design and build quizzes. However, Moodle (at least version 1.x) does not offer a tool to analysis, compare and make reports based on students’ results.

Our online testing system allows the teacher to create online tests consisting of a large variety of question types, including true-false, multiple choice, multiple-select, and short answer questions. Besides the text of a question, a question can also have an image. These questions are kept in the question bank and can be re-used in different tests. In our testing system, tests (exams or quizzes) can be configured to allow multiple attempts. Each attempt at a test is automatically controlled.

A test can automatically select random and/or specific questions from different categories of questions from the question bank. Besides, the test settings allow different display methods. A test can randomize the questions for each student and/or randomize the answers for each student.

In Fig. 2, an example of test is displayed. A test has a title, a description, and instructions for the test takers. During the test, a timer shows the elapsed time.

The screenshot shows the ERAMIS Project - Testing System interface. At the top right, a dark box displays the starting time as 08:32:58 pm and the finish time as 00:01:20. The main content area is titled 'Europe Capitals' and includes a subtitle 'Capital Cities Test'. Below this, there is an 'Instructions' section followed by a 'Test' section. The test contains two questions: '1. What is the capital city of Spain?' and '2. What is the capital city of Hungary?'. Each question has three radio button options. For the first question, 'Barcelona' is selected. For the second question, 'Budapest' is selected.

Fig. 2 Example of a test

The screenshot shows the summary of the 'Europe Capitals' test. It features a table with the following data:

Europe Capitals	
Starting time	2012-05-13 20:32:58
Finish time	2012-05-13 20:34:33
Number of questions	10
Answered questions	10

Below the table, there are three links: [View your answers](#), [View solution](#), and [Main page](#).

Fig. 3 Summary of a test

At the end of a test, the teacher can choose whether to give feedback and/or show the correct answers to the test takers. In Fig. 3, the summary of a test is displayed. In the summary, the number

of questions in the test and the number of questions answered is shown. Besides, the total elapsed time is also displayed.

At the end of a test, if the teacher allows it, test takers can review the questions and answers. For example, in Fig. 4 the review form of a test is displayed. In this example, the first question was answered incorrect by the test taker.

**ERAMIS Project - Testing System**

**Europe Capitals**

Capital Cities Test

**Instructions**

Instructions...

**Test**

**1. What is the capital city of Spain?**

Barcelona

Alicante

Madrid

**2. What is the capital city of Hungary?**

Budapest

Badajoz

Belgrade

**3. What is the capital city of Poland?**

Krakow

Warsaw































Gdansk

Fig. 4 Checking a test

## 5.1 Management of the online testing system

Creating questions and tests is an easy and logical process. Our application provides a question bank to help to reuse the same question in different tests. The teacher simply has to gather the questions from the question bank, set up some configuration parameters for the test, and the test is ready. This process includes retake rules and randomization options. Besides, the look and feel of a test (colour schemes, fonts, and son) can also be customized.

In Fig. 5, the part of the system that allows the teacher to manage the question bank is displayed. Apart from the title of the question, the difficulty, the category, and the language are also displayed. The question can be defined in different languages. Therefore, the same test can be answered by students from different countries, in each student answering the test in their mother tongue.

ERAMIS Project - Testing System						
Show 10 entries						Search:
ID	Question	Image	Difficulty	Categories	Languages	Operations
9	What is the capital city of Spain?		7		EN	  
10	What is the capital city of Hungary?		9		EN	  
11	What is the capital city of Poland?		2		EN	  
12	What is the capital city of France?		4		EN	  
13	What is the capital city of Czech Rep.?		6		EN	  
14	What is the capital city of Greece?		8		EN	  
15	What is the capital city of Norway?		10		EN	  
16	What is the capital city of Denmark?		5		EN	  
17	What is the capital city of Germany?		5		EN	  
18	What is the capital city of Turkey?		5		EN	  

Showing 1 to 10 of 15 entries

First Previous 1 2 Next Last

Fig. 5 Management of questions

## 5.2 Analysis and reporting

The main aim of application is to compare the level of education in ERAMIS network. Our application provides live, real time access to all the results all of the time.

The quality control system of the ERAMIS project needs to obtain and analyze the following requirements:

- Average level (course by course) for the whole network, country by country, and university by university.
- Comparison (course by course) of each university to the average level in the network or in the country.
- Comparison (course by course) of the best and the worst students' results in each course, university, and the whole network.
- The worst and best answered questions in each course and university.
- Statistics of question by question (good and bad) in each course, country, university, and the whole network.

The statistics report gives a statistical analysis of a test and the questions within it. This report gives a summary of the whole test. It is possible to drill down into a detailed analysis of a particular question to compare the results among the different participants. The statistics report can provide the following information:

- Average mark.
- Median mark.
- Standard deviation of marks.

In Fig. 6, a chart example is displayed. In this example, the average marks of students are aggregated by university.

# ERAMIS Project - Testing System

Test: Europe Capitals

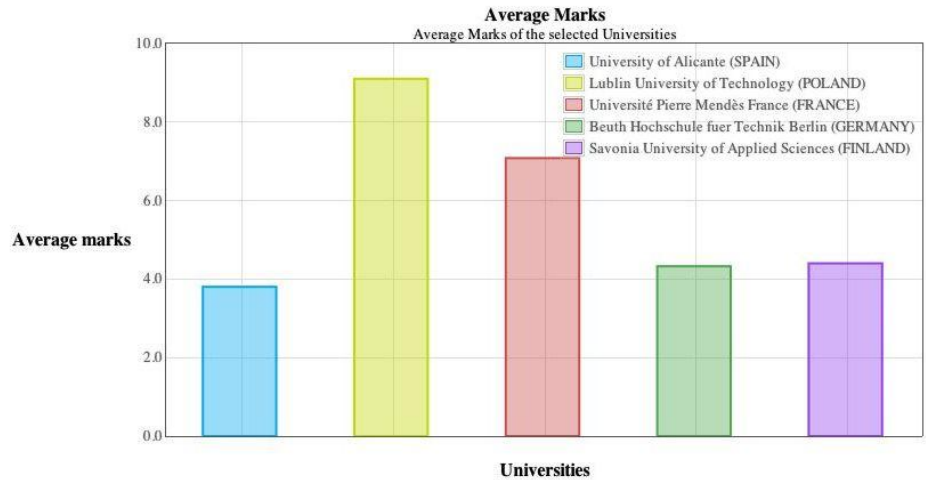


Fig. 6 Average marks of a test by university

In Fig. 7, another chart example is displayed. In this case, the worst and the best mark from each university are displayed. This chart can help to detect the outliers in the answers in a test.

Finally, the results can be downloaded in a variety of formats, such as CSV or plain text.

# ERAMIS Project - Testing System

Test: Europe Capitals

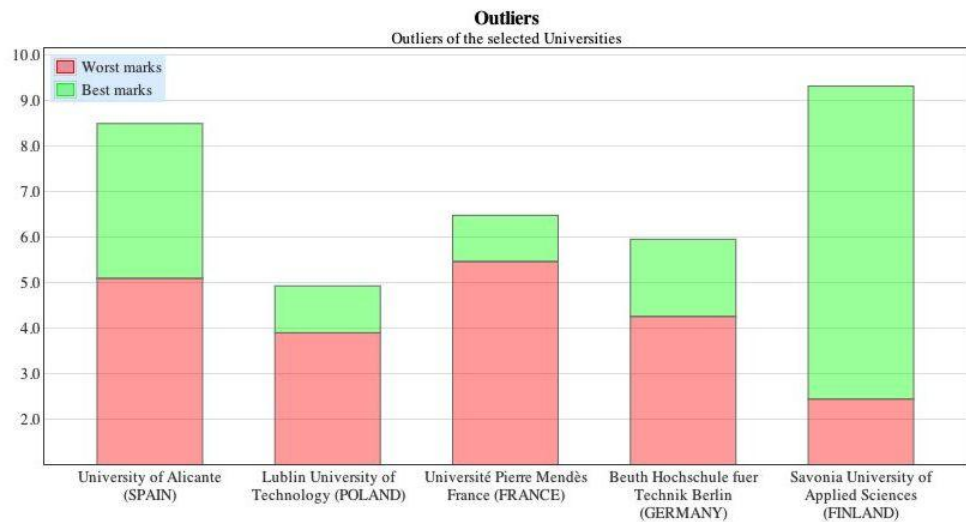


Fig. 7 Box plot of marks by university

## 6 CONCLUSIONS

In this paper, the online testing system that has been developed as part of the quality control system in ERAMIS network has been presented. The ERAMIS project aims to develop Information Society by creating a European-Russian-Central Asian network of masters in Informatics as a Second Competence, between four Russian universities, three Kazakh universities, two Kyrgyz universities



and five European universities. This network will permit the exchange of knowledge and experience between the partners of the project.

Unfortunately, due to the international and heterogeneous nature of this project (14 universities from 8 countries), developing and applying comparable criteria and methodologies are difficult tasks. The ERAMIS network is using this online testing system to compare the educational results between subjects, programmes, and institutions. The primary purpose of the assessment is to improve student learning. The results and knowledge obtained from the testing system will allow to improve the educational process, to change the syllabuses of the master programs, to change the teachers or provide additional training to some teachers, to find the educational gap between the universities and propose areas to be improved, and to check the level of knowledge of students from one university before moving to another university.

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