

NEW CHALLENGES IN MATHEMATICS FOR THE EUROPEAN HIGHER EDUCATION

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Abstract

In this paper we will talk about a math project submitted to the Lifelong Learning Programme. European higher education needs a reform in order to play its full role in the Europe of Knowledge. Modernisation of higher education is necessary in the areas of curricula (Bologna process), funding and governance so that higher education institutions can face the challenges posed by globalisation and contribute more effectively to the training and retraining of the European workforce. On the other hand Mathematics is an essential component of all educational systems. Mathematical literacy is being scrutinized in assessment efforts such as the OCDE Programme for International Student Assessment (PISA). This showed a low level in Europe.

Due to the Bologna Process, which brought several didactical implications for Higher Education (HE) institutions, there is the need of lifelong learning. This evolution is in conflict with the earlier mentioned lack of competencies on basic sciences, such as Mathematics. Forced by this duality, efforts are combined to share expertise in the Math field and the integration of pedagogical methodologies becomes a necessity. Thus, several European countries have proposed an International Project to the Lifelong Learning Programme, Action ERASMUS Modernisation of Higher Education, to make institutions more attractive and more responsive to the needs of the labour market, citizens and society at large. One of the main goals of the project is to attract students to math through high-quality instructional units in an understandable, exciting and attractive way.

Keywords: Higher Education, Mathematics, Lifelong Learning Education, Bologna Process

1 WHY THIS PROJECT?

The origin of the project, Motivating Math with Moodle (MMM), comes from the reality of a needed cooperation between Higher Education (HE) institutions to increase the rate of success in maths or related subjects. To work on that a research for European partners was done. The selection criteria for participants was geographical, since we had in mind strategic points in Europe to provide institutions from the Western and Eastern Europe and EU candidates (Turkey), to have a wider and more complete experience, and of coexistence of different types of institutions: Polytechnics, Universities, Colleges, Business schools Public and Private owned.

Having found a variety of interested partners and after having initial on-line communication, a preparatory visit was organized in January 2010 in Oporto city.

During the meetings held it became clear that we had to focus in more than one aspect as all of us also dealt with the lack of competencies on basic Mathematics present in our students.

Therefore we should reconsider new strategies in the mathematics educational field.

We all realized that new technologies offer large possibilities of teaching and learning, and although there are different studies about its importance in the educational system, we believe that there is a gap between such thinking and the reality in HE institutions, and that is why we realized that there is a need to:

1. Update the methods of training in Mathematics;
2. Present the teaching contents of Mathematics in a more attractive way using ICT;
3. Facilitate students' mobility and lifelong learning.

Mathematics is a fundamental part of all educational systems.

With the Bologna Process, which brought a lot of implications for teaching higher education institutions, it became necessary to think about lifelong learning from an European point of view.

Share experiences and pedagogical methodologies from different mathematics expertise, from Western to Eastern Europe and EU candidates (Turkey), appear to be a good idea to enhance mathematics' skills. Evolving students from several countries, the project also promotes student mobility (i.e. ERASMUS).

One of the most important goals of the project is to attract students to math through high-quality instructional, in an understandable, exciting and attractive way. Therefore we will use the Moodle platform as a technology that offers large possibilities for teaching and learning. European institutions (e.g. ODL Liaison Committee) encourage the use of such new technologies. Moodle is an open source product that is used by many institutions worldwide. It offers a big set of "learning activities", can be used as a database and has the capability of using quizzes for the assessment. Students can have unlimited access to the platform and receive at all time the information provided by their teachers. Through its dynamic, Moodle creates opportunities to enlarge the autonomy and improves self-learning attitudes.

The main result of this project is increase the Math level of the students and their rate of success.

Therefore, the project develops didactical concepts of different types of math. By sharing these materials, the project will harmonize education in math in HE Institutions and facilitate student mobility.

For these all reasons we decided to submit the project to the Lifelong Learning Programme (LLP), Sub-programme ERASMUS, under the action Multilateral Projects, sub-action ERASMUS Modernisation of Higher Education.

2 THE LIFELONG LEARNING PROGRAMME (LLP)

The Lifelong Learning Programme – **LLP**, aims to contribute through lifelong learning to the development of the EU as an advanced knowledge society, with sustainable economic development, more and better jobs and greater social cohesion. In particular, it aims to foster interchange, co-operation and mobility between education and training institutions and systems within the EU so that they may become a world quality reference. In this way, it addresses the modernisation and adaptation of education and training systems in the participating countries, particularly in the context of the strategic Lisbon agenda goals, and brings European added value directly to individual citizens participating in its mobility and other co-operation actions.

The programme's specific objectives [1] are mentioned below in the "Table 1". They ensure that the LLP supports and supplements action taken by the Member States and other participating countries, while fully respecting their responsibility for the content of education and training systems and their cultural and linguistic diversity.

The **LLP** will run for seven years (2007-2013).

GENERAL OBJECTIVE	<ul style="list-style-type: none"> – To promote interchange, cooperation and mobility between education and training systems within the Community so that they become a world quality reference
SPECIFIC OBJECTIVES	<ul style="list-style-type: none"> – To contribute to the development of quality Lifelong Learning, to promote high performance, innovation and a European dimension in systems and practices in the field – To support the realisation of a European area for Lifelong Learning

	<ul style="list-style-type: none"> - To help improve the quality, attractiveness and accessibility of the opportunities for Lifelong Learning available within Member States - To reinforce the contribution of Lifelong Learning to social cohesion, active citizenship, intercultural dialogue, gender equality and personal fulfilment - To promote creativity, competitiveness, employability and the growth of an entrepreneurial spirit - To promote language learning and linguistic diversity - To contribute to increased participation in Lifelong Learning by people of all ages, including those with special needs and disadvantaged groups regardless of their socio-economic background - To support the development of innovative ICT-based content, services, pedagogies and practices for Lifelong Learning - To reinforce the role of Lifelong Learning in creating a sense of European citizenship based on understanding and respect for human rights and democracy, and encouraging tolerance and respect for peoples and cultures - To encourage the best use of results, innovative products and processes and to exchange good practice in the field covered by the Lifelong Learning Programme, in order to improve the quality of education and training
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Table 1: Programme's Objectives

3 ERASMUS - MODERNISATION OF HIGHER EDUCATION

Higher education needs to change in order to play its full role in the Europe of Knowledge and contribute to the Lisbon Strategy for Growth and Jobs [2]. Modernisation of HE is essential in the areas of curricula (Bologna process), supporting and governance so that higher education institutions can face the challenges posed by globalisation and contribute in fact to the training and retraining of the European workers. Aims at giving a new impulse to the modernisation of higher education systems in Europe in order to make them more coherent and responsible to the needs of society today.

The Lifelong Programme priorities of the modernization of higher education are:

1. strategies for modernising curricula, improving governance and optimising funding
2. lifelong learning strategies (linking HE with Vocational Education and Training (VET) provision and certification)
3. enhancing the quality of HEI performance and their accountability
4. improving access arrangements for people with non-formal or informal learning backgrounds
5. enhancing the attractiveness of HE, provision of guidance and information

4 APPLICATION PACKAGE

To submit a project we need to fill in an Application Package, consisting of several elements. The following elements make part of the Application Package:

1. Application form

The application form is organized in 6 sections as follows:

- Part A: Identification of the applicant and other organisations participating in the project
- Part B: Organisation and activities
- Part C: Description of the project
- Part D: Technical Capacity
- Part E: Project implementation / Award criteria
- Part F: Work plan in work packages

2. Detailed financial tables and Work packages summary chart

Standard Excel tables containing details of all planned expenditure (including Third country participation) and revenues as well as a Gantt chart summarising the work packages.

3. Declaration of Honour By the Legal Representative of the Applicant Organisation

4. Legal Entity Form

5 List of associated partners

5 PARTNERS

In table 2 we have the identification of the applicant and other organisations participating in the project.

Acronym	Institution Name	URL
ISCAP	Instituto Superior de Contabilidade e Administração do Porto	www.iscap.ipp.pt
KaHo Sint-Lieven	Katholieke Hogeschool Sint-Lieven	www.kahosl.be
VTU	Visshe Transportno Uchilishte "Todor Kableshev"	www.vtu.bg
VSPJ	College of Polytechnics Jihlava	www.vspj.cz
WSB-NLU	Wyższa Szkoła Biznesu - National-Louis University	www.wsb-nlu.edu.pl
ASE	Academy of Economic Studies from Bucharest	www.ase.ro
INSA-ETEA	ETEA, Faculty of Economic and Business Sciences	www.etea.com/alumnos
UU	Uludag University	www.uludag.edu.tr/

Table 2: Partners

6 CONCRETE AIMS OF THE PROJECT

Taking into account the needs mentioned before we set the following concrete aims and more specific concrete goals.

The general objective of this project is to increase the Math literacy of the students and their rate of success in Mathematics, taking into account that Mathematics is an essential component of all educational systems. The project will serve a number of approximately 30000 students by helping those developing Math skills and consequently increasing their opportunities into job market insertion after graduation.

The specific objectives are:

1. Improving Math skills necessary for graduation of Math and Math-related university courses and for further insertion in the labor market, for 30000 students from partner universities
2. Improving qualifications and competencies of 100 Math teachers from the seven partner universities
3. Institutional integration of resources by developing an interactive electronic platform
4. Development of interregional and transnational partnerships between universities with the aim of helping students achieve a higher rate of success in Mathematic exams.

The project generates positive effects for Math students by:

- a) access to new skills required in the Math courses in universities
- b) improvement of career opportunities through fulfilling current labor market requirements

The project also helps in upgrading the academic skills of the teaching staff involved by:

- a) exchanging experience and best practices
- b) participation in training modules to support the project

7 STRUCTURE OF THE PROJECT MMM

The MMM activities are mainly structured as six work packages

WP 2 - Development of a project website

WP 3 - Creating guided lessons

WP 4 - Creating Online Tests (Diagnostic Tests, Assessment Tests)

WP 5 - Audiovisual Learning Materials

WP 6 - Audiovisual Learning Materials

WP 7 - Try-out (with students)

Additional work packages are meant to provide overall steering of activities for evaluation of the project, for concerted dissemination, exploitation and for the administrative management of the project:

- Project management is captured in WP 1, which is responsible for the overall coordination.
- WP 8 - Dissemination Strategy
- WP 9 - Exploitation Plan
- WP10 - Quality Assurance

<p>Project Management</p>	<p>The project manager will</p> <ul style="list-style-type: none"> - be responsible for the overall planning and monitoring of the work of the consortium and will track deliverables and be responsible for the management and progress reports, cost statements and for the final report. - be responsible for scheduling and organising meetings, for producing agendas and minutes and coordinating and, if necessary, circulating, discussion papers for the management meetings. - maintain an online archive of project documents and information (partner's only section on the website), continuously accessible for the participants. - maintain the directory of email addresses and contact points for project partners.
<p>Development of a project website</p>	<p>MMM website will be developed by Institute of Accounting and Administration of Porto. It will have a partner's only section and a public section. The member area will not only be used for communicating results and information sharing between the working groups, participants and coordinator, but also will serve as a repository for news releases and information materials.</p> <p>There will be a common platform in English</p> <ol style="list-style-type: none"> 1. Moodle framework 2. Contents proposed also in different languages 3. Different uses and levels <p>All partners, a community of teachers of</p> <ol style="list-style-type: none"> 1. Mathematics 2. Applied mathematics <p>will go to develop Math material in English and put it in MMM website, creating a big database of Math contents.</p>
<p>Creating guided lessons</p>	<p>All partners will go to use LAMS (Learning Activity Management System) and Moodle integration, an open source software package, for designing, managing and delivering sequences of online collaborative learning activities, to develop online guide lessons. These activities can include a range of individual tasks, small group work and whole class activities based on both content and collaboration.</p> <p>In the lessons development we will use the best way to organize the material so that the sequence keeps the students on track, and allows them to develop successful learning strategies so that they perform well in their outcome assessments. Moodle makes it easy to select, incorporate, and organize our content. Moodle also helps us lead students through the material in a way that will maximize the chances of them finishing the course and successfully achieving learning outcomes.</p> <p>At least will be developed 16 Guided Lessons around different fields</p> <ul style="list-style-type: none"> • Common core material (one variable calculus, geometry and linear algebra, basic statistics) • Level 0 (pre-requisites in algebra and geometry) • Supplementary materials (e.g. several variables calculus, series, differential equations, financial mathematics)
<p>Creating Online Tests (Diagnostic Tests, Assessment Tests)</p>	<p>All partners will use Moodle, an open source software package, for develop online questions.</p> <p>In the questions development we will use the best way to organize the material so that the sequence keeps the students on track, and allows</p>

	<p>them to develop successful learning strategies so that they perform well in their outcome assessments. Moodle makes it easy to select, incorporate, and organize our content. Moodle also helps us lead students through the material in a way that will maximize the chances of them finishing the course and successfully achieving learning outcomes.</p> <p>Moodle's quiz module has a large number of options and tools. For example, quizzes with different question types can be randomly generated from categories of questions. Students can be allowed repeated attempts at a question; they can also be allowed to retake a quiz multiple times.</p> <p>There are different scoring options available for each type of quiz and each question type.</p> <p>If we ask good questions, we'll get useful data about our students' performance and understanding of the material.</p>
Audiovisual Learning Materials	<p>Audio and video information is extensively used in supporting teaching and learning. At the simplest level, all lectures, tutorials, workshops, seminars, convey considerable information through these media. However these sources of information and learning experiences have typically required attendance by the student at a physical location and a specific time.</p> <p>In this work package will be developed some Audiovisual Learning Materials.</p> <ul style="list-style-type: none"> - Developing the appropriateness of various Mathematics audiovisual learning materials in view of the learning objectives - Integrating the created learning materials in the project website.
Translating all material	<p>Each partner will choose the materials which best fit for their courses and translate the English version of those into their native language. All partners will do a technical translation: importing the modules into their Moodle Platform or Blackboard System. As soon as a module is translated, it will be put on the website of the project and in the Moodle platform of each institution, enabling a team of academics/students from each institution to give feedback and formulate suggestions for better translations, if necessary.</p>
Try-out (with students)	<p>The goal of this WP is to test the methodology providing a feedback and validation. Each partner will choose the produced materials which best fit for their courses and translate the English version of those into their native language. All partners will do a technical translation: importing the modules into our Moodle Platform or Blackboard System. As soon as a module is translated, it will be put on the website of the project and in the Moodle platform of each institution, then a team of students will assess the Online Guided Lessons and the Online Tests. Tests will be carried out on newly developed system.</p>
Dissemination Strategy	<p>The aim of this work package is to promote, present and disseminate the project and its results and to foster the transfer of the knowledge thereof. The target groups for dissemination will be:</p> <ul style="list-style-type: none"> • Students of each institution (Starters at Higher Education Institutions, Home students, Distance students, ERASMUS students, Lifelong Learners) • Professors • Scientific community • National educational authorities

<p>Exploitation Plan</p>	<p>Partners will work on mainstreaming and multiplying project results to appropriate decision makers, target groups and individual end users:</p> <ul style="list-style-type: none"> • designing the exploitation strategy and plan • conceiving and selecting exploitation tools (leaflets, posters, workshops, press releases, information at conferences, information via online networks, mailing list, newsletter, multilingual website) • performing effective exploitation activities • Using the materials developed in the project. Materials developed in MMM will be used by partner universities for teaching future generations, the electronic platform developed in the project will be integrated by each partner institution, will be expanded by adding materials and continuously updated
<p>Quality Assurance</p>	<p>An independent external evaluator will be subcontracted to monitor project progress, quality and timing of project deliverables by reading the documents on the project website and by contacting partners. He will push all the partners to keep to the deadlines they agreed on and to produce high quality output.</p>

Table 3: Work packages

8 TARGET GROUPS

The short term target groups are:

1. Students of each institution
 - Starters at Higher Education Institutions
 - Home students
 - Distance students
 - ERASMUS students
 - Lifelong Learners

Students with weak preparation or without consolidated basis in Mathematics fields wanting to improve their basic knowledge and overcome their difficulties in Mathematics.

2. Teaching Staff

The teaching staff is selected by the partner institutes/universities according to their professional qualities and those required in the project.

3. Technical/media staff

The technical staff is selected also by the partner institutes/universities. Involvement is secured also by providing them with a special training to upgrade their competences to produce international Math learning materials.

Long term target groups after project:

- One of the project objectives is the integration of project results in their institute/university, which implies that the students of the each partner institution will be the future target groups.
- Moreover the partners want to disseminate the project to other interested Higher Education Institutions and also High Schools whose students can also participate in this international project.
- The Teachers of Mathematics from High school remain an important target group, for after all, this international project can assist them in 'doing a better job'. Input from these teachers in the continuing process of curriculum development is a necessity as well as providing them with opportunities for re-training and upgrading in the future.

9 CONCLUSION

The project will promote students mobility (i.e. ERASMUS) and contribute towards university excellence and competitiveness within the Higher Education system in the European countries. Developing a common set of didactical concepts and teaching materials will harmonize education in Mathematics in the partner universities. Using a high-quality instructional units in an understandable way in a large range of math subjects and areas will facilitate students mobility giving an opportunity to the students for learning math sciences of one and the same level in different universities. The common database for training (guide lessons, quizzes, tests, etc.) will put together the assessment criteria in Mathematics for the students at the partners. An important advantage is applying a free platform for e-learning Moodle, excluding the need of special software. Spreading over wide range of math subjects will make easy applying ECTS for the math courses included in the teaching agreement for the ERASMUS students. Moreover, outcomes of the project developed in eight European languages will help the dissemination of the results of the project.

The added value for a student enrolled in studying mathematics after MMM will be new skills and abilities for working on an interactive learning system. The effectiveness of the project could increase in case the model of the project is applied for training of students in other subjects besides Mathematics.

REFERENCES

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