

# **EVLM pilot project - European challenges in on-line teaching and learning of mathematics**

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**Key words:** *e-learning, virtual laboratory, interactive mathematics*

## **Abstract:**

*We present the key ideas, aims and results of the Leonardo da Vinci pilot project EVLM (European Virtual Laboratory of Mathematics), SK/06/B/F/PP - 177436.*

## **1 Introduction**

The total invasion of computers and ICT, combined with the power mathematical software provoke radical changes in methods of teaching and learning mathematics. This is pursued of some negative trends in education not only in Europe but all over the world in particular, a declining level of mathematical knowledge among secondary school graduates and first years university students and unattractive outdated traditional ways of teaching mathematics. The general needs that could be traced here include: to upgrade the overall level of mathematical knowledge, to promote innovative methods in teaching Mathematics, as e-learning, usage of interactive computer algebra systems, on-line consultancy and other blended solutions, to improve the quality of teaching and training materials for mathematics and others.

The European Virtual Laboratory of Mathematics (EVLM) is a European pilot project in the Leonardo da Vinci programme of the European Commission scheme for Education and Science, which is focused on the above-mentioned needs in vocational education and training. We present here the main aims and results of the project achieved so far.

## **2 Presentation of the EVLM project – aims and ideas**

The aim of EVLM is to promote better understanding and utilization of mathematical knowledge, to promote e-learning in Mathematics, to provide solutions for different target groups and help for teachers and trainers to enhance their skill in using the most advanced educational tools and environments. EVLM aims to provide a range of online resources to support and enhance the teaching of mathematics in secondary schools and higher education and to help the research needs of individuals in a number of areas including mathematics, statistics and mathematics education [1].

EVLM is designed to comprise of a network of seven National Centres of Mathematics located at seven partner universities throughout Europe with the partnership of two non-governmental organisations. The project team consist of the coordinator: Slovak University of Technology in Bratislava (Slovak Republic) and partners: University of Plovdiv, Faculty of Mathematics and Informatics (Bulgaria), University of West Bohemia, Faculty of Applied Sciences, Plzeň, (Czech Republic), Miskolc University (Hungary), University of Limerick (Ireland), University of Salamanca (Spain), Faculty of Informatics and Computing, Coventry

University (United Kingdom), Tullossilta (Finland) and Slovak Society for Geometry and Graphics (Slovak Republic).

The main structure of the EVLM includes a Central portal and eight National portals, hosted in the respective national languages. The portals provide a virtual database of mathematical resources and e-learning materials available from the partner institutions and other sources such as previously EU funded projects. In addition, the National Centres offer consultancy services to those wishing to learn about the latest results in mathematics and mathematics teaching.



Fig. 1. The welcome webpage of the EVLM Central portal.

### 3 The EVLM results

The EVLM pilot project started on October 2006 and will end on October 2008. The partners successfully reach the planned expectations. At the end of the first year the Central Portal and partner's National portals of the EVLM structure were established. The EVLM National Centres of Mathematics opened their consultation offices.

Central Portal provides basic information about mathematical materials available in the EVLM Central Database. Information such as the subject, the topic covered within each subject category and relevant file types is provided to make navigating the Central Portal easier. The EVLM Central Database and National Databases provide free access to different e-learning educational materials in mathematics covering different subject areas such as: Fundamental Mathematics, Algebra, Calculus, Geometry, Optimisation, Numerical Analysis, Probability and Statistics, History of Mathematics, Maths Games etc. Within each mathematical subject area a selection of frequently asked consultation topics (FACTs), reusable learning objects (RLOs), related problems and modules is provided to facilitate easier navigation within the database. On-line calculations and search engine is provided in English, as well other interactive e-learning materials in Mathematics, performed by WebMathematica, GeoGebra and relevant mathematical software [1].

Illustrations of a part of some educational e-learning materials, made by Mathematica and SciWriter are shown in fig. 2 and 3.

**Решение :**

**Дефинираме функциите по правилата на система Mathematica :**

```
f[x_, y_] := 2 * x^3 - y^2 - 1.
g[x_, y_] := x * y^3 - y - 4.
```

**Построяваме графики на двете функции и на равнината Оху в някакви интервали за x, y, например  $x \in [-2, 2]$ ,  $y \in [-4, 4]$  :**

```
g1 = Plot3D[f[x, y], {x, -2, 2}, {y, -4, 4}, ViewPoint -> {-1., -3., 1}, ColorFunction -> Hue]
g2 = Plot3D[g[x, y], {x, -2, 2}, {y, -4, 4}, ViewPoint -> {-1., -3., 1},
ColorFunction -> (Hue[1 - #] &)]
(* (Hue[1 - #] &) е инверсно оцветяване *)
g0 = gf = Plot3D[0, {x, -2, 2}, {y, -4, 4}, ViewPoint -> {-1., -3., 1}, ColorFunction -> Hue]
```

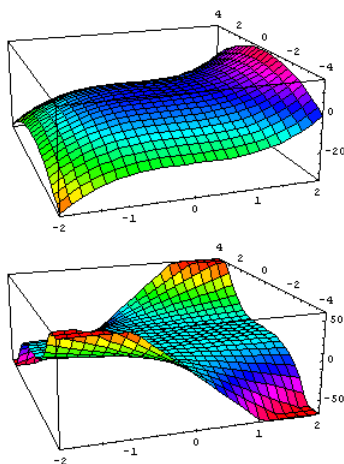


Fig. 2. The top of an example with *Mathematica*, which help in graphical localization of the real roots of a system of nonlinear equations (in Bulgarian).

In addition, two didactic guides for teachers of mathematics and students of mathematics are provided to act as standalone resources to aid in either the teaching or study of mathematics. The translated versions of the two guides in relevant national languages are also provided in the partner's National portals. The Teacher's Guide contains a few chapters, devoted to different aspects of e-learning, some chapters with introduction to basic interactive computer algebra systems, such as Maple, MathLab, Mathematica, Derive, etc. The description of software packages for preparing on-line e-materials as WebMathematica and GeoGebra are

also provided. The Student's Guide is mainly oriented for application of computer algebra systems in solving problems of differential equations, statistics, calculus, etc.

Electronic forms for the submission of an online consultancy request as well as a users' feedback questionnaire to support evaluation of the portal's quality are also available.

## Interoperability with Mathematica

### Copy and Paste from SciWriter to Mathematica

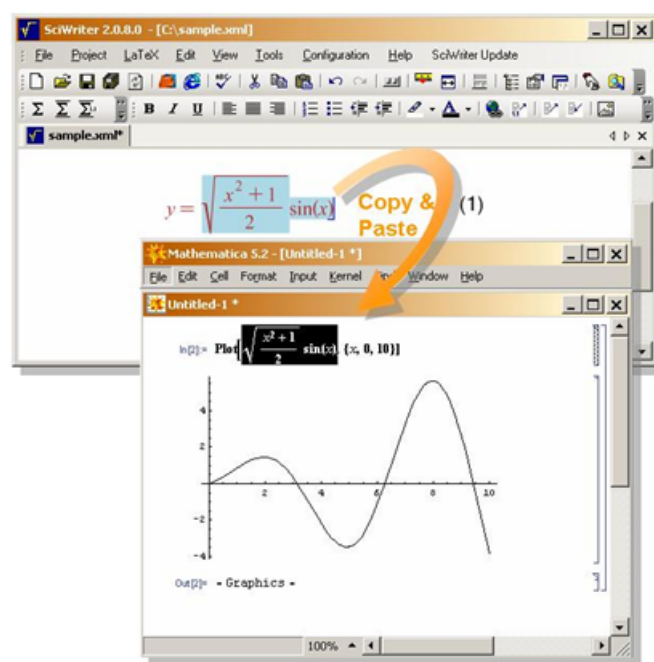


Fig. 3. A part of XML file, about the use of MathML coding in web pages.

## 4 Conclusion

The results of the EVLM project has an impact on the teaching and learning mathematics in all partner's institutions. Especially to introduce a change into the education of mathematics, to raise the awareness about the existence of new training methods and enhance competencies of educators, teachers and tutors, to enhance the role of mathematics in the general education.

### References:

[1] <http://evlm.stuba.sk>

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