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MATHEU: Identification, Motivation and Support of Mathematical Talents in European Schools

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Abstract. In many European schools the mathematics curriculum is designed to serve the average and special needs students without identifying and supporting potentially talented/competent students in mathematics. The aim of this project is to develop methods and educational tools, which will help the educators to identify and motivate talented students in mathematics as well as to support their development within the European Community without any discrimination. The project intends to merge forces and establish a network through the Mathematical Societies and universities in the European area to support the aims of the project as well as to use new technologies in the support, dissemination and sustainability of the developed structure of cooperation. MATHEU is a new approved project under Socrates-Comenius 2.1 action with characteristic activities that are expected to enhance the learning of mathematics in the European region as described above. The presentation will discuss the philosophy, aims and objectives and the work plan of the project and will invite interested individuals and organizations to support the aims of the project.

1. Introduction

The decision of the European Union, COM/2001/678 says, "In a society of knowledge, Democracy requires the citizens to have scientific and technological knowledge as part of the basic competence"

The future objective aims of the European Educational Systems, which was agreed on 12 February 2001 from the Education Council in Stockholm, identify Mathematics as one of the major priority subjects. The basic objective is the increase of interest in mathematics from early age and the impulsion of youth to follow careers in these subjects, more specifically in the research in these fields.
The types of students who will be able to contribute in the research of these fields are more likely to be students who are talented in these fields and more specifically in mathematics.
Certain activities towards this objective are already taking place in some countries. The aim of MATHEU is to bring together experts from the partner countries and to exchange ideas, background knowledge and experience and to develop together a system that will work for the whole of Europe.
Talented students in mathematics have to be discovered in early stages and in a systematic way. The usual method for identifying such students is through competitions but it is generally acceptable that many talented students in mathematics

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are never discovered simply because they do not participate in competitions or simply because they were not among the top ten during the competition process or talented students who cannot perform under strict time limits.

European countries have to find ways to keep their talents and brains in Europe. In order to accomplish this, mathematicians, academicians and educators have to work together in a European dimension and to design a programme, which will change attitudes of governments, universities and foundations in favour of supporting the gain of mathematical talents in Europe and decreasing the brain drain outside the European Community. Talented students need attention, love, support, training, recognition, identification. MATHEU promises to offer solutions to all these for the development of European talented students through their teachers, educational administrators and other bodies-organizations-institutions-government, as well as through the direct links via the Internet.

2. Aims and objectives

The aim of MATHEU is the development of methods and supporting material for the identification of talented students in mathematics in European Schools and their development and support. The project aims to establish a network of sustainable support through universities, mathematical societies and foundations of the partner countries at first and later throughout the European community at large.Teachers in Europe need to be trained with methods and to be provided with material in order to be able to identify and support such talented students.The main objective is to help Europe to gain the maximum contribution to and from these students, who will become the backbone for the scientific and technological knowledge necessary to make Europe the major technology developer and economic power in the years to come.These aims and objectives will be accomplished by:

- Analysis of the flexibility of existing mathematics curricula in European Schools with emphasis in the partner countries focusing on the aspect of talented students
- Analysis of methods and tools used in European countries for the identification, motivation and support of talented students in mathematics
- Design methods and tools for identifying potentially talented students in both primary and secondary education levels and for training teachers so that they can bring the students to express their 'talent' in mathematics (talent as ability to face and solve problematic situation and to appreciate the role of theoretical thought)
- Design special pedagogical methods and subject material for the development and promotion of talented students in European schools
- Develop methods/solutions and a programme for changing attitudes within government , universities and foundations in providing fellowships and support in order to keep mathematical brains in Europe
- Design a special Web-site devoted to this purpose which will enable the sustainability of the project aims

To achieve the above a team of European mathematicians, experts in either Didactics or Subject or Technology has been assembled to address the problem in an integrated and coherent manner.Developing a unified European training programme that offers tools for identifying, motivating and supporting talented students in mathematics is a new approach, which can be used complementary to the existing curriculum systems in the European community without any discrimination. In addition, using new technologies to provide sustainable support for a group of students with high competence in a particular topic is a recent development. Keeping mathematical talents in Europe through a "brain-gain effect" is also a new philosophy and approach. Also, part of the work will investigate the problem of mathematics talented students with learning disabilities, which currently lacks investigation.We see mathematics educators as educators able to practice the teaching in either a mixed ability environment or in a selective environment. Regardless of the environment, mathematics educators need to have the necessary tools and skills in order to evaluate the competence of their students and to be able to encourage, motivate and support the development of those who appear to be strong in subject areas such as mathematics. Educators with such developed skills will achieve higher methodological standards. The project is also investigating the problem of "talented students with learning disabilities".

Specifically, MATHEU seeks to develop a programme emphasizing the role of the teachers in:

- Identifying mathematical talent through a range of measures that go beyond traditional standardized tests. Measures should include observations, student interviews, open-ended questions, portfolios, and teacher-, parent-, peer- and self-nomination. Recognition should be made of the fact that mathematical talents can be developed; they are not just something with which some students were born.
- Presenting interesting tasks that engage students and encourage them to develop their mathematical talents.
- Improving opportunities for mathematics learning and a much more challenging, nonrepetitive, integrated curriculum which is needed to help students develop mathematical talents. Students must be challenged to create questions, to explore, and to develop mathematics that is new to them. They need outlets where they can share their discoveries with others.
- Encompassing a variety of methods including differentiated assignments, a core curriculum, pull-out programmes, in-class programmes, magnet schools, and extracurricular activities such as after-school or Saturday programmes, mentorship programmes, summer programmes, and competitions.
- Improving the ways in which students learn mathematics. Teachers must become facilitators of learning to encourage students to construct new, complex mathematical concepts. Students must be challenged to reach for ever-increasing levels of mathematical understanding.

3. Target Groups

All mathematics educators at all educational levels (primary and secondary) associated with the partner institutions will directly benefit. Educators in other areas may also benefit as the methods and tools for identifying mathematical talented students could also be used to identify talented students in other subjects. Through the dissemination process individual educators from all countries in the European Community and beyond as well as educator staff of educational authorities will benefit from the outcomes of MATHEU through their participation in the training course to be offered under Comenius Action 2.2. Finally, the largest group to benefit is the European Community's potentially talented/competent students in mathematics

Target group 1: Teachers/Teacher trainers/Teacher trainees
MATHEU will allow the individual non-gender biased, to develop knowledge on pedagogical methods, use of tools appropriately to support different levels of students.

Target group 2: Educational administrators/Inspectors
In addition to the above listed impacts this target group will become better curriculum developers, will raise the quality of their teacher support, improve their own background in the needs of the topic and will gain an educational tool.

Target group 3: Educational Psychologists/Counsellors
Nowadays, educational establishments involve educational psychologists and counsellors and therefore MATHEU has to provide for these educators as they play a very important role in the educational development of all types of pupils and students. Counsellors could become the catalysts for the "brain-gain effect" in Europe through their counselling to the students.

4. Outputs of MATHEU

The outputs of the MATHEU project are listed below:

- A Tool that identifies talented/competent students in mathematics at two different age levels Methods/Activities for motivating potentially talented/competent students in mathematics
- A European Manual and CD-Rom, which will contain the tool above together with material needed to support the development of such students. The Manual will be initially translated in seven languages, English, German, Greek, Italian, Bulgarian, Czech and Romanian.
- A Course Design in English for teacher trainees and teacher trainers for primary and secondary levels for the target age levels using the tool, methods and the manual mentioned above
- An Information and Dissemination Symposium for administrators-government decision makers, for university enrollment managers-deans-representatives, for presidents-representatives of Foundations and Societies

- The MATHEU Web-site, designed to provide sustainable communication between the partners and to provide support to talented students in mathematics as well as to mathematics educators of different levels. The site will initially support the languages of the partner countries.

5. General remarks

The recent developments of the project suggest that Identification, Motivation and Support (IMS) are divided in two age groups, the 9-14 age group and the 15-18 age group. For each age group a number of topics were agreed as a basis for IMS development. It was agreed to use the idea of a curriculum and level of difficulty ladder for each topic. A group of experts is now developing these ladders which will then be evaluated and will constitute the basis for Identification. Motivation elements have been discussed and are circulated among the partners of the project to evaluate in their own countries and to try to finalize them by the end of 2004. Support materials have been collected for different topics and will be developed further in connection with the final form of the ladder in each topic and at each age level.

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www.schoolnet.ca
www.mathpropress.com/mathCener.htm
www.enc.org/topics/inquiry/ideas

Specific Websites
MATHEU website: http://www.matheu.org
The National Research Center on the Gifted and Talented (NRC/GT) http://www.gifted.uconn.edu/nrcgt.html
Johns Hopkins University: The Center for Talented Youth (CTY)
http://cty.jhu.edu/
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