



Extended Abstract

GeoMaTech: Integrating Technology and New Pedagogical Approaches into Primary and Secondary School Teaching to Enhance Mathematics Education in Hungary

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Abstract

During the past decades, technology has been becoming an integral part of everyday life and slowly shaping mathematics and science teaching and learning (e.g. Heid & Blume, 2008). Although there have been enormous investments on educational technologies in many countries technology has yet to make a sizable impact on education (e.g. Drijvers et al., 2010). On the one hand students are becoming increasingly proficient users of technology while on the other hand opportunities offered by technologies have still little been utilized. Nevertheless, as technologies are becoming more integrated into education, they are providing new opportunities for pedagogical approaches and classroom organization. For example, mathematicians stated that they use technology because in this way they can more easily treat students as mathematicians and nurture their knowledge through discovery and experimentation (Lavicza, 2010). To utilize the opportunities technologies offer we developed a large-scale project, GEOMATECH (<http://geomatech.hu>), in Hungary integrating teaching traditions of the country as well as good practices from around the world.

Many Hungarian mathematicians, scientist and mathematics educators have a world-wide respect. In addition, mathematics education theorist and practitioners; among others George Pólya, Zoltán Dienes, Imre Lakatos, Tamás Varga; are often quoted as great innovators and founders of modern

theories and practices in mathematics education. In the GEOMATECH project, we are developing new approaches for technology integration into Hungarian schools utilising Hungarian teaching traditions, successful international examples, and experiences of Hungarian teachers. The GEOMATECH project (owing to the generous 8million Euro EU Funding, TÁMOP-3.1.12) is developing high-quality teaching and learning materials for all grades in primary and secondary schools in Hungary (<http://tananyag.geomatech.hu/>). These materials (1200+ Mathematics, 600+ Science) will be embedded into an on-line communication and collaboration environment that can be used as an electronic textbook, a homework system, and a virtual classroom environment. In addition to material development, we are offering 60-hour professional development courses for more than 2400 teachers in 800 schools in Hungary. Furthermore, we are organizing a wide-range of teacher and student activities including competitions, maths and science fairs, and developing a network of schools for the long-term sustainability of the GEOMATECH project. The technology background of the project is offered by GeoGebra (<http://geogebra.org>), which is an open-source, dynamic mathematics software widely used around the world.

The accredited GEOMATECH courses including both mathematical and natural scientific modules and are intended for primary and secondary school teachers, covering all K-12 levels. The training takes place in small, 10-12 person groups. The most important goals of the course that the participants familiarize themselves with the GEOMATECH education materials in order to implement them successfully in their own teaching practice, and also to learn the advantages that new technologies can offer to their teaching. The training focuses to three main areas:

- Geogebra in education: to become able to design own Geogebra applications.
- Familiarizing with the GEOMATECH materials and preparing to use them in everyday-work.
- Learning and practicing new pedagogical approaches (<http://komplexinstrukcio.hu>), developing IT competences, studying methods for experience-centered mathematics education (www.experienceworkshop.hu). The mathematical training is based on problem-based approaches and the natural scientific modules are supporting inquiry-based learning.

GEOMATECH offered not only teacher training and development programs. GEOMATECH launched national student competitions to support the dissemination of GEOMATECH materials and to motivate and inspire Hungarian students living inside and outside the borders of Hungary. The organizers of the competitions prepared tasks for six different age groups, between 6-18 years. Groups of maximum 5 students could participate in the competition. There were competition rounds for 9 months, and each round had a central topic.

Competition organizers had to comply with several requirements during the design of the appropriate tasks and problems for the competition:

- Tasks should be complex enough that the teams could work on it for a full month.
- Tasks had to allow everybody to join in, not only the best students in mathematics. Tasks had to be exciting enough for the most gifted students as well.
- Tasks had to be new and interesting to motivate and inspire students to join.
- The use of IT and GeoGebra had to be central in finding the solution to the task. (This was the most difficult to achieve in the case of task design for lower-primary school students.)

In some of the competition rounds, instead of solving traditional mathematical tasks and problems, students could create various kinds of compositions by the toolkit offered by the GeoGebra software. In many cases, during the solution of these creative tasks, participants mobilized much deeper mathematical knowledge than they would have done in the case of a traditional mathematical task or a problem. Many of the solutions illustrate GeoGebra's high potential in creating representations of various connections between mathematics and the arts.

In the framework of our presentation, besides introducing GEOMATECH, we will compare it to other large education development projects from the Central-European region, which are using GeoGebra, such as the Slovakian EMATIK projects (Dillingerová & Koreňová, 2007).

References and Notes

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