Deliverable 8.6: Web-based networks with other projects

8.6.1 Important related links

Here are some links to current and recent projects related to the activities of InnoMathEd:

- Math to Earth Project - http://www.km.fpv.ukf.sk/math2earth/
- Unite project: http://www.unite-ist.org/
- ShareTec - Sharing Digital Resources in the Teaching Education Community Project http://www.share-tec.eu/
- http://math.fau.edu/yiu/geometry.html (a link suggested by Dr. Gunetcho Skordev, Bremen University after the workshop in Ohrid)
- Innovative Didactics via Web Based Learning (IDWBL) http://wad.fmi.uni-sofia.bg/wad/

Links to InnoMathEd are envisaged to be inserted in the websites of ShareTec and Innovative Didactics via Web Based Learning

8.6.2 Papers referring to the InnoMathEd


- Boytchev, P., Bridging the Gap between Abstract Math and Reality. In Proceedings (CD) and Book of Abstracts (hardcopy) of the 7th Pan-Hellenic Conference with International Participation “Information and Communication Technologies in


- **Boytchev, P.,** *Re-experiencing Engineering Inventions within a Modern Virtual Environment*. The 2nd International Conference Software, Services & Semantic Technologies (S3T 2010), Varna, Bulgaria, September 11-12, 2010


- **P. Boychev,** *Reincarnations of Mandelbrot set,* Mathematics and informatics, vol. 4, p. 21


- **Chehlarova, T.,** Explorations in mathematics education by dynamic software simulations, in Education in the information age, Plovdiv, 27-28 May, 2010, pp. 205-212 , ISSN 1314-0752

- **Chehlarova, T., D. Dimkova, E. Sendova,** *Are five days enough? What about five hours?* Mathematics and Informatics, vol. 3, p. 3 (in Bulgarian)

- **Chehlarova, T., E. Sendova,** Variety in the similarities, Mathematics and Informatics, vol.4, p. 3. (in Bulgarian)

- **Chehlarova, T.,** Experiments with compositions of congruences in 8th grade, in the proceedings of Reflection and synergy in mathematics education, Bachinovo, 2010

- **Chehlarova, T., D. Dimkova, E. Sendova,** Air trackers with GeoGebra (Mathematical fairy tale about the falling ladder), Mathematics and Informatics, vol. 6, 2010, p. 3. (in Bulgarian)

- **Dimkova, D., E. Sendova,** About the newest (but not forgetting the not so new) in mathematics education, Mathematics and Informatics, vol.1, p. 3. (in Bulgarian)

- **Dimkova, D.,** *20 Years Later – Inquiry Based Learning Again*, in: Mathematics Education with Technology -Experiences in Europe Tamara Bianco. Volker Ulm (Ed.) University of Augsburg, Augsburg, 2010. ISBN 978-3-00-032628-8
- **Gushev, A.,** *Dynamic mathematics for everybody.* Mathematics and Informatics, vol.4, p. 15 (in Bulgarian)


- **Kuncheva, D.,** *Let’s not be shy to experiment,* Mathematics and Informatics, vol.6, 2010, p. 3. (in Bulgarian)

- **Pehova, Y.,** *The history of a project (... or how GeoGebra helps in difficult situations),* Mathematics and Informatics, vol. 5, pp. 2-13

- **Petrova, D.,** *Dynamics on the screen and among the students,* Mathematics and Informatics, vol.3, p. 11-14 (in Bulgarian)


- **Sendova, E., T. Chehlarova,** *Breathing life back into inquiry-based learning of mathematics,* Mathematics and Informatics, vol. 5, p. 3-10 (in Bulgarian)

Deliverable 8.7 Conference Contributions

8.7.1 InnoMathEd Workshop organized in the frames of the MASSEE congress, Ohrid, 16-20 September, 2009

The workshop was included in the Congress program and a team of 5 members was in charge of preparing materials for the participants and presenting the InnoMathEd project:

The materials for the workshop included a brochure of didactic scenarios associated with specific computer environments – GeoGebra, Elica Applications (Origami Nets, Cubix Editor, Math Wheel, Bottle Design, Potter Wheel) and GEONExT. All the scenarios were in English (20 copies, 50 pages each, printed in colors).

It was decided to dedicate the workshop on the memory of the late Prof. Ljubomir Davidov, a well-known Bulgarian mathematics educator. The learning environments dealing with geometric transformations in GeoGebra were developed based on his draft materials.

The atmosphere of the workshop was very warm although the room was not conventional for that sort of events

The workshop was opened by Petar Kenderov who presented the InnoMathEd Project to the participants – mathematicians and math educators from Bulgaria, Republic of Macedonia, Serbia, Croatia, Romania, and Germany.

Then Evgenia Sendova introduced the teaching strategies envisaged in the project emphasizing on the learning by doing principle.

Dessislava Dimkova presented her scenarios on Geometric transformation developed in GeoGebra focusing on symmetry and inversion.

Angel Gushev demonstrated possible approaches to solving a math contest problem by means of geometric transformations in GEONExT.

Toni Chehlarova ended the presentations with showing didactical scenarios and possible approaches to problem solving and problem formulating in Elica applications for developing the spatial imagination of students. The topics were: Nets of Archimedean and Platonic solids, Color arrangements in a cube, and a newly developed scenario: Going around rotational solids.

Unfortunately the conditions were not very favorable for hands-on activities since there was only one computer for demonstrations. Still the audience was very active in making interesting proposals and providing food for reflection.
The last day of the Congress the Bulgarian project team attended the workshop lead by Matthias Brandl. He encouraged the audience to use their laptops and thus achieved a good interactivity. The materials spread by Matthias Brandl were very helpful. At the end of the workshop the Bulgarian teacher Angel Gushev presented learning environments developed by students under his guidance by means of GEONExT. The two workshops gave a very good idea of the project as a whole and launched very fruitful ideas for further explorations.

In the workshop organized by Matthias Brandl (left) there was a chance for Angel Gushev (right) to present learning environments based on GEONExT

8.7.2 The Interactive Computer Aided Learning Conference ICL 2009 - September 23-25, 2009, Villach, Austria

Pavel Boytchev presented the paper IT for Innovative Educational Environments: Exploring, Authoring and Programming (in co-authorship) at the Conference ICL2009 September 23 - 25, 2009 Villach, Austria, in which the authors talk about some novel Elica applications in the context of the InnoMathEd project. The paper is published on the project website and in the proceedings of the conference (see 8.6.2):

Pavel Boytchev demonstrating an innovative view on recursion
8.7.3 National conference *Information technologies for a new education*,
30 October, 2009, Sofia

Petar Kenderov and Evgenia Sendova presented the ideas and the current contributions of the *InnoMathEd* project as well as the progress of implementing them in a Bulgarian context. Their presentation was entitled: *About some innovations in the mathematics education – the InnoMathEd project in a Bulgarian context*. The authors offered leaflets about the project to the participants and encouraged them to get in touch for further information and collaboration.


8.7.5 Sixth Congress of the World Federation of National Mathematics Competitions - Riga, Latvia, July 25 -30, 2010

[http://nms.lu.lv/WFNMC](http://nms.lu.lv/WFNMC)

Petar Kenderov delivered a talk entitled: *Higher Ability Students and Inquiry Based Learning in Bulgaria – the Role of European Projects InnoMathEd and Fibonacci*.


P. Kenderov and E. Sendova delivered a talk on the projects *InnoMathEd* and *Fibonacci* under the title *European Projects for Implementation of Innovations in Mathematics Education*

- D. Dimkova presented a talk on *Geometrical Transformations - Innovative Presentation of Classics*.

8.7.7 **XXXIX Spring Conference of the Union of Bulgarian Mathematicians, Albena, Bulgaria, 2010.**

Talks were delivered by:

- **P. Kenderov**: *Innovations in mathematics education: European projects InnoMathEd and Fibonacci*
- members of the Bulgarian *InnoMathEd* team in the frames of the workshop dedicated on the project.
Albena Vassileva presenting another dynamic representation of a parabola

(The details of the workshop are provided in Deliverable 5.1.6)

8.7.8 National Conference Education in the information age, Plovdiv, 27-28 May, 2010

E. Sendova delivered the talk (on invitation) *Challenging the limitations instead of limiting the challenges in the IT education*, which was published in the conference proceedings.

8.7.9. Seminar of CIESE, Stevens Institute of Technology (NJ, USA), 5 August, 2010

Evgenia Sendova delivered an invited talk *On some innovations of mathematics education – a European perspective* to the CIESE team on recent European Projects related to the IT in mathematics education (including InnoMathEd):

(CIESE (http://www.ciese.org/engineering/stevens.html) stands for Center for Innovation in Engineering and Science Education.)


http://my.aup.edu/conference/2010/constructionism

T. Chehlarova and E. Sendova delivered a plenary talk on *Stimulating different intelligences in a congruence context.*
An *InnoMathEd* scenario in the core of a plenary talk – *Constructionism 2010*

Constructionists from all over the world – Paris, France. 17-24 August 2010

*Dynamic mathematics* on the scene – the performers are mathematics educators – *Constructionism 2010*
E. Sendova (with co-authors) presented a talk: *From a “Flap of a Butterfly Wing” to the “Wind of Change”.*

A team of 4 lecturers and 4 students presented their experience within a course on ICT in education embracing the team-work ideas of *InnoMathEd* – Constructionism 2010

**8.7.11 VIII Mathematics Conference, Nitra, 14 September, 2010**

http://www.nmk2010.fpv.ukf.sk/

Evgenia Sendova – delivered a talk: *The beauty in mathematics and the mathematics in the beautiful*, on projects developed by in-service and pre-service teachers under the title’s theme.

**8.7.12 A scientific conference Traditions and Innovations in Education – 24-25 September, Dimitrovgrad**

Katia Chalukova, the chair of the Dimitrovgrad section of the Union of the Bulgarian Mathematicians, opened the Conference and delivered an overview of the teachers’ achievements in the frames of the *InnoMathEd* course in the town (see 5.1.7).

A conference on traditions and innovations is a good platform for presenting the achievements of teachers from Dimitrovgrad who participated in *InnoMathEd* courses
The audience embraced young and older teachers – equally excited about innovations in the mathematics education

Evgenia Sendova delivered a talk on invitation: Innovations in the mathematics education – the European projects InnoMathEd and Fibonacci. Then teachers from the junior-high and the secondary school reported on their most recent experience in implementing InnoMathEd learning environments.

Teachers from Dimitrovgrad presenting their InnoMathEd inspired projects
The InnoMathEd scenario on modeling rotational solids by means of the Elica application Potter’s wheel was an example of a natural integration of real with virtual objects since the participants had the chance of observing a workshop on pottery for young students organized in the local museum. This lead to a discussion of the various possibilities of personalizing the scenarios offered by the Project team.

Not only virtual, but tangible rotational solids were available to the conference participants

8.7.13 Regional Autumn Conference on IT in Education, Burgas, Sunny Beach, 5-7 November, 2010.

T. Chehlarova and E. Sendova presented InnoMathed inspired ideas on Stimulating the creativity of the students. These ideas were put in the context of teaching IT as a separate object for the junior-high school the emphasis being on IT as a means for expressing oneself.

Some impressions of the Bulgarian Project team

In a nutshell, the impressions of the Bulgarian members of the Project team are that the prevailing number of teachers getting familiar with the InnoMathEd are motivated to try out the ideas presented at the workshops and to be involved in implementing, evaluating and possibly modifying the proposed scenarios, as well as in developing some new ones.

The discussions (in formal and informal setting) showed that the question: What software should be used in the math classes and to what extent? doesn’t have a unique answer. It depends on multiple factors including the level of the students and their mathematics and informatics culture. In any case it is the nature of the mathematical problems that matters, and the environment has just an auxiliary role.

The specific options of the computer environment should be used only after the learners have acquired the standard methods for geometric constructions. Thus the learners would realize that the basic geometric constructions or graphs are not a matter of simply pressing a button or selecting a menu option.

In the case of the Bulgarian teachers, the native language is an essential issue and we have published most of our Project materials in Bulgarian.

The activities within the InnoMathEd project have been reported to the traditional seminars of two departments of the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences - Operations Research and Education in Mathematics and Informatics (EMI). A guest lecturer of the Didactical Modeling seminar at EMI, Boyko Banchev, made a A Brief Tour to Dynamic Geometry Software (http://www.math.bas.bg/omi/DidMod/Articles/BB-
dgs.pdf) and provoked a vivid discussion among the participants which is expected to continue with sharing personal experience.

The Department of Education in Mathematics and Informatics at IMI has been appointed to work part of the time on the project (starting on October 15, 2009) by a special order of the IMI Director, Acad. Stefan Dodunekov. Evgenia Sendova (in charge of the Department) has been distributing the tasks among its members, which include

- studying the existing learning environments, posted by the project partners;
- developing new ones;
- implementing some selected scenarios in the teacher training;
- giving (virtual or face to face) feedback to the teachers having attended the Project workshops in relations to their ideas, problems and requests.

The first presentations of teachers’ projects for dynamic mathematics scenarios have demonstrated that teachers still see it as a great challenge to develop original resources (since it is difficult and time consuming). They express great interest in having access to ready-made dynamic constructions, or even to complete lessons that could be used directly or after small modifications. At the same time, the teachers express their appreciation of scenarios relating mathematics in a natural way to other fields – art, dance, nature, architecture, etc.

This explains the direction of our efforts in two main streams:
- embedding lessons from classical math textbooks in HTML structures
- enriching the existing curriculum with scenarios for extracurricular activities

In addition, we encouraged the teachers to use the homework for organizing specific stages of the inquiry-based process. To work actively and on their own is crucial for the learners to achieve the goals behind the inquiry-based learning strategies. The mere demonstrations would never accomplish these goals. The time dedicated to exploring, observing, conjecturing, generalizing and studying special cases will not only lead to a better understanding of the subject matter, but will enhance the thinking and the imagination of the learners, the acquirement of research skills and contribute to a relevant attitude to science in general.

In conclusion, the development of resources making use of dynamic constructions is just an element of the dynamic mathematics education. The discoveries, the representations and the implementation of mathematical objects and ideas could be related to the enhancement of the creative potential of learners by providing appropriate conditions and our on-going efforts are in this direction.

The achievements of the Bulgarian Project team are due to the professionalism and the enthusiastic attitude of all its members – scientists, administrative and technical specialists alike.
The financial team of our Project team

These achievements wouldn’t be possible without the on-going support by the Project Coordinator - the University of Augsburg’s team, who provided an excellent professionalism and leadership.

From the kick-off meeting till the end of the Project the coordinators acted as genuine leaders

Even though it is hard for a single organization or a research team to do very much to affect the overall system directly, addressing the problems of the current educational system with InnoMathEd-like strategies will hopefully influence the situation in the whole country.
Further activities

The Bulgarian InnoMathEd team will continue its efforts even after the completion of the Project by:

- organizing an annual seminar on inquiry-based mathematics learning within the framework of the Spring Conference of the Union of the Bulgarian Mathematicians;
- conducting competitions for teachers developing educational environments for inquiry-based mathematics education;
- developing new educational environments;
- publishing (on a regular basis) related materials on the pages of the most popular mathematics magazines and on the web-site of IMI-BAS (via a bulletin);
- moderating a forum on implementing the inquiry-based learning in the mathematics and informatics education;
- publishing a book (in Bulgarian) with examples of best practices in using dynamic constructions for inquiry-based learning of mathematics;
- working intensively in preparing the next generation of lecturers promoting and disseminating the InnoMathEd ideas country-wide.