Wrocław University of Technology

Faculty of Pure and Applied Mathematics
Hugo Steinhaus Center

Interdisciplinary approach to the mathematical modelling in a high school – an example from Poland

Wojtek Okrasinski

Beggining of the project

Since September 2009 the mathematical modelling experiment is running in the Grammar-School in Rawicz- Sierakowo (Poland)

The project entitled

"Mathematical Modelling as a key to the future - the support of the mathematical education in a grammar-school"

is supervised by the ECMI Teaching Center in the Wroclaw University of Technology.

View of the School

Preparation of teachers for the modelling educational project

It should be emphasized that teachers related to mathematical modelling were prepared for that project since September 2008 (the project has started in September 2009). During one year time they participated at different seminars and modelling activities at the Wroclaw University of Technology

Contacts with ECMI activities

- In August 2009 teachers took part at final presentations of the 23rd ECMI Modelling Week in Wroclaw.
- In October 2010 teachers visited the EMS School on Industrial Mathematics in Bedlewo (Poland). During that visit professor Helmut Neunzert gave a special talk to them entitled:

"Models for industrial problems:
How to find and how to
solve them in industry and in education".

ECMI


Objectives in Opti-TRANS® dispatching algorithm

Aims of the project

The aim of the venture having the form of pedagogical experiment is understanding by pupils of the role of mathematics in contemporary world and in the future the choice of studies in technical universities.

Organisation of the project

The Grammar-School in Rawicz counts all together about 500 pupils from 13 to 16 years old. In present moment in the school there are three class departments with mathematical modelling (one in each age education group). Each class counts 26-28 pupils. selected by some recruitment criteria. For the modelling the class is divided into four 6-7 pupils groups. During one semester every group is realizing one modelling project under supervision of a teacher playing the role of instructor. Every group has different project and different instructor.

How do modelling groups work?

Every semester the pupils composition of modelling group is changed. Every week pupils have one hour obligatory meeting with instructor, but they have free access to the instructor all the time. Pupils exchange ideas concerning the project during their stay in the school and also meet sometimes in the free time. Problems solving by modelling gives pupils an opportunity to develop their own creativity and to work at teams.

Some selected examples of modelling projects 2009-2014

- Setup of projector in classroom in order to displayed image was visible for each person.
- Any advices on wastes litter to the town council? How to reduce wastes litter? When our town will be covered with the mountain of wastes?
- How to reduce the usage of paper sheets in the school during one year?
- Project of the optimal watering system in front of the school

Contacts of pupils with the Wroclaw University of Technology

The Gramma-School is situated 60 kilometers of Wroclaw. But frequently pupils together with teachers vist the Wrocław University of Technology. They participate in the student modelling seminars. Moreover from time to time the University professors give talks in the Gramma-School. There also some meetings between pupils and doctoral students

Young students at the WrUT

Evaluation of the project by pupils

The majority of questionnaired young people say that the choice of the modelling classes was their best decision at the beginning of education at the high school. Only few pupils are of different opinion.

Evaluation of pupils by teachers

- **Teachers instructors prepare notes with remarks concerning every project. This is a very interesting pedagogical material**
- **The most impressive is, that the groups, which realized the full three year modelling programme, pass the final national mathematics tests with the following result: 70-80 % of good answers, when meantime the national average is 45-50 % good answers.**

Main effects of the experiment 2009-2014

- **Problems solving by modelling gives pupils an opportunity to develop their own creativity and to work at teams.**
- **The experiment in the Gramma-School in Rawicz-Sierakowo (Poland) shows that mathematical modelling may be also introduced in high schools which are not situated in university centers.**

Change of the recruiment criteria

- 2009 – 2014. Recruiment for modelling classes according marks on mathematics, physics, elements of computers sciences, foreign language. Human subjects were not taken into account.
- Since 2014 the governmental rules of recruiment were changed. All final marks from the primary school have to be taken into account (also human subjects). It means that the knowledge of pupils applying for the modelling is usualy more human.
- It implies the new style of the modelling experiment.

New extension of the experiment

STEM - Science, Technology, Engineering, Mathematics

For two years

STEM style education

(MINT in Germany)

STEM style education

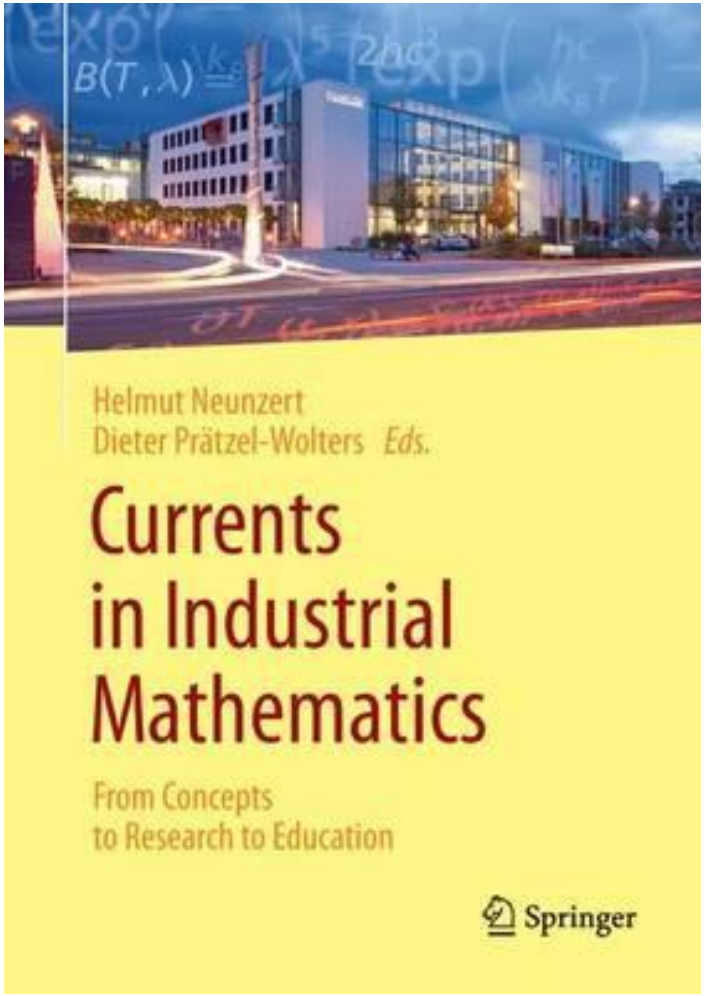
Modelling groups join pupils having interest, for example, in maths and biology or even in maths and history

Examples of two new style projects

Trebusz - medieval catapult or trebuchet

Paintball at home

High Schools – Future for Universities



The final chapter shows how the use of mathematical modeling in the classroom can change the image of this subject, making it exciting and fun.

http://www.gimnazjum.rawicz.pl

Thank you for your attention!