

## **HEUREKA WORKSHOPS 2003-2007: NON-TRADITIONAL MEETINGS OF (NOT ONLY CZECH) PHYSICS TEACHERS**

Irena Koudelkova  
Leos Dvorak

### **ABSTRACT**

Heureka project concentrates mainly on physics education for age group 12-18, but it also aims to cultivate both teaching of physics as such and interactions of teachers and pupils. It puts together teachers from different types of schools, future teachers, people from universities and other people interested in physics education.

Heureka started “from below”, by teachers themselves, about 15 years ago as an activity of just few people. In last years it has expanded to the project that includes more than 70 active participants – Czech and Slovak physics teachers from all types of schools. The basic features of this project were described already e.g. in GIREP 2004 proceedings.

In recent years a common event connecting various branches of the project takes place once a year. It may be called “conference” but it is a non-traditional one. It has the form of a set of workshops (there are about 15 of them every year) prepared and led by the participants themselves. Each workshop lasting 1,5 hour repeats several times and every participant can attend up to 8 of them. The whole event is very active and according to guests from abroad who attended it, its character is in a sense unique even in comparison with teachers’ conferences and meetings in other countries. Really, the activity which started as a quite limited project of several people and evolved to a conference with more than fifty participants, printed proceedings and guests e.g. from the Netherlands and Belgium (as in 2006) might be considered as an interesting activity.

The paper will try to describe the “flavour” of the Heureka meetings, present the range of topics of workshops, show some examples and discuss why we perceive this kind of meeting as important, useful and inspiring.

### **KEYWORDS**

Physics education, constructivism, continuing education of physics teachers

### **INTRODUCTION**

The main aim of the Heureka project is to improve physics education. It started in 1991, when several teachers looked for the way of teaching physic in more interesting and in the same time more effective way. So, at first it concentrated to physics education for age group 12-15. Now it covers much broader scope. It remains a project for both pupils and students at schools and future teachers, but nowadays it is mainly concentrated to continuing education of physics teachers. In a sense, Heureka seems to be singular in comparison with other project aimed at teachers.

Why the Heureka project may be interesting for people from other countries?

- It started “from below”, without any official support.
- Its basic principles are in agreement with many modern trends in physics education worldwide, in spite of the fact that the authors have had minimum information about those trends (in the

beginning of 90's there was very hard to obtain foreign pedagogical literature in Czech Republic for the teachers).

Several of these principles are (more in Koudelkova, Dvorak 2004):

- The criterion of truth is reality, not the words of the teacher
- It is normal to make a mistake
- The starting point of education is a question
- The terms are defined at the end, as a result of observations
- We come out from things that children know from everyday life
- It is children who are responsible for their work, the teacher only offers help

From these principles we start in teaching physics not only at school, but also at seminars for teachers and future teachers.

- All seminars are completely voluntary; participants have no formal advantages or benefits at their schools. Their only benefits are teaching methods, plans of lectures, problems and tasks, etc., they obtain during seminars.
- All seminars are free of charge, we don't require any payment.
- Seminars of our project take place at school, so they are very informal. We offer "lodging excluding meals" - participants sleep in their sleeping-bags at classrooms and they have to bring meal with them. In spite of those conditions we have almost 100 active participants, some of them from Slovakia.
- The Heureka project is an example of cooperation between teachers at schools, future teachers and teachers from University.



Figure 1. Heureka at school – to investigate physics is interesting

## **SEMINARS FOR TEACHERS**

We organize three types of seminars for teachers

- Seminars for teachers who want to learn Heureka teaching methods (familarly we call it "teachers' kindergarten"). Participants work very similarly as pupils at school in about 8-10 weekend seminars during two years. They do experiments, solve problems, sometimes write tests, but besides they discuss about teaching methods they have seen, talk about pedagogical problems in

their schools, etc. We will start already the fourth two years' course of those seminars in October 2008.



Figure 2. Teachers are exploring properties of a candle.

There are also seminars for students from our faculty (future teachers of mathematics and physics), which are organized very similarly, but as a standard voluntary seminar during four semesters.

- Seminars for more experienced teachers, i. e. for people, who have taken part in the Heureka project for a long time (some of them since 1992). These participants of our project meet four times a year on seminars, which are focused usually on one topic (e.g. forces, physics and chemistry, etc.)
- Annual conference for participants from all types of seminars.

### **ANNUAL CONFERENCE OF THE HEUREKA PROJECT**

These conferences have been organized since 2002 as an opportunity for participants from all types of seminars to meet each other. About 70 teachers, future teachers and people from universities come at the end of September to a small town in the northeast Bohemia to spend one weekend with physics. We call this meeting “conference”, but there are no lectures there and no theoretical discussions about education. Whole program is based on workshops prepared by teachers for other teachers. Also conditions of accommodation and boarding are the same as in “normal” seminars – very informal. In spite of that, several guests from abroad came to our conference and presented their experiments.

In 2004 we had invited Dr. Elizabeth Swinbank, head of the Salters Horners Advanced Physics Project (UK); next year (2005) Gorazd Planinsic (University of Ljubljana) presented his experiments from optics. You can read their articles about our conference in *Physics Education* (Swinbank 2005, Planinsic 2006).

In 2006 we were very glad to welcome Wim Peeters and 3 other teachers from Belgium, Ed Renes and 2 people from Nederland and Alex Kazachov and his two students from Ukraine. They prepared a lot of very interesting experiments for us. Wim Peeters brought his box of experiments and showed us fascinating experiments for challenging teaching with “Physics is cool”, Alex Kazachov lead a workshop about non-traditional optical illusion, and all participants were fascinated by physics show demonstrated by Patrick Walravens.

**How a program may look like**

As you can see in following tables and text, apart from two “foreigners” workshops on our conference there were 15 workshops led (as usually) by Czech teachers. Table 1 shows a brief program of the conference in 2006, topics of all workshops in that year are listed in Table 2.

Workshop:	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
<b>Friday</b>																	
19.00	Opening of the conference																
19.30 - 21.00			x		x			x		x	x		x	x			
21.15-22.00+	Guitar, piano, violin, singing, talking, informal discussions																
<b>Saturday</b>																	
8.30 - 10.00	x	x		x	x					x	x					x	
10.15 - 11.45	x			x	x			x		x			x				
12.00 – 15.00	Lunch, trip to the castle or to the fortress Dobrosov																
15.00 - 16.30			x	x			x			x				x		x	x
16.45 - 18.15		x				x		x	x			x		x		x	
19.30-19.50	Ed Renes et al.: Experiments with <i>Coach junior</i>																
20.00-21.30	Wim Peeters et al.: Physics show																
21.30-24.00+	Guitar, piano, violin, singing, talking, informal discussions																
<b>Sunday</b>																	
8.30 - 10.00	x	x					x		x			x				x	x
10.15 - 11.45	x	x	x	x			x		x			x					
12.00 - 13.30			x		x	x				x	x	x		x			
13.40 - 13.50	Closing of the conference																

Table 1. Example of a program of the conference

Workshop No.	Topic of the workshop	Workshop No.	Topic of the workshop
1.	Low-cost teslameter	10.	Intelligent plasticine +other toys
2.	“Happy-cow physics”	11.	How electric batteries work
3.	Experiments with plastic bottles	12.	Electricity in our homes
4.	Measurement of Earth’s magnetic field	13.	Videomeasurements in physics
5.	Lever and center of mass	14.	Moment of inertia
6.	Statics	15.	Orbitals of hydrogen atom
7.	Electric motor made by your own hands	16.	Fascinating experiments for challenging teaching ...
8.	Graphs in physics	17.	Non-traditional optical illusions
9.	Several problems from geometrical optics		

Table 2. The workshops cover broad scope of topics

Workshops 16 and 17 were led by foreign guests, from the rest seven workshops were led by teachers from schools (plus one by a former teacher), three by people from University and four by Ph.D. students.

To be fair, it must be said that workshop 4 was led also by a person from abroad – by Peter Horvath from Comenius University in Bratislava (who is also physics teacher at secondary school). But we do not perceive colleagues from Slovakia as “foreign guests”; Czech and Slovak teachers are freely mixed in the whole Heureka project.

### Examples of concrete workshops

To mention just “technical” or organizational aspects of the conference, as we have done so far, is not sufficient for characterization of all its flavour. The content and style of workshops is, of course, the other very important point. And the overall atmosphere, which may be partly perceived from Figure 3.



Figure 3. Workshop focused on wave optics

Let us describe very briefly the content of several workshops. Again we will take examples from the year 2006.

- In the Workshop 1 the participants built a simple teslameter using Hall probe. They calibrated it to be able to use it in their schools. They can, of course, take away the product they built.
- “Happy cow physics” in Workshop 2 consisted of several (about 20) experiments using round paper cheese boxes. One of them (a simple centrifuge) was already presented by the author at GIREP seminar (see Dvorak 2006). The other included experiments ranging from mechanics through electricity to optics. The participants also built their own “centrifuges” or spinning tops from cheese boxes.
- Graphs are important tools used not only in physics. Workshop 8 was closely related to a part of Ph.D. thesis of its leader and helped the participants to realize what misconceptions pupils have when working with graphs.

- Workshop 11 took us, in fact, to another discipline – chemistry, or, to be more specific, electrochemistry. It was led by another Ph.D. student (in this case from Palacky University in Olomouc) whom we know from Czech delegation at European program Science On Stage).
- Electricity was also the theme of Workshop 12, but in this case it concerned the electric systems in the house or flat including their safety. The leader prepared a model of electric circuits at home that included electric outlets and other real components.
- Range of topics of workshops extended even to the realm of atoms and quantum physics. Workshop 12 was devoted to electron orbitals in hydrogen atom. Its author allowed the participants to use and test some tools (computer programs) and tasks that she developed (with her colleague) and successfully presented at GIREP conference in Amsterdam – see (Broklova and Koupil 2008).

### **“The show goes on”**

In 2007 there were 15 workshops prepared for the conference. Teachers from lower and higher secondary schools prepared eleven workshops; four workshops were led by people from our university. Once again workshops were very different. Several workshops were aimed to simple experiments (“*Experiments with water*”, “*Physics for babies*” (i.e. for children about 6 years old), “*Origami*”), on the other side, some of the workshops required harder thinking (i.g. “*Elements of quantum physics*”). Participants of two workshops built simple meters (thermometer and teslameter), which they can use in their schools.

We also published two proceedings of Heureka Workshops (from years 2003-04 and from 2005), the proceedings from years 2006-07 should appear in the foreseeable future. Of course, their use for international communication is severely limited by the fact that the articles are mostly in Czech or Slovak. But still – for the project which started from the effort of just a few ordinary teachers and still largely depends on the active approach of teachers themselves, it is probably not bad result. We hope the development of our conference will continue in further years and this event will still be the source of encouragement and inspiration for its participants.

### **To summarize...**

What is special in our conferences?

- Teachers are active (both as participants and as authors of workshops).
- Teachers, students and people from University are here as equal partners.
- Meeting is very informal, there is friendly atmosphere there. Sometimes whole families of participants of the Heureka project take part. (The youngest “participant” was six months old boy. And the 8-years and older children really participated at some workshops.)
- Wide scope of workshops is offered, of both lower and higher level. Everybody can choose what is interesting for him or her.
- All experiments and topics are concrete, ready for use at school.

Maybe the most important point concerns the reactions of teachers. They say that the conference (and also other seminars of the Heureka projects) gives them enthusiasm and energy for further work.

## **CONCLUSION AND INVITATION**

This year our conference will be organized as usually at the end of September (26. – 28. 9. 2008). Workshops will cover topics as e.g. “*Physics with eggs*”, “*Experiments with sun-cooker*”, “*Bridge from newspapers*”, “*Simple measurements with computers*”, etc. If you are interested in such kind of informal and active conference, you can come and meet Czech and Slovak physics teachers. You will be welcome. You need not be afraid of any language barrier, physics teachers can talk to each other across any boundaries – see the impression of our guest from UK (Swinbank 2005). Of course, the invitation is not restricted to this year. We hope that physics teachers will perceive Heureka workshops

to be interesting and useful activity also in the future and so our meeting has the potential to survive and further develop.

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Irena Koudelkova, Leos Dvorak  
Department of Physics Education  
Faculty of Mathematics and Physics  
Charles University in Prague  
V Holesovickach 2  
180 00 Prague 8  
Czech Republic  
Emails:

Irena.Koudelkova@mff.cuni.cz

Leos.Dvorak@mff.cuni.cz

Bring a non-traditional student that is a not a member to the table, if they sign up you BOTH get your names into a drawing for some NTS Swag! UAFS Non-Traditional Student Organization - NTS shared a post. 11 September Â. UAFS Student Activities Office. 11 September Â. Today we reflect, not only on the events that happened 18 years ago, but also on the people who protect and serve our country every single day. #NeverForget . . . â€œThe home I found at UAFS. HEUREKA WORKSHOPS 2003-2007: NON-TRADITIONAL MEETINGS OF (NOT ONLY CZECH) PHYSICS TEACHERS Irena Koudelkova and Leos Dvorak ABSTRACT Heureka project concentrates mainly on physics education for age group 12-18, but it also aims to cultivate both teaching of physics as such and interactions of teachers and pupils.Â The basic features of this project were described already e.g. in GIREP 2004 proceedings. In recent years a common event connecting various branches of the project takes place once a year. It may be called â€œconferenceâ€ but it is a non-traditional one. It has the form of a set of workshops (there are about 15 of them every year) prepared and led by the participants themselves.