

INVITATION TO PHYSICS NOT ONLY FOR GIFTED PUPILS

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Abstract

In Talnet - we create new opportunities for gifted pupils in science. We suppose any level of giftedness or interest must have practical opportunities to be found and developed. We focus on study, research, inquiry, collaborative and modeling activities where the learning itself is not a primary goal. The activities combine online with face to face and are designed for 13 to 19 years old pupils. More than 1000 pupils has participated in 28 different yearlong courses, more than 500 pupils in tens of different „T-excursions“ and collaborative research activities. Gifted pupils involved such systemic and authentic activities can play an important role on the pupils' side of communication with “physics”.

1. Introduction

It is a matter of fact that gifted pupils and students are of a great potential for physics as future researcher, explorer, experts etc. This contribution is about a secondary, but effective, potential of gifted pupils for popularization in physics (communication of physics). It is based on our eight year long experience of the national project “Talnet – online to science” that is focused on 13-19 years old gifted pupils interested in science, mathematics and technology. Despite the discussions about giftedness the practical approach for identification and development of gifted pupils we use is a very practical approach. The approach to giftedness is close to Renzulli's definition of giftedness “...an interaction among three basic clusters of human traits: above-average general and/or specific abilities, high levels of task commitment (motivation), and high levels of creativity...” (Renzulli, 1978). We consider giftedness as a complex notion including not only passive – segregation but preferably active – development stimulating moments.

We looked at real situations in physics teaching in schools, opportunities for pupils who are interested in science (physics) in or out of schools in the Czech Republic from the point of present knowledge about gifted pupils. In the classroom there are very limited opportunities for individual and differential care about gifted. The national system of extracurricular activities consists of:

- *On national level*

Olympiads and other national contests (FO, 2011)

Secondary School Expert Activity (SOC, 2011)

- *On regional or local level*

“Correspondence seminars”, “Child's universities”

“School club” type activities

“Camps”

“Stints” (e.g. at research institutions)

Individual or series of lectures

Visits to (interactive) exhibitions in museums, “Science fairs” etc.

Most of these activities (namely that of higher population capacity) are more competitive than collaborative; more individualized than team oriented, more isolated than inter-related, systemic, and continuously developing pupil's ability with respect to individual potentially gifted pupil's abilities and needs. It is hard to find activities supporting systemic development of creativity, critical thinking, enquiry skills and emotional, (meta) cognitional, communicational and other social needs of gifted pupils.

There is only a very limited experience in identifying and teaching gifted pupils among schoolteachers and among university teachers.

Talnet (Talnet, 2011) aims to cover some of the gaps and invite subject experts to meet, communicate and make an authentic more continuous contact (most of time moderated via computer and web) with potentially gifted pupils.

With the help of online (web) technology and face to face activities Talnet offers a variety of different systemic, continuous activities to our pupils and teachers accessible in some sense sufficiently in time and geographically. The activities are specially designed with respect to present knowledge about gifted pupils. Discipline experts and facilitators are guiding or supporting pupils in

their activity. Two important principles make the system usable as a practical tool for identification of gifted pupils interested in a discipline. 1. Suggested relatively autonomous blocks of activities (topics, enquiry etc.) should be designed and offered in several different levels (different assignments) to be meaningful and at least partially completed by pupils of different (pre) knowledge, interests and ability levels. 2. The second principle: The available support and usage of the Talnet environment (including communications with experts) is limited only by pupil's purposive activity.

Pupils, nominated mostly by their teachers or experienced friends, reveal important characteristics of gifted and talented pupil's profiles (cf.: Betts, 1988) in such an online environment and in a variety of structured activities. Keeping them in their school among classmates and simultaneously in their "gifted pupil's" (virtual) community we support them in accomplishment (filling up with people) their two different "Zones of Proximal Development" (McLeod, 2010) in each of them they can play different roles. That is the important factor of their potential for communication of physics to their class or school mates.

2. Types of activities in Talnet

Activities differ by subject (by subject are organized in series) and by individual design that should fit with the guide's (instructor – the subject expert) intentions and styles. The types of activities (Table 1) differ namely by organizational forms, durations, outputs an expected assets to kids.

Table 1: Types of activities in Talnet

Activity	Nature	Main objective
<i>Structured, individual and team</i>		
T-excursions (combined)	Education	Opportunity to demonstrate interest
T-courses (online)	Education	Knowledge deepening and ... to learn to study
	Research	Application of ability/interest ... to learn to research
T-pro-seminars (online)	Education and training	Acquire general skills
T-projects (combined)	Study	Deeper study of selected problem
	Research	Authentic research
Online support (e.g. courses for Math. Olympiad participants...)	Education	To offer more active forms of preparation for existing activities
	Research	To offer more active forms of preparation for existing activities
International activities (combined)	Communication & Research	To experience international interaction ... the need of language skills
<i>Loosely structured</i>		
TalnetSpace, Café Talnet, T-journal (pending)	Communication	Own suggestions, information exchange within the community...
	Assistance	To apply the acquired knowledge in helping others
	Production	Presentation of the results and the community
	Games	To apply and develop the intellect

Expedition	Project	To apply the range of knowledge, skills, and volatile qualities
Workshop	Experience	To complement the online activities

T-courses mostly offer online individual studies of several topics, based on communication between a student and an expert when working on assignments. The year-long study of such a course is divided into two online study period and a period to complete individual or team research like 'seminary work'. When completed it is online discussed and defended among all pupils of all courses of Talnet. The authors are invited to present it at one (of three) face-to-face meetings of the courses faced to a jury. Talnet T-courses in physics (and mathematics support) realized annually follows:

For ages 13 -15:

Mathematics 0 -Functions and Transformation

For ages 14 -15:

Astro & Modeling I - Astronomy in Black & White for Now, and Learning Modeling on Computers

Mathematics I - Mathematic Algorithms and Their Geometric Representations

Materials and Crystals I - Experimenting and Measuring

For ages 15 -16:

Astro & Modeling II – Astronomy in Color and Our Models are Usable

Mathematics II - Geometry in Standstill and Motion

Materials and Crystals II – Exploring Structures

For ages 15 -18:

Doing Physics in a Team

For ages 16 -17:

Mathematics III – Combinatorics Games

Meteo & Modern Physics – World in Terms of Meteorology, Solar Energy Uses

For ages 17-18:

Astro & Modeling IV – The Space in Ultra & Getting Better with Our Models

Programmable Machines - Simulation and Control

SW Mathematica for the Inquisitive - Application I

Selected Chapters of the Theory of Relativity - Special and General

The T-pro-seminars train more general types of skills, e.g. how to make presentations, to process measurement data, to use certain SW, etc. The online support of long term face-to-face activities, such as a series of lectures concerning the Mathematics Olympiad, allows the participants to practice, deepen and consult their knowledge gained during the traditional lectures. The most demanding activities are the multinational international activities (T-international). Another extreme, in terms of demands on knowledge, creativity, and observation, experimenting and research skills, are the team's enquiry activities (e.g. Doing Physics in a Team).

2.1. Team's enquiry activities - Doing Physics in a Team

This activity uses annually published problems of International Young Physicists' Tournament to be explored, investigated and explained in a virtual team consisting of pupils from different schools and regions. It is a very difficult task for facilitators to manage up to 30 pupils in such ambitious activities. The Tournament competition is developed for a five member team in a school. But lack of capacity of physics teachers and lack of pupils' motivation (typically only one or two pupils of the school are interested and ready to spend so much time by in physics enquiry, limits the possibility of Young Physicists' Tournament in the school practice. The Talnet course Doing Physics in a Team get together individual pupils who have no partners in the school and on the other side small teams (typically a couple o triple) of interested pupils from the same school get needed support and training useful for participation in the Young Physicists' Tournament regardless if they are gifted or not. The course environment includes T-pro-seminars, sources, (modeling and other) tools carefully prepared to be used by students when needed in studying the problems.

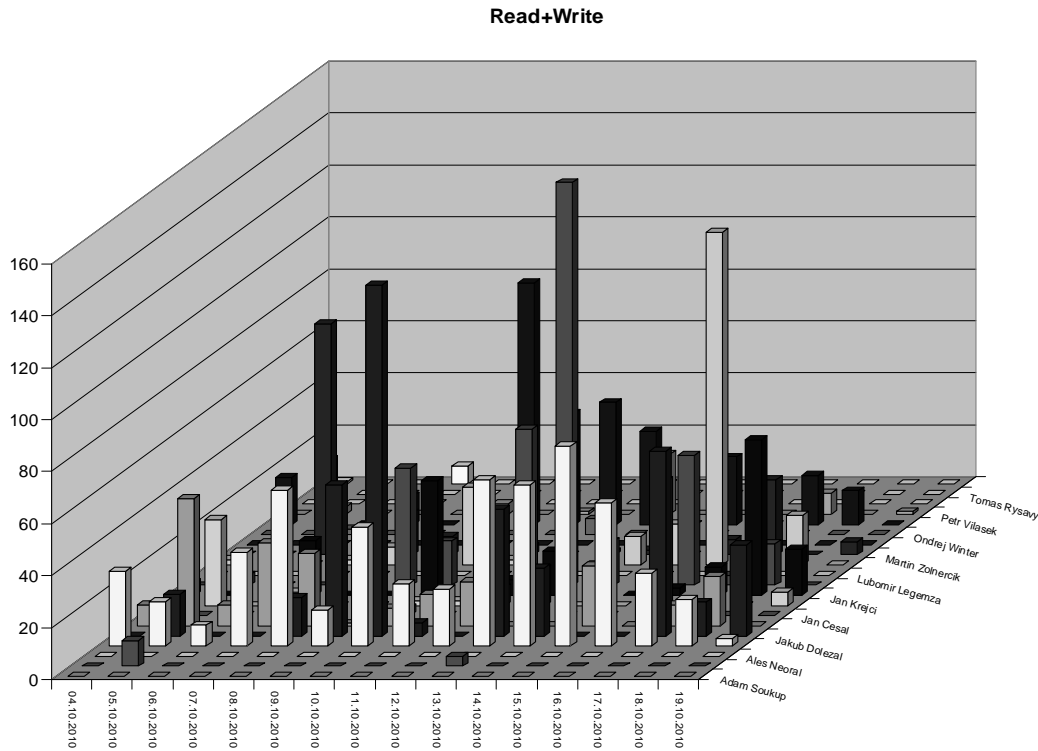


Figure 1: Frequency of pupil's activities in the Team's Enquiry Course (by day and pupil)

Tal11: NAFTA - Vývoj
 Talnet Test07

Zahájit diskusi Hledat Odhlásit se

Učebna

- Diskuse
- Úkoly
- Týmová práce
- dle studentů
- dle data
- Diskuse - celé
- Reflexe diskusi
- Úkoly - celé
- Diskuse - pozn.
- dle kategorie

Zobrazit dokumentů 1000

		02.10.2011	
Výběr úloh - řešitelé (3)		Dominika Kalasová	
HLASUJ - Schůzka 27.9. v Pr (6)			
Dopisy studentům (0)			Jako komentáře budeme připojovat nějaké nápady, které si myslíme, že asi nemá cenu realizovat letos, protože bysme udělali příliš velký zmatek změnou systému v průběhu roku, ale bylo by možná zajímavé je třeba zkusit pro příští rok. A nemusíte k tomu nutně psát komentáře - zakládám to spíše jako svůj veřejný poznámkový blok k tomu, co mě napadá. Ale budu rád, když vás taky něco napadne.
Propagace Nafty (2)			
Článek do mezinárodní "ročenky" IYPT 2010,2011 (0)	07.09.2011	Karel Kolar	TO DO
Prezenční setkání (16)	17.08.2011	Karel Kolar	aktivní
Co dodělat/zkontrolovat? (10)	17.08.2011	Karel Kolar	aktivní
NOVÝ VÝVOJ (5)	17.08.2011	Karel Kolar	TO DO
Komunikace s Ivou (2)	03.02.2011	David Wagenknecht	
Možnosti zlepšení pro tento školní rok (tj. 2011/12) (14)	23.01.2011	Karel Kolar	aktivní
Aktivita studentů (0)	28.11.2010	Vlasta Stepanova	aktivní
Drby (1)	24.11.2010	Karel Kolar	nejdůležitější
Pomůcky (13)	08.10.2010	Vlasta Stepanova	pomůcky
ZZ-Technické problémy (6)	07.02.2003	Stanislav Zelenda	technické Jenom problémy s prostředím LS!

ac.troja.mff.cuni.cz/!space35/tal11-nftvyvoj/croom.nsf(ModeratorCommentsWeb)/9CBDC756C66CE525C12578EF004F4088?OpenDocument

Figure 2: Special tools and meta layers were developed for massive communications

The above figures 1 and 2 illustrate “character of collaborative enquiry and mutual learning” in the virtual environment. A closer analysis of communications shows that communications are horizontal (among pupils), more regular, more frequent and topic related. The difficulty and complexity of enquiry problems make pupils to meet more frequently than in other courses.

This type of courses aims to create some opportunities to solve well known epistemological problems of school science (teaching) in almost all countries: the absence of development of science creativity by reducing science to the only moment of logical and experimental defense. This way the alumni (also future researchers, scientists) are not ready for discovering.

In our seminars for school teachers they are (in their words) “fascinated” when see pupils - participants of the course - working and can interact with them. The teachers mention strong positive feelings and a will to look at their teaching and pupils in a new perspective.

3. Conclusions

The recent experience and results, despite the limits given by computer mediated communication, shows that there are students who are willing and able to go deep in physics, does not matter whether we call them gifted or not (interestingly some seems to be independent learners). They have a great potential to communicate their live and authentic experience, gained in “doing physics with a real physicist” or in “physics enquiry with mates sensitively guided by a physicist”, with their classmates in an acceptable way and the language of the group knowledge and age level.

In Talnet we offer study or developmental trajectories that include team’s enquiry activities and simultaneously we open gates to “real physics” (as complement to school physics) not only to interested potentially gifted pupils (nominated by teachers) pupils but also their mates.

For higher effect of gifted pupils’ influence in the classroom we offer teachers special opportunities (seminars with online support) to get experience in nomination of gifted pupils and get inspirations for involving pupils participating in Talnet to “popularize physics” in their classrooms or schools.

There is still another critical point: limited possibilities and motivations of physicists to participate in such a complicated and time consuming “intergeneration communications”.

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