

FYKOS – Physics Education through Correspondence Competition and Camps

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Abstract

The article introduces the reader to FYKOS – the internet physics competition for high school participants (ISCED 3) which has history of more than 28 years (formerly only as a correspondence competition by post). Participants of FYKOS solve complex physics problems. In order to solve these problems properly they usually have to learn something new. FYKOS' organizers prepare more activities for high schoolers, such as camps, Online Physics Brawl and many others.

The article also includes some interesting data about participants acquired by questionnaires and interviews with participants (and organizers), such as where they get information about FYKOS, why they started to participate and why they continued in their participation.

Keywords

Physics competition, Physics education, outreach, internet competition, correspondence competition

Basic information about competition

“FYKOS” is an abbreviation from the Czech name of The Physics Correspondence Seminar (in English, the name “The Internet Physics Competition” is usually used) [1, 2]. It's a project running for over 28 years. It is organized by university students (ISCED 5A) for participants who are upper secondary pupils (ISCED 3). The organizers prepare physics problems. Problems are released six times every school year and the participants have usually six weeks for solving them. Then the participants send the organizers their solutions. The organizers correct participant's solutions and send them back with points and comments. The best problem solvers are invited to camps which are held twice a year.

The camps take place in some place near nature somewhere in the Czech Republic. The program consists of formal and informal educational activities. List of historical camps can be found at [3].

Primary language of FYKOS is Czech but the problem assignments are translated into English and solutions are accepted in Czech, English and Slovak. Actually, in recent years there were not many participants from abroad, therefore the author solutions are not translated into English, but there can be found more than 500 problem assignments in English on FYKOS' web [4].

FYKOS' organizers also prepare other activities, for example the competition called Online Physics Brawl (OPB) [5]. OPB is an internet team competition held once a year. Every team can consist of five or less participants. The competition is primarily for upper secondary students but it is opened for anyone. The participants have three hours for solving as much as they can. The team with the highest score wins the game.

There is also a similar competition like OPB, located in Prague, only in Czech and only for high school Czech and Slovak participants. It is called FYKOS' Physics Brawl. Another activity are lectures with topics related usually to the current topics of Physics Olympiad. They are not only in Prague at our faculty but also online streamed. They are also only in Czech. Other activities for Czech and Slovak participants are connected to the excursions to places where physics research is conducted or applied physics is used. They are called Day with Experimental Physics, Week with Applied Physics and Weekend with Applied Physics.

Camps

Twice a year, in spring and in autumn, a camp is held for the best participants of FYKOS. In recent years there were about 28 participants of each camp. List of historical camps with photos can be found at [3].

The program of a usual day on camp consists of two lectures in the morning separated by short agility exercise. After lunch there is a little free time after which students play games (informal education) in which the organizers want to develop key competences of participants, especially communication in mother tongue, mathematical competence and basic competences in science and technology, social and civic competences and sense of initiative and entrepreneurship.

On every camp there are also some demonstrative experiments, for example experiments with liquid nitrogen or with 3M Novec 1230 Fire Protection Fluid. There is also one day filled with experiments conducted by participants. They choose an experiment from our offer and they have to build their experimental setup, measure important variables, and process obtained data, prepare presentation with graphs and explanation of what they measured and finally they show the presentation to the others in the evening on "FYKOS' conference". On the last camp (26. 9. – 4. 10. 2015) the style of presentation was similar to the one at the International Young Physics Tournament (IYPT) – one team presented their measurement, the second team opposed and the jury of organizers rated both teams (but there was no reviewer like in IYPT).

FYKOS' camps are also a place of meeting people with common interests and creating friendships which can last for entire life. The acquired friendship can be useful in many ways – for example it can lighten the start of the studies at Faculty of Mathematics and Physics on Charles University in Prague, because former participants know elder students and they can easily ask them about their everyday problems on the contrary to the students, who don't know anyone and they are usually introverts or ambiverts who are too shy to ask someone.

Research of FYKOS' participants

The research presented here was conducted mostly in years 2012 – 2014 by the author of this article [6] and more observations are in Czech in his diploma thesis [6]. Used methods were semi-structured interviews [7] with participants and organizers (and questionnaires ($N = 196$, $N = 81$)). Besides this, FYKOS' organizers are trying to obtain feedback on every activity they organize.

Sources of information about FYKOS

If the organizers of some competition want to effectively address more potential participants, it is vital to learn where the participants come from. Additional desired information can be what channels of communication work well and were recently effective or information about what channels should be

improved. The list of sources of information about FYKOS follows. The sum is greater than 100 % because some students were informed about the competition through more ways.

- Leaflet delivered to school by letter (33 %) – our faculty is sending letters to the schools – mostly to the participants of Mathematical Olympiad, Physics Olympiad or Astronomical Olympiad
- Friend, but not schoolmate (21 %) – there was a clear distinction between schoolmate and friend but not schoolmate. This is relatively the easiest method of propagation for organizers because participants are the best reference. But it is not enough for sustaining the numbers of participants.
- Internet (17 %)
- Leaflet delivered home by letter (14 %) – this is in the case that our faculty has address of the potential participant, what happens if he/she participated in some competition organized by faculty.
- Schoolmate (14 %)
- Leaflet on noticeboard in school (12 %) – usually placed by some teacher from that school.
- Teacher (12 %) – that was for us a bit unpleasant surprise that teachers do not inform so much about out-of-school possibilities of competition and education.
- Physics Olympiad (6 %)
- Other means gained less than 5%

Initial motivation for participation

Actually only having the information about existence of FYKOS is not enough. Only small part of those who know about it starts with participation. Therefore one of the very important questions was the reason, the initial motivation why they started sending their solutions.

The list of important initial motives for participation follows. The sum is also greater than 100 % because more motives were important for some.

- Improve herself/himself in physics, learn to solve physics problems, general interest in physics (38 %)
- Interesting (complex, not straightforward) problems in FYKOS (28 %) – problems of FYKOS are generally more challenging than those in schools and often also more complex than those in Physics Olympiad (at least on national level).
- Competition, be better than others (15 %)
- Camps (11 %)
- Interest in continuing of solving some seminar (9 %) – there are also seminars for lower secondary school pupils (ISCED 2) in Czech Republic. There is one physics seminar on our faculty from which come the most participants who answered that this motive was for them important.
- Boredom (6 %)
- Other motivation (below 5 %): friends, schoolmates, teacher, preparation for future studies, family, opportunity to make new friends, visit of CERN...

There was an even more unpleasant surprise about teachers than in the previous question. The teacher (or school) was important motivation almost for no one. So maybe, more intense communication with teachers could lead to the gain of more participants.

Motivation for further participation

Not only the initial motivation is important, but also the motivation, why they continue in their participation, is important for FYKOS. If they lose interest after one series of problems, it is not optimal behaviour of a participant, because they can learn much more from continuous participation. We expected from the beginning of our work that those motives can be different from the initial motivation, therefore the question was divided into these two.

The list of important motives for further participation follows. The sum is also greater than 100 % because more motives were important for some.

- Camps (39 %) – it can be seen that the camps became the most important motivation for those who continued in participation. They usually discover that they like such events. Of course – it could not be generalised to all of the participants – some did not continue and some were not on any camp.
- Competition, be better than others (26 %) – this motive has also risen, but the less competitive participants could have ended and didn't continue.
- Interesting problems (22 %)
- Improve herself/himself in physics (22 %) – this motive is further one of the most important but significantly lower than in the question about initial motivation.
- Entertainment (16 %)
- Friends, reunion with them (15 %)
- Other activities of FYKOS other than camps (6 %)
- Learn something new (6 %)
- Other: visit of CERN, teacher, school, good feeling from participation, receiving of comments on solutions from organizers...

Conclusions

FYKOS is one of the largest project or sub-organisation in organization of physics related competitions in Czech Republic besides Physics Olympiad and Astronomical Olympiad. It has wide range of activities for motivation of students for physics and teamwork. FYKOS has also more than 28 years of tradition of correspondence seminar, developed many new activities in recent years and it is trying to improve them by continuous reflecting of the feedback acquired from participants.

The research of FYKOS' participants showed, for example, that they are, in recent years, mostly addressed by letters from Faculty of Mathematics and Physics although the good source of information are also friends and schoolmates. The initial motivation for starting solving FYKOS is mostly to become better in physics and challenging and interesting problems. This motivation often continues but the most important motive for continuing in participation are usually the camps – the possibility to go to the next one.

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