FACTORS THAT TRIGGERED STUDENTS’ MOTIVATION TO PARTICIPATE IN SCIENCE OLYMPIADS

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There has been an on-going debate how to engage students into science and possibly motivate them toward studying science. Participants in science competitions have greater understanding of nature of science and the best ones are often accepted to universities without entrance tests in the Czech Republic as they have expressed their motivation for further career in science. Olympiads and summer camps, which are often part of them, can change students’ interest into deeper engagement. We have therefore decided to describe and analyse factors that motivated participants in the Czech National Round of Biology, Chemistry, Physics and Geography Olympiads to take part in the competition. We collected data from 207 participants using a questionnaire constructed and previously tested for this purpose. Descriptive statistics was used after coding the data. Consequently, Mann-Whitney U test, Kruskal-Wallis test followed by multiple comparisons and χ² test for independence were used. Genders were not represented equally among the participants in some Olympiads. We show different roles of the family and teacher for participants of different Olympiads. Parents were crucial for participants in Biology, Physics and Geography Olympiads but it was the teacher who mostly triggered interest of participants in Chemistry Olympiad. Consequently, Chemistry Olympiad participants (together with participants in Physics Olympiad) became interested in nature and the respective science field later than Biology and Geography Olympiads participants. Biology and Geography Olympiads participants felt they mostly prepared for the competition by themselves by studying recommended literature, Chemistry Olympiad participants received more often support from their teachers. Summer camps were very important for the participants of Biology and Chemistry Olympiads and more important for girls than boys. Boys were more motivated by competing and the results of the competition than girls.

Keywords: Science Olympiad, Motivation, Non-formal Learning

SCIENCE OLYMPIADS ROLE IN EDUCATION

There is an increasing demand on citizens to make decisions based on their scientific knowledge about e.g. genetically modified organisms or handling environment. Therefore, it is important to educate and engage students in science. As participants in Science Olympiad have better understanding of the nature of science (Philpot, 2007), such Olympiads are one of the possibilities. Former participants in different science Olympiads very often became top university students (Wu-Tien, 1999) and most of them felt Science Olympiad led them to a science career (Wirt, 2011). There were less female participants in Chemical and Physics Olympiads than males (Tirri, 2000). Several moments can be identified as crucial if we look at organisation of science Olympiads in more detail. One of them are summer camps, which are often organised as a part of the Olympiad. The participants of summer camps gain true passion for the science subject here (Oliver & Venville, 2011) and they recognise the camps as important stimulus itself (Kuťáková & Janštová, 2015). It is people, both coeval and lectors, who are important for participants at the summer camps, Czech National Rounds of the Olympiads (which usually takes several days) (Kuťáková & Janštová, 2015) and at International Biology Olympiad (Tirri, 2000). The participants also get a better idea of what does it mean to be a scientist during these occasions (Kuťáková & Janštová, 2015; Lim, Cheah, & Hor, 2014). Meeting a good science teacher is also important for development of scientific skills (Wu-Tien, 1999). It seems to be clear that participation in science Olympiads can attract young people to science career. Therefore, we asked following research questions: What does motivate students to take part in different science Olympiads (namely Biology, Chemistry, Physics and Geography)? Who motivated students to take part in these science Olympiads? Are there differences among participants in Biology, Chemistry, Physics and Geography Olympiads and between genders?
METHOD

The questionnaire described previously (for details see Janštová, Jáč, & Dvořáková, 2016) was used and slightly modified according to different scope and competition format of the Biology/Chemistry/Physics/Geography Olympiads. The participants in the Czech National Round of Biology, Chemistry, Physics and Geography Olympiads in years 2015 and 2016 were asked to take part in the research. The questionnaire was administrated in a paper and pencil form. In total, 207 participants returned completed questionnaire’s, 43 girls and 158 boys (6 participants did not specify gender), 48 participants in the Czech National Round of the Biology Olympiad (BiO), 53 participants in the Czech National Round of the Chemistry Olympiad (ChO), 60 participants in the Czech National Round of the Physics Olympiad (PhO), 46 participants in the Czech National Round of the Geography Olympiad (GeO). The data was coded using Excel 2010 and analysed using Statistica 12. Descriptive statistics were used to characterise the respondents and non-parametric tests (Mann-Whitney U test and Kruskal-Wallis test followed by multiple comparisons) were employed to calculate differences among groups (individual Olympiads and boys vs. girls). $\chi^2$ test for independence (comparison of observed frequencies in different groups of students) was used in case of nominal scales. The differences were considered statistically significant if $p <0.05$. The data from year 2015 were partially used and published in another comparison (Janštová et al., 2016). The research was authorised by the Institutional Review Board, Charles University in Prague, Faculty of Science (approval No. 2014/17).

RESULTS

Significantly more boys participated in ChO, PhO and GeO, the numbers of girls and boys were equal in BiO ($\chi^2=24.34$, df=3, $p=0.0002$). The participants of different Olympiads recognised their interest in nature at different ages ($\chi^2=46.08$, df=9, $p=0.00001$). Most of the BiO and GeO participants stated they become interested in nature before attending school (usually at the age of 6 in the Czech Republic). ChO and PhO participants became interested in nature later, mostly at lower secondary school. The origins of the interest in nature and the science subject of the respective Olympiad were different but similar for both boys and girls. Participants in BiO stated their interest was mostly triggered by “spending time outdoors”. ChO competitors were motivated toward competing mostly by their teachers, whereas for the PhO and GeO participants it was mostly “the thirst for knowledge”. The person who triggered the interest in nature and specific areas of science was most often parent for BiO, PhO and GeO participants, but a lower secondary school teacher for ChO participants. Lower secondary school teacher was important for PhO participants as well and was mentioned nearly equally often as a parent. The Olympiad summer camp was a very important stimulus for BiO and ChO participants but not at all for GeO participants, probably because their summer camp is the shortest one ($H(3)=19.14$, $p=0.0003$). While preparing for the competition, ChO participants were supported by their teachers more than BiO and GeO participants ($H(3)=20.42$, $p=0.0001$) whereas BiO and GeO participants stated they mostly studied by themselves ($H(3)=13.75$, $p=0.003$) with a help of official texts issued by their Olympiad organisers ($H(2)=16.51$, $p=0.0003$). Regarding preparation for the competition, girls perceived summer camp as more important factor than boys ($U=523.5$, $p=0.04$), summer camps were also more important for girls as a motivation factor for participating in one of the science Olympiads for the second and next times ($U=2445$, $p<0.01$). Girls also found new information gained during Olympiad participation more motivating than boys ($U=2524$, $p=0.01$). On the other hand, boys were more motivated by achieving good results in the competition compared to girls ($U=2490.5$, $p<0.01$).

DISCUSSION AND CONCLUSIONS

Girls were underrepresented in ChO, PhO and GeO. Similar finding was described by Tirri (2000) in case of ChO and PhO. The roles of a teacher and parents were different for participants in individual Olympiads. Family and spending time outdoors in early age was an important trigger of interest in nature for BiO
participants. Teachers initiated the interest in nature and chemistry in most of the ChO participants and were important also for PhO participants. This is in accordance with the age of first recognised interest in nature/science subject as this was before school in case of BiO and GeO participants and during lower secondary school for ChO and PhO. The role of a motivating chemistry and physics teacher was also recognised by Wu-Tien (1999). Participants in BiO and ChO stated the summer camps supported their decision to take part in the Olympiad the next year. The summer camps play an important role in supporting students’ interest in science which was also concluded by Kutáková & Janštová (2015) and Oliver & Venville (2011). The students also have better idea what being a scientist means after taking part in the Olympiad and summer camps which can support their decision to choose this career. Supporting Science Olympiads can therefore facilitate gaining future scientists (Kutáková & Janštová, 2015; Lim et al., 2014; Wirt, 2011). BiO, ChO and PhO organise two weeks long camps for their best participants, GeO has only 4 days long summer camp. The length corresponds with the importance of the summer camp as perceived by the participants. Girls also perceived summer camps more important than boys, which could be only partially caused by unequal gender distribution in Olympiads as there were more male participants in ChO and summer camp was rated as important by them as well as by BiO participants with more girls. This can be caused by girls being more triggered to Olympiad participation by people and relationships and being less competitive.

ACKNOWLEDGEMENT

The authors would like to thank to Steven Morris, M.A. for language revisions of the manuscript. The research was supported by project GAUK 1168214 and OP VVV project No. CZ.02.3.68/0.0/0.0/16_011/0000660.

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