

Inquiry Based Science Education in National Technical University "Kharkiv Polytechnic Institute" as a Way to Increase the Popularity of Natural and Technical Sciences

*K Minakova, S Petrov, S Radoguz,
 R Tomashevskyi
 National Technical University «Kharkiv
 Polytechnic Institute», Ukraine
 friday.marjory.johnes@gmail.com*

Abstract. The article analyses the problem of reducing the rating of natural sciences in youth. Possible options for solving this issue are considered. Based on the experience of young scientists of the National Technical University "Kharkiv Polytechnic Institute" (NTU KhPI), it is indicated on perspective directions of interaction between higher education and secondary school in order to increase the popularity of natural and technical sciences. One of the points of contact can be the foundation of a creative space for children, which will be the focus of STEM education, and promote a positive image of the natural and technical sciences.

Keywords. IBSE, NTU "KhPI", natural science, technical science, STEM education.

1. Introduction

In Ukraine, for several years now, there has been a system of admission to higher education institutions based on the results of an external independent assessment – a kind of a single state examination system. Taking into account that uniform requirements are applied to all entrants within the country, it is easy to use the test results as a relevant indicator for assessing the popularity of a particular profession or specialty.

For instance, in 2017, similar studies were conducted in the analytical centre of CEDOS [1]. Unfortunately, the conclusions are disappointing. Many technical specialties are not very popular among applicants. Thus, according to research, applicants who entered mechanical and electrical engineering in 2016 on average demonstrated one of the least levels of knowledge in the main subject field (in average amount of universities it was

mathematics). That is, we personally witness a dilemma when students with low balls enter complicated and important for innovative development of the country's specialties.

Such a picture is not observed in all technical professions. For example, a degree in IT and biotechnology, on the contrary showed the highest exam results with mathematics. But IT specialties are now at the peak of popularity in Ukraine. Therefore, they among exceptions, which only confirms the rule, and detaches from the already "poor" engineering and technological specialties top-level school-leavers.

Naturally, each branch of knowledge has motivated entrants, with high rates of entrance examinations. But in general, the "average temperature in the hospital" is not comforting. Competition for most technical and natural specialties sciences is relatively low. What has been said above demonstrates the rapid decline in the rating of natural and technical sciences among young people. And this situation is quite usual not only in Ukraine, but also in the global context.

2. Heating up

Looking at the deteriorating positions of natural and technical sciences among those entering higher technical institutions, many faculties and departments of NTU "KhPI" began to gradually develop in the direction of career guidance for secondary school pupils. However, in most cases, the successes of these works were insignificant. In general, some of the chemical departments succeeded, on which interesting popular science programs were developed. Those were the combination of educational meet-ups with labs and "show" elements. Most of the events did not have a systematic nature. A turning point occurred after the opening in the university of a Space for children and young people creative development, that's called "The Space of Ideas: Science & Museums / Arsenal of Ideas Ukraine".

3. The Space of Ideas: Science & Museums

In 2013, a project of an inclusive educational space for children under the name "Arsenal of Ideas" arose in "Arsenal of Arts" (Kyiv, Ukraine). In 2017 it was decided to expand the

project to the regions of Ukraine. Young scientists of NTU “KhPI” actively supported this idea. As a result of successful cooperation of both institutions, Kharkiv became the first regional city where a new creative space was opened. It was created on the basis of NTU “KhPI”. Later, similar locations were organized in Melitopol and Lviv. The main slogan of the space was “Accessibility. Equality. Inclusiveness”. The space was oriented to the leisure time of school-age children, and wholly adapted for children with disabilities. It included permanent interactive installations (like Sensoricum, Uncontrolled Painting), developing games (Kinetic sand, various of constructors), materials for creativity, several interactive lectures, etc.

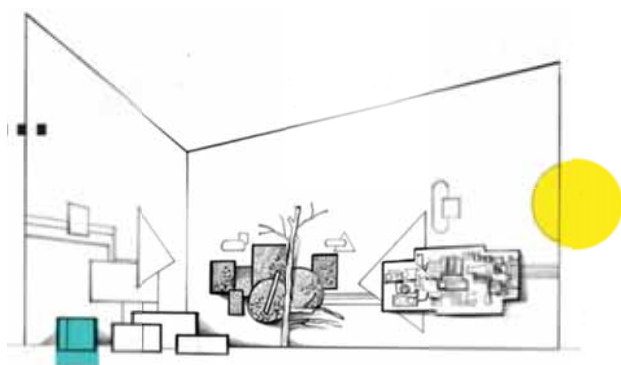


Figure 1. «Scetch of The “Space of Ideas: Science & Museums / Arsenal of Ideas Ukraine”»

It was assumed that “The Space of Ideas: Science & Museums” will become an interactive platform for joint learning and family intellectual pastime. Indeed, after the opening, which took place on September 7, 2017, there was a surge of visitors. Unfortunately, within a month the flow began to dry out.

One of the reasons why the original idea did not work, we see in that, in essential differences from the space that was in the Kiev Arsenal of Arts. Original “Arsenal of Ideas” covers an area more than 1000 square meters and has a significant amount of entertainment installations. Despite the fact that the space in Kiev also began its history in a relatively small room, it was established in the exhibition gallery with a significant flow of people, which provided a sufficient audience.

The space in NTU “KhPI” was only about 75 square meters. In addition, the location in the higher technical educational institution imposed its limitations: the students are already too old

to attend such kind of the educational places. At the same time, they were too young for to be interested in the location like in the space for family leisure. The reasons mentioned did not allow the original concept to stay alive. It is demanded an immediate rethinking.



Figure 2. «Lecture in “The Space of Ideas: Science & Museums”»



Figure 3. «Meet Up: Edible Chemistry»

4. Holidays with “Polytech and Arsenal of Ideas”

The idea of possible solution to the imminent failure was brought by the approaching traditional autumn holidays in first and secondary schools. We communicate with quite big amount representatives of the scientific and educational departments of the university and received a significant number of agreements to participate in the creation of a non-stop weekly popular science lecture with the integration of workshops and masterclasses that would be based on the principles of STEM education.

Fortunately, the authors of the article, which were the initiators of the idea, already had a certain experience of holding similar events, as well as various developments for scientific and

popular events. In our practice we also used some methodologies from world-wide practices [2-4].



Figure 4. STEM projects that appeared within the NTU “KhPI” and aimed to the increase of the Natural and Technical Sciences popularization

In general, during the 7 days (October 23 - October 29, 2017), 25 events were held with a total of 470 visitors. It was more than for the whole previous month. And it was the beginning.

5. Conclusions

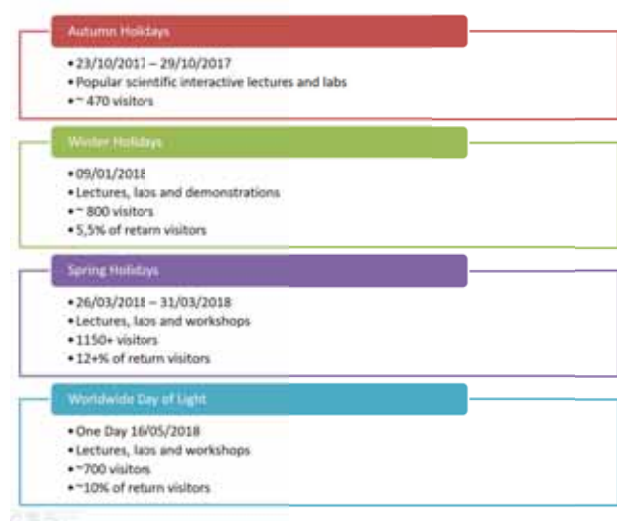


Figure 5. Analytical Data

Subsequent activities have shown that such a format works perfectly, as an opportunity to popularize technical sciences among young people. “The Space of Ideas: Science & Museums”, has become a catalyst for active action in this direction. In addition, it allowed to

coordinate the work of individuals and to give them a system.

During October 2017 - May 2018, 7 large-scale events were held, as well as a significant number of single small events. At the same time, it has been a positive trend in terms of total number of visitors as well as in the number of repeated visits.

6. References

- [1] <https://cedos.org.ua/uk/osvita/vybir-abituriientiv-2016-roku-haluzevyi-analiz>
- [2] https://www.ecsite.eu/sites/default/files/bevan_making_sse-min.pdf
- [3] http://www.cvtisr.sk/buxus/docs/SEE_Science/SCIENCE_FESTIVALS_Key-points.pdf
- [4] <https://www.mdpi.com/2227-7102/8/1/4/pdf>