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CHILDREN'S UNIVERSITY - A WAY TO CONVINCING CHILDREN TO STUDY SCIENCE AND TECHNOLOGIES

UNIwersytet Dziecięcy - Droga Przekonywania Dzieci DO STUDIOWANIA NAUK Ścisłych I Technologii

Abstract: Technical University of Liberec implemented programs to attract pupils, high school students and first-year university students for study of technical and scientific disciplines. The first program is called "Children's university" with the aim to convince elementary school pupils and secondary schools student. Children attend practical lectures and solve basic scientific tasks including work with real scientific equipment. They got exams for their activities and when passing all prescribed "lectures" they got a "diploma". In addition to university examinations the Children's University offers many different leisure activities, *eg* Open University, Walk for science and technology, Scientific cafes, Saturdays with technology. The main objective of the Children's University is to catch talented individuals early and awaken their interest in university studies of technical and scientific disciplines in order to better direct their future professional orientation towards sectors with high added value, which the labour market has a long-term interest in. The second program, entitled "Scientific incubator", is a follow-up programme to catch talented first-years university students for technical and scientific disciplines.

Keywords: pupils, students, science, technology

Introduction

In recent years we have witnessed a continual decline of the interest of high school graduates in studying science and technology at universities in the Czech Republic. A significant decrease was also seen at the Technical University of Liberec (TUL), which decided to actively resolve this unfavourable situation. Over the last four years an integrated communication and outreach platform has been established at TUL composed of both staff and students of TUL and external collaborators who help to actively seek talented children, and to develop and maintain their interest in technical and scientific fields in order to increase the number of talented researchers in these fields. Key activities, focused on developing a system to search and subsequently educate talented young people from elementary, secondary and vocational schools over the long-term, are performed under the

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title “Children’s University”. The aim of this article is to introduce the reader to the experiences and success with the implementation of this progressive project. The paper also describes activities and principles of the Children’s University and mentions some statistical data. Finally the reader will learn about the follow-up programme entitled “Scientific incubator”.

Children’s University and its basic principles

As mentioned above, Children’s University is the name of the programme at the Technical University of Liberec focused on long-term and systematic work with promising students of primary, secondary and vocational schools to awaken and maintain their interest in the study of science and technology. The basic principles of the Children’s University are based on the principle of “3C”, formed from the initial letters of the words Capture, Captivate and Connect.

Captivate activity

This is the first phase of searching for talented students. The aim is to reach the largest possible number of potential candidates for activities at TUL. Short informative media events are held with the intent to capture the interest of the participants - children, high school students, their parents, and current students of TUL, get them interested in the results of scientific work at the Technical University of Liberec and attract them to a particular event, described further in the text. Various events are selected where a larger number of people can be assumed *ie* festivals, open-street events, and also short-term leases of space in shopping centres. Furthermore, promotional events led by young researchers from TUL are held in primary and secondary school classrooms by replacing the regular class. These events have already taken place at primary schools in the towns of Liberec and in many surrounding towns.

Capture activity

The first phase is directly followed by activities that aim to bring children and the general public to TUL where they are shown specific instruments, laboratories and procedures and the results of scientific work. For the public from further afield the school and its activities are presented in the form of lectures and seminars. The events can be divided into three categories of participants. In the first there are activities for general public. Examples of such events include:

- **“Open University”** is an event that takes place at the beginning of the academic year and combines elements of fun, learning and getting to know each other. It includes an open-air music festival, performances by school choirs and musical groups, theatre groups, thematic games and competitions for all ages and visits to laboratories and classrooms. In 2012, the event attracted around 2,500 visitors including students and teachers of TUL and public from Liberec and its surroundings.
- **“Walk for science and technology”** is an activity aimed at families with children. Participants follow maps of the university laboratories, where in addition to expert interpretation fun tasks are prepared for all ages.
- **“Science cafes”** are a new format of outreach events for the general public. They are lecture events for the public focused on the latest results of research and development

not only from the Technical University of Liberec, where a team of scientists from TUL describes in laymen's terms such issues as bionics, the impact of electromagnetic radiation on humans or to explore the benefits and application of nanomaterials and nanosurfaces in industry. The science cafes are a two-hour event, the atmosphere corresponds with their name, *ie* a pleasant chat about current issues of science and research over a cup of coffee.





Fig. 1.-4. Participation of pupils in Saturdays with technology (photo Miloš Hernych)

The second category of participants represents pupils of the 8th and 9th grade. The events are often linked with practical demonstrations and visits to laboratories either in TUL or in industrial practice. Specific examples of the activities include:

- **“Saturdays with technology”** are intended primarily for pupils of the 8th and 9th grade who are unsure about what field to choose for further study. Participants can try soldering electronic circuits, fundamentals of design using a PC, programming or basic video and photo editing, work with vector graphics and much more. Children discover what they are interested in, which help them to decide which secondary school to apply for in their further study.
- **“PřiTUL se!”** (play of words where TUL is a part of Czech word meaning “nestle together”) is a set of weekly events for primary school children, which take place during the school holidays (autumn, winter, spring, Easter). Children can sign up for a course of programming robots, make rings on a lathe, learn to solder, build model airplanes and boats, try out different traditional and non-traditional textile technologies, and participate in interesting chemical experiments in the laboratory etc.

In addition to activities aimed at primary school children events are also organized primarily directed at high school students.

- **“Technical Day”** - During “Technical Day” individuals and teams have the opportunity to present their unconventional and original idea or thought to an expert committee. A team from TUL then provides financial and material support to the most interesting topics as well as the possibility to use the instrumentation of the TUL laboratories.
- **“Cyber robot”** - a creative competition especially for high school teams that participate with their home-made robots.
- **“Mentoring programme”** is an opportunity for applicants from high schools to try one week of university study in their chosen programme under the supervision of a TUL student.

Connect activity

If the above activities attract children and high school students and galvanize their interest in technical and scientific fields so much that they start thinking about future careers in these areas, they can try a “dry-run” of a university education and participate in the Children's University for one full school year. During their “studies” students go through all of the steps of a university education including recruitment, matriculation and the subsequent study obligations of a university student. Children “study” subjects through games which focus on engineering - fundamentals of engineering, machining and assembly, automotive design, electrical engineering, robotics, microelectronics and natural sciences - chemistry, physics, fluid mechanics, microbiology and remedial technologies. The Children's University also offers an opportunity to “study” fields such as material engineering and applied chemistry. Upon successful completion of the lectures, seminars, semester projects and “thesis defence” children who obtain the required number of credits attend a graduation ceremony, where they are addressed by the Rector who awards them with a Children's University diploma. This year was the third annual Children's University which was successfully completed by nearly 200 children, as well as in previous years it

generated a great deal of interest among both children and their parents, who play a very important role in deciding on the further studies of their children.

The Children's University and other events for children and young people were completed by a total of 2,606 primary school pupils (654 girls and 1,952 boys) and 266 secondary school students (58 girls and 208 boys) between 2009 and 2012.



Fig. 5. Rector awards children with Children's University diploma

Science Incubator

The Science Incubator is a follow-up programme to the Children's University. It is aimed at students of Bachelor's and Master's degree programmes at the Technical University of Liberec. The aim of the Science Incubator is to catch talented young scientists in time and keep them for research work at TUL. The Science Incubator offers a variety of activities:

- **“Open days for students in the laboratory”** take place together with the exchange of themes with offers to participate in activities within R&D teams. Young scientists can become a junior scientist in scientific research projects or obtain a current diploma or thesis themes.
- **“All-day courses and seminars”** - Implemented Scientific hatchery together with researchers TUL students represent the results of their research in order to engage talented young scientists in their research teams.

- **“Excursions for students to interesting sites linked to research activities”** - Students can visit interesting places and companies where they work with the research results. In the past excursions include a nuclear power plant, Škoda Auto, Josef underground laboratory and other interesting places.
- **“Use of Science Incubator equipment for the realization of their own ideas”** - the Science Incubator has the financial resources to purchase new laboratory equipment or for their development at TUL. On the already mentioned “T day”, if the committee is interested in their ideas, students can obtain financial support and the opportunity to use new laboratory equipment at TUL.
- **“Student workshop or “MOCK EXAM”** - the Student workshop is intended for TUL students who are preparing for their final exam and defence of their Bachelor's or Master's thesis. Under the guidance of a mentor they prepare a mock defence of their thesis and presentation in front of several people. The mentor is ready to advise the student and correct his/her verbal communication and reasoning.

Investigation of interest in the study of science and technology among students

To determine the interest in activities offered by the Children's University the implementers of the project in 2011 conducted a survey at primary and secondary schools. In total, 132 children and primary and secondary school and college students were interviewed, 92 boys and 40 girls. Most pupils were from grade 6 to 9 (73 children), as well as students of secondary schools (33). Sixteen were primary school pupils from grade 1 to 5, and five respondents were grade 5 to 8 grammar schools and secondary vocational school or college students (Fig. 6).

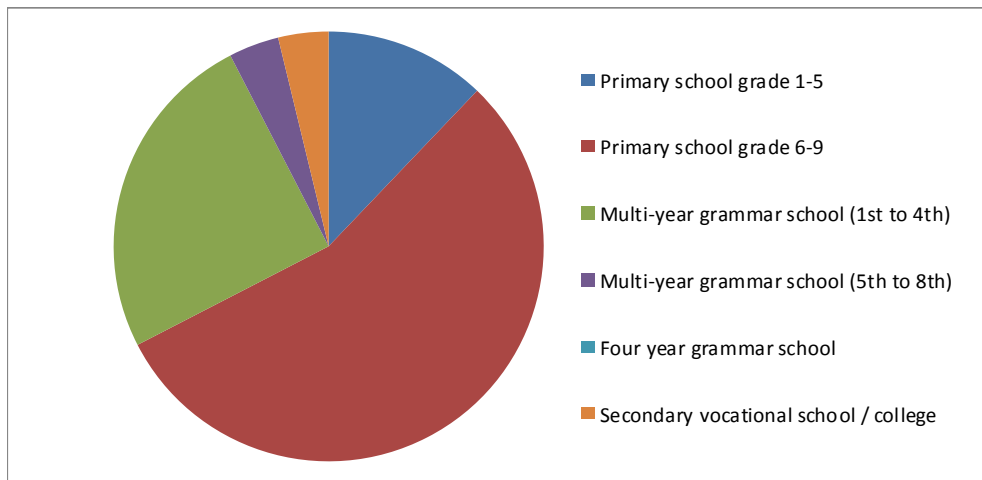


Fig. 6. Proportion of student categories participating in the survey

Respondents were asked brief questions on whether they were interested in technology or natural sciences and about a specific field of their interest. Most children and students

were interested in computers (92), robotics (68) and electrical engineering (55), followed by mechanical engineering (42), chemistry (38) and nanomaterials (33) (Fig. 7). All of these disciplines can be studied at the Technical University of Liberec; hence the implementers were able to verify the sense of the activities of the Children's University at TUL.

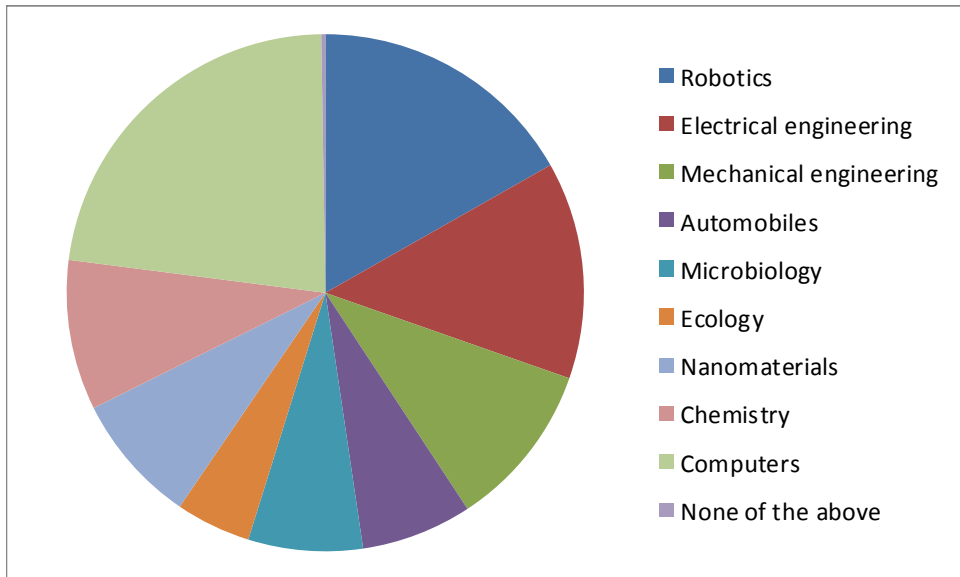


Fig. 7. Which specific fields of technology and science are you interested?

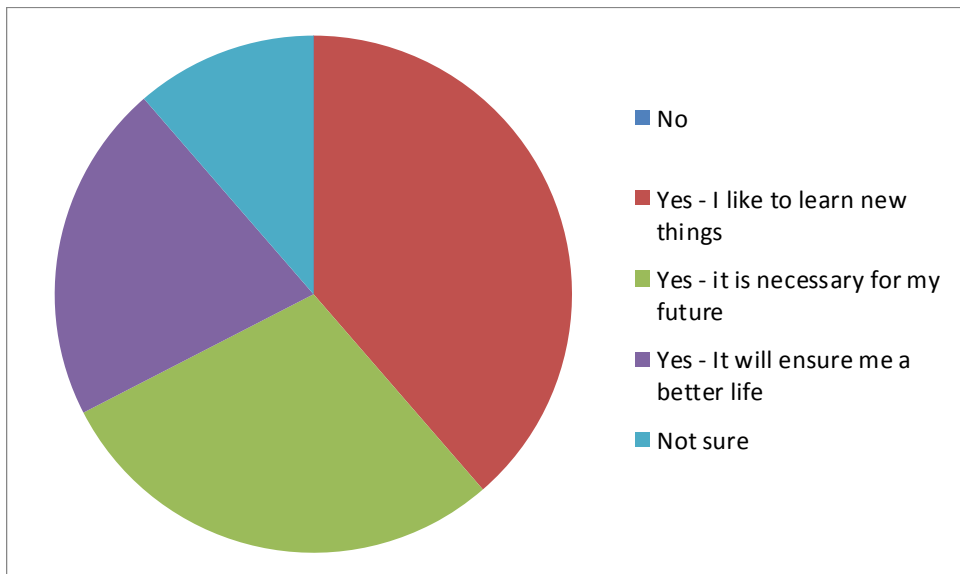


Fig. 8. Would you study at university?

Another question was whether the respondent plans to study in at university. In total 117 children and students responded that they want to study at university. Only 15 respondents said that they did not know. Most children and students (51) responded that they want to study at university because they like to learn new things, 38 respondents said that it is necessary for their future and 28 respondents said that their study will ensure them a better life.

The next question was whether the respondent wanted to try a “dry-run” of a university, to which 131 respondents answered positively. Ninety children and students said they would like to try a “dry-run” of a university with their current classmates and another 41 children or students would like to go to school with university students and see what happens there. Only one respondent said that they are not interested in this activity.

Another question asked whether the respondent would be interested in the work of a scientist. A total of 62% of students and children responded that they would be interested in the work of scientists because it must be interesting and fun, 25% did not know but would like to try. Only 11 children were not interested. The reasons are the work is poorly paid, it is boring or they could not handle it.

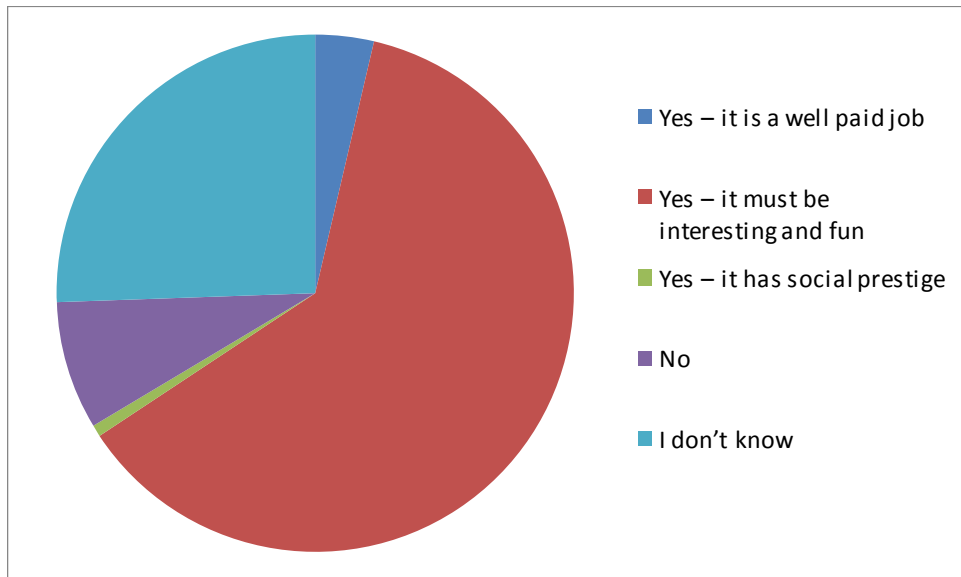


Fig. 9. Would you be interested in the work of a scientist?

The survey indicated to the implementers of the Children's University that children and high school students have an increased interest in studying science and technology and thus also the leisure activities of the Children's University.

Implications

Several years of experience working with talented children and students have given the Children's University team of implementers the chance to verify the following rules:

- Voluntariness - events are intended only for those candidates who register voluntarily.
- “Edutainment” - Participants are actively involved in all activities so that they “get a feel” of the theory and participate in the experiments and production of prototypes, graphic editing of photography, technical aids or develop their own computer program, etc.
- Involvement of parents and grandparents - Parents play a crucial role in the future direction of their children’s study, therefore the implementers of the Children’s University regularly invite parents as well as their children to their events.
- “The sooner, the better” - it is necessary to catch the interest of children in technical and natural sciences with development related to these disciplines from early childhood where children exhibit an immediate interest.
- Patience and durability - the implementers of the Children’s University realize that a technical education is a long and enduring journey, the results of which will take effect only after years of effort. Some results of the Children’s University are already reflected with up to twice as many applications at the Secondary School of Mechanical and Electrical Engineering in Liberec, which was once part of the Children’s University project team.
- Promotion of “good example” - The best advertising is a good reference which spreads itself among people. The implementers have verified in particular the promotion of “good example”, where information about events is spread directly by the participants to their friends and acquaintances [1, 2].

Conclusions

To capture and maintain the interest of children and young people in technology and science fields is a “long haul” which is already producing results. This experience has been verified in practice over the past four years by the implementers of the Children’s University and the Science Incubators. Activities of both projects have captivated thousands of children, students and their parents and we can say that the interest in technical and scientific fields at Liberec schools has begun to increase. Evidence of increased interest can be found both in the results of the survey mentioned and also double the number of applications to study at the Central School of Mechanical and Electrical Engineering in Liberec (secondary school). Hopefully, the efforts made by the implementers of the Children’s University and Science Incubator will reflect in future in an increased interest in studying at the Technical University of Liberec, which will be able to offer highly qualified specialists to industrial enterprises based on their demand.

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References

- [1] Kretschmerová L. Motivace žáků ZŠ a studentů SŠ ke studiu technických oborů. Sborník z konference Rozvoj lidských zdrojů ve vědě a výzkumu. Sychrov 2011.

- [2] Hernych M. Budeme hledat budoucí vědce už v mateřské školce? Sborník z konference Rozvoj lidských zdrojů ve vědě a výzkumu. Sychrov 2011.

UNIwersYTET DZIECIĘCY - DROGA PRZEKONYWANIA DZIECI DO STUDIOWANIA NAUK ŚCISŁYCH I TECHNOLOGII

Abstrakt: Politechnika w Libercu realizuje programy, których celem jest przyciągnięcie uczniów, licealistów i studentów pierwszego roku do studiowania nauk technicznych i przyrodniczych. Pierwszy program, mający przekonać uczniów szkół podstawowych i średnich, nosi nazwę "Uniwersytet Dziecięcy". Dzieci uczęszczają na wykłady praktyczne i rozwiązują podstawowe zadania naukowe, korzystając ze sprzętu laboratoryjnego. Ich praca jest oceniana, a gdy przejdą wszystkie wymagane „wykłady”, otrzymują „dyplomy”. Oprócz egzaminów Uniwersytet Dziecięcy oferuje wiele różnych form wypoczynku, np. Otwarty Uniwersytet, Spacer do nauki i techniki, Kawiarnia naukowa, Soboty z techniką. Głównym celem Uniwersytetu Dziecięcego jest wczesne promowanie utalentowanych dzieci i budzenie ich zainteresowania studiami wyższymi w zakresie nauk technicznych i przyrodniczych dla lepszego kierowania ich przyszłą orientacją zawodową w stronę sektorów o wysokiej wartości dodanej, które na rynku pracy cieszą się ciągłym zainteresowaniem. Drugi program, zatytułowany „Inkubator naukowy”, ma na celu promowanie utalentowanych studentów uniwersytetu będących na pierwszym roku na kierunkach technicznych i przyrodniczych.

Słowa kluczowe: uczniowie, studenci, nauka, technologia