

SCIENCE FOR KIDS – PRESENTATION OF THE ROLE OF CHILDREN UNIVERSITY USING THE EXAMPLE OF KITCHEN EXPERIMENTS

Małgorzata Bartoszewicz, Grzegorz Krzyśko

Adam Mickiewicz University, Faculty of Chemistry, Laboratory for Chemistry Teaching
and Community Relations Building, Uniwersytetu Poznańskiego 8, 61-614 Poznań, Poland

Abstract

This paper presents in brief information about the Children's University (CU) (learning activities for children conducted by scientists) in Europe and in Poland. We present examples of chemical experiments for students ages 6–11 who are new to chemistry. During the workshops we used standard products from our kitchens to discuss the importance of chemistry in everyday life. By performing the tasks themselves, young students get familiar with the safety rules necessary for the work in a laboratory.

Keywords: science, chemistry, experiments, Elementary / Middle School, Children's University (CU)

INTRODUCTION

In the Polish school, quite often, the message does not refer to knowledge possessed by the students and is only provided in the form of a structured set of facts. While the children are naturally born explorers, the school environment often suppresses this natural curiosity. Even at a very early stage of school education children already have a developed sense of creativity. Awareness among parents of the importance of this early stage promotes the popularity of children's universities, inspired by the natural curiosity of a child (Bruner 1978, Devall Sesions 1994, Dylak 2000, Brzezicki 2020, Dylak 2014).

Children's universities are extracurricular educational activities for children, mostly aged 6-13. The aim of these activities is to awaken the listener's scientific passion by showing that learning can be a fascinating adventure. They are organized mainly by universities and foundations. Lectures, workshops and laboratory activities take place at the universities, and the lecturers are mostly academics or experts in a given field (Krzczkowska, Orwat & Migdał-Mikuli 2013, Uniwersytety dziecięce 2024).

First such a university was founded thirteen years ago in Germany in Tübingen. On 4 June 2002, to be exact, prof. Gregor Merkel gave a lecture for children titled: "*Why do volcanoes breathe fire?*", attended by 400 children. It met with such great enthusiasm that the number of listeners who attended the next lecture grew up to 900 (Krzczkowska, Orwat & Migdał-Mikuli 2013, Uniwersytety dziecięce 2024).

Currently, the largest institution of this type in Europe, operating since 2003, is the Children's University in Vienna, which initiated the online portal, available in six languages (including Polish) for all the 'small students', their parents as well as members of the international organization **EUCUNET**, uniting all Children universities (EUCEU.NET 2024). The importance of this kind of institutions in the educational system is mentioned by others (Bruner 1978, Devall & Sesions 1994, Dylak 2000).

In Poland, the first kids' university was established in 2007 in Krakow. Since then, Poland witnessed a rapid growth in the number of subsequent children's universities, which now reaches over 50 (Dylak 2014, Krzczkowska, Orwat & Migdał-Mikuli 2013).



Fig. 1. Map of the distribution of children's universities in Poland

Fig. 2. Children's Universities in Poznań. Source: http://uniwersytetydzieciecie.lud-rekrutacja.p.lodz.pl/03_mapa

Based on research conducted in 2018/2019 in Poland, it was found that Children's Universities were mostly organized by higher education institutions (29 entities), then foundations (8 entities), houses, cultural centers (5 entities), as well as associations, libraries and other entities established by municipal and city offices (3 entities). The dominant group of people conducting various classes are academic teachers. The forms of classes organized by the CU were varied, but the most popular were lectures, workshops, and multimedia shows and presentations. The topics of the classes were focused primarily on biology, nature, paleontology and geology, then culture and art, including music and visual art, as well as physics and astronomy and computer science (Fig. 3) (Brzezicki 2000).

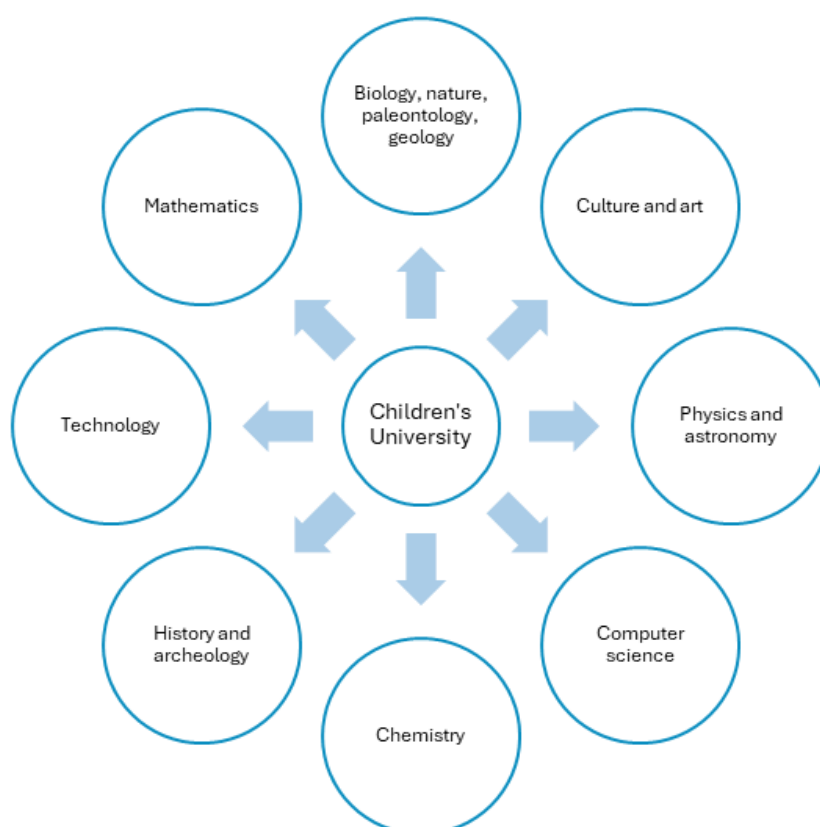


Fig. 3. Main thematic areas of lectures, classes, workshops, shows, laboratory classes and others organized by Children's University. (Brzezicki 2020)

Taking into account our personal experiences, the authors are here discussing the idea of classes at the Children University UNIKIDS (UNIKIDS 2024).

The project of the kid's university is addressed to children in the first and second stage of their education. Classes are held in the form of lectures and workshops conducted by researchers from Polish and foreign research centers. Presented topics include various areas of science such as astronomy, anthropology, biology, mathematics, physics, chemistry, paleontology, economics, psychology, medicine and law. The content and the form of classes is tailored to each age group. Each 'small student' has an index and a student identity card. Students receive a stamp for participation in each class, and they need to collect 3 stamps to complete the semester. The intention of the school founders is to combine learning and fun. Children University has 30 branches all over Poland and it cooperates with other children universities both in Poland and abroad (Krzeczkowska, Orwat & Migdał-Mikuli 2013, Uniwersytety dziecięce 2024).

An important element supporting school education at the Children's University project is its website.



Fig. 4. UNIKIDS Children's University in Poznań website;

Source: <http://www.unikids.pl/poznan/10/10> (internal material)

Students and their parents can also use the university's online resources. By clicking the "On the trail of science" tab you can find brief information in the form of scientific curiosities from different fields of knowledge. The "Experiments" tab contains descriptions of simple experiments in chemistry, physics, biology and geography, that kids can carry out at home themselves. The site also presents biographies of famous scientists, adventurers, politicians and explorers. When going through the "Famous people" tab, for example, a kid or a parent can find information about the discovery of synthetic dyes ("Thanks to it our jeans are blue. The achievements of Adolf Baeyer"), elements and chemical compounds ("The story of the birth of the great chemist, who built his laboratory in the shed. Who was Karl Scheele?").

The "Scientific Glossary" presents simple definitions of basic concepts for scientific research (such as a scientist, an experiment, a research team) and the structure and functioning of scientific institutions (e.g. an academic year, a student, a professor, an institute) (UNIKIDS 2024).

Young students can sign up to different "Scientific Clubs". The following ones are available once you log in:

- Young Chemist Club – showing many interesting, safe and easy ways to perform home experiments, you can also post your own curiosities,
- Biologist Club,
- Crazy Physicists Club,
- Traveler's Club,
- Animal Lovers' Club,
- Questions & Answers Club,
- Polite People's Club (UNIKIDS 2024).

Lectures covered the following topics in the field of chemistry:

- Chemical chameleons

Exemplary topics of workshops:

- Ointments and laboratory

The general objectives of our activities:

- to develop kids interest in chemical science,
- to widen the knowledge about chemistry,
- to help children acquire the critical thinking skills and performing simple chemical experiments,
- to teach the kids the ability to link information about the basic physical and chemical properties of substances and their use in everyday life (UNIKIDS 2024).

The other objective of the classes is introducing and developing of the scientific thinking ability during the safety workshops. There is a possibility of introducing the substantial elements of applying the scientific perception:

- formulating a hypothesis,
- solving problems,
- using the knowledge and skills in verifying hypothesis,
- using the skills acquired in the laboratory to conduct experiments,
- interpretation of the data received,
- simple and understandable description of the experiment (UNIKIDS 2024).

During the properly prepared and conducted classes a child becomes a "researcher".



Fig. 5. Student – researcher

Students can perform the tasks independently and at the same time learn the principles of safe work in the laboratory.

Methods and forms of work

Method:

- verbal: conversation, explanation,
- seeking: self-experience,
- demonstrative: presentation of the experiment.

Forms of work during the workshops:

- work with all students,
- work in groups,
- individual work.

Advantages of workshops:

- children can perform experiments themselves,
- opportunity to confront conclusions and observations with a teacher,
- the teacher can focus on a small group (Krzeczkowska, Orwat & Migdał-Mikuli 2013).

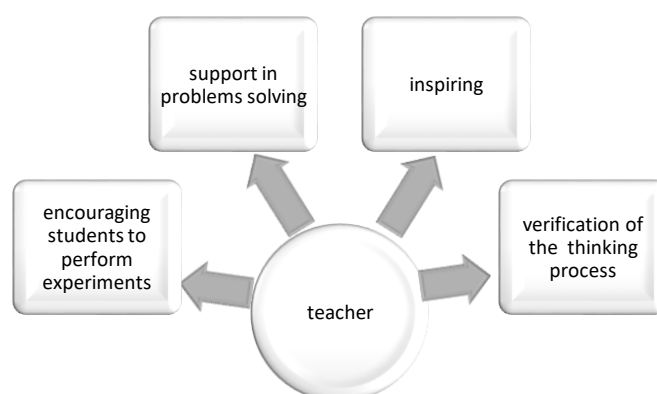


Fig. 6. Teacher's tasks during workshop

It is important to formulate the names of experiments in an interesting way to encourage the children to participate in activities. The table below shows our proposed activities for the chemistry workshops (Table 1, Table 2).

Table 1. Topics of the proposed chemistry workshop

"Sugar, soda, flour – chemical power"	
A group of 6 - 8 year olds	
•	will form colored images from the food products
•	will examine what is hidden in the water,
•	will conjure up glue and check its use.
•	will make a mysterious mass made of potato flour

Table 2. Topics of the proposed workshop in chemistry for children aged 9 - 11 years

"Kitchen experiments"	
A group of a 9 - 11 year olds	
	• Is flour safe or dangerous? – Flour power (Supplement) • What is the relation between coal and sugar? • What is hidden in fruit and vegetables? • Are nuts fat? • What can you find in a cola drink? • What can we see in fruit tea?



Fig. 7. Kids during workshops

Selection of the appropriate teaching materials and aids allows to awake the child's curiosity about the surrounding world. Simple chemicals from the household, used during the activities with children, helped to discuss a number of chemical issues and topics (Table 3). Kitchen substances are also an inspiration for many other experiments (Jacobsen 2011).

Table 3. Substances used during the workshop and the topics discussed with kids

Substances	Topics
wheat flour	• physical properties (state, color, hardness) • chemical properties (flammability, solubility) • examining the physical and chemical properties of starch



Fig. 8. During workshops

Can the flour burn?

Materials

20 g of wheat flour
matches
Petri dish
funnel with the drain tube
gas burner

Student Procedure:

Pour the flour into a Petri dish. Lit a match, tap flour.

Teacher Procedure:

Place the flour on the funnel. Draw air from the lungs and blow spilling flour funnel. His departure substitute lit burner.



Questions

What happens when you burn flour?
What lights up faster flour dust or pile?
Why dust cloud of flour can easily/hardly explode?
What kind of food materials can be just as easily catch fire ?

Fig. 9. Example of worksheet “Can the flour burn?” (own source)

CONCLUSIONS

Workshops at the Children's University allow an independent research activity, improve communication and develop teamwork skills. The suitable curriculum provides the child with new insight into the surrounding world and helps to organize the already existing knowledge. Classes combining elements of teaching, fun and interdisciplinary studies can also provide an opportunity to perfect the teacher's teaching skills. The measure of the workshop's usefulness was kids' passionate engagement in the proposed experiments. The workshop participants were able to acquire their personal knowledge through experience (Krzeczkowska, Orwat, & Migdał-Mikuli 2013, Jacobsen 2011).

The out-of-school education has great potential to help kids to learn, appreciate, and develop positive feelings toward science. This is very important considering the fact that 85% of the time kids spend outside the classroom. Their life experiences, both in and out of school, have profound effects on their achievement in school and their functioning in society (Eshach 2007).

Out-of-school programs where learners engage in scientific practices within the context of kitchen chemistry to engage and support children in the design of their own personal investigations. A wide range of activities for children creates opportunities for the implementation of activities in chemistry, which are not restricted curricula (Judd 2000).

The mission of Children's Universities is primarily to develop children's natural curiosity about the world around them and their interest in science. The activities of CU are consistent with the concept of "lifelong learning" developed in the European Union, which refers to all activities related to lifelong learning, aimed at improving the level of knowledge, skills and competences in a personal, civic, and social perspective (Brzezicki 2020).

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