MTA-SZTE
Science Education
Research Group

This good practice was funded by the
Content Pedagogy Research Program of the
Hungarian Academy of Sciences.

Teaching science subjects on new paths: Workshop for primary and secondary teachers

The MTA-SZTE Science Education Research Group and its partner school, Arany János Primary School, invited the primary school teachers, who teach lower-primary students and the teachers of natural sciences in the upper sections in the Szeged School District for a workshop. The aim of the program was to exchange experiences among the in-service teachers, pre-service teachers and researchers and to shape the approach of the educators. The interest of teachers in the development of scientific reasoning and active learning has been particularly important. In the fast-paced world of the 21st century, the skills that enable the systemisation, acquisition, application of knowledge, and problem solving in different contexts are becoming increasingly important. Furthermore, solving problems as they appear in different fields of life is also crucial. The participants were able to see many examples of the development of these skills through the results of the research group and the good practices of the school.

More than 50 teachers attended the workshop. It was implemented in the cooperation of the members of the Research Group, 5 university lecturers, 1 doctoral student, 2 pre-service teachers, approximately 20 teachers and 60 students of the school. Descriptions of all the here shown projects and experiments are to be accessible on the webpage of the MTA-SZTE Science Education Research Group.

After the introductory lectures, the events took place in several locations simultaneously.

TEACHING SCIENCE SUBJECTS ON NEW PATHS: WORKSHOP FOR PRIMARY AND SECONDARY TEACHERS

Date: 02. 02. 2018.

Venue: Arany János Primary School Szeged, Hungary

Programme

14.00–14.10 **Opening session**

Judit Plesovszkiné Ujfaluczki
Head

Szeged School District

14.10–14.40 **Changing approaches in the development of scientific thinking**

Erzsébet Korom
Associate Professor

MTA-SZTE Science Education Research Group
Department of Learning and Instruction, University of Szeged

14.40–15.00 **Science in everyday life – everyday science: A school-year long community project in Arany János Primary School Szeged**

Ágnes Kissné Gera
Headmistress

Arany János Primary School Szeged

15.00–16.30 **Insight into the world of science**

Cognitive development tasks
Children teaching children – Experiments for "sibling" classes
Creative learners, creative models and experiments – Topic-based experiments
Ideas, possibilities – Experiences, results and conclusions of the school project

16.30–17.30 **Teachers in the role of students**

Trying an inquiry-based lesson

17.30–18.00 **Discussion of experiences**

18.00–18.30 **Evaluation of the workshop and further plans**

Cognitive development tasks online

Teachers could try out science-related online tasks to development of reasoning skills, inquiry skills, and learners' thinking in embedded science learning. The research group was to develop sample items for the individual school subjects of biology, physics and chemistry and for the previously identified complex subject areas. These sample items were to be tested at partner institutions.

Science in everyday life – everyday science
A school-year long community project

The participants learned about the annual community project of the Szegedi Arany János Primary School ***Science in everyday life - everyday science***. This series of programs, in addition to attracting students' interest in science, mobilizes students' creativity, problem-solving skills, analogy and critical thinking, and develops their social and communication skills. It provides opportunities for students to engage in projects, to study and experiment with companions and to design and construct models.

In the workshop, the school presented the student's presentations of the projects, which had been realized during the academic year, and their teachers shared their methodological background and the details of their implementation with their colleagues.

Hungarian Science Day project

9th November – Hungarian Science Day

In our project, which was related to the Hungarian Science Day (9th November), students made illustrations for the milestones over several thousands of years of development in science and technology.

Call for participation

Collect and make illustrations of the inventions that have changed the life of humankind from the prehistoric times to the present.

Students' activities

- Collecting data: each year group researched inventions of different historic periods
- Filtering of information
- Designing illustrations, finalizing the number and size of inventions
- Preparing the illustrations
- Putting the illustrations on display

A student's comment

The hardest part was that we had collected a lot more inventions than that we could fit on a 10x2.5 metre display panel. We quarrelled a lot, but in the end, mathematics won.

(Norbi, 12 years old)

Thoughts about science

With the intention of shaping students' attitude towards science, we asked students to put their feelings and ideas about science and its role into words.

This is what our students think about science

- Science helps us a lot. Now we can cure even those illnesses that we were not able to a long time ago. However, there is plenty of room for development.
- Science is important because the technology of chocolate making can advance.
- For children, science means health, convenience and development.
- Science is like mathematics. Not everybody can understand it.
- For me, science means the implementation of creative thoughts and ideas which are useful in our life.
- Science is a set of information that can explain why something happens in the world and it includes its laws.
- Science means a way of thinking that makes our everyday life easier.
- I do not see science only in technology: everybody can know something that I do not and that is science too.
- With the help of science, we can become smarter and can make better decisions.
- Without science, there would not be a „giant leap for mankind" of any sort.
- Science is interesting and amazing; there have been many useful inventions with the help of science.
- Science is very important because in the past, sending homework via the internet, Facebook, Messenger, Viber or Skype was not possible.

On this day a mobile planetarium moved into our gym. All students could participate in one of its shows which was chosen according to the students age.

A Scientific playground-experiments by "sibling" classes

Preliminaries

Last year, going hand in hand was the slogan of the programmes advertised for our "sibling" classes. (Each class from the senior section chose a class from the junior section.) They played and did tasks together, going hand in hand.
We were pleased to see the senior students taking care of the junior students and giving them so much love. The younger ones looked at the elder ones with amazement. The idea of a scientific playground comes from this experience: Let them do experiments together and let the elder ones teach the younger ones.

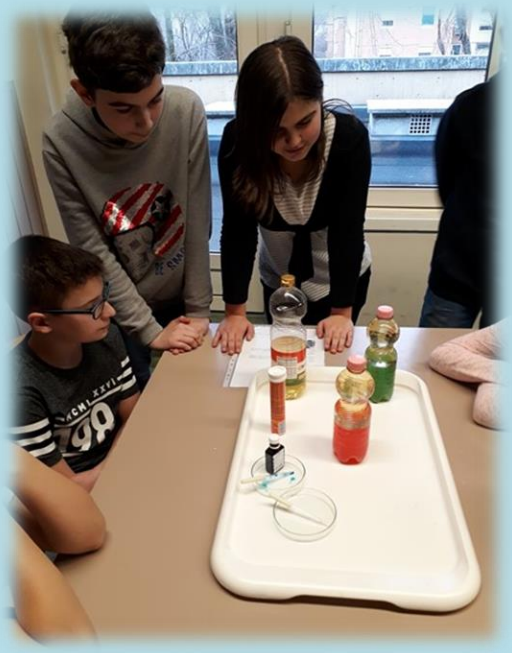
The scenario of experimental afternoons of “sibling” classes

- A team of science teachers compiled 35-40 physics, chemistry, biology and geography experiments, which are not dangerous, and the materials used are not harmful to our health. Furthermore, these experiments can be carried out easily and they even are quite spectacular.
- The teachers of the “sibling” classes selected 5-6 experiments which can be done as a part of an extra-curricular activity and take about an hour to do.
- Two students were chosen to be responsible for each experiment. They did the experiments with the help of the teacher and before their presentation they practised how to do them. They discussed the causes of failures, observed and gave explanations for the phenomena.
- The students, who were responsible for the experiments – prepared the tools and materials for their experiments and waited for the afternoon.
- The workshops were led by the senior students. The junior students were put into groups by them and each group could carry out all the experiments one by one. During the experiments the junior students kept on asking questions and listened to the explanations of the elder ones with great interest. The smartest ones were able to answer the thought-provoking questions linked to the experiments.

The Experiments of “sibling” Classes 7.a & 4.b

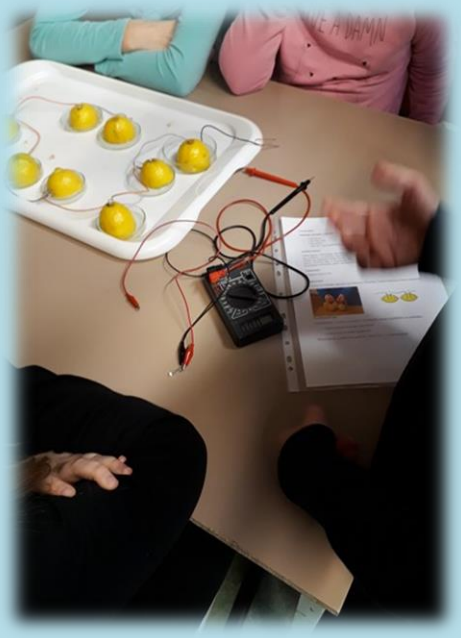
1. The detection of oxygen production of plants

2. Making a lava lamp



3. The experiment of a volcanic model

4. Producing electricity with the help of lemons



5. Swimming and floating of bodies in different density sorbents

6. Making a rainbow

Comments on the "sibling" classes' experiments

- I never thought that so many interesting things could be done in the senior section.
  Ármin (8 years old)

- When I grow up I will also have a "sibling" class from the junior section and I will teach them some experiments.
  Márk (8 years old)

- I never thought that I was also able to do the experiment.
  Zoé (9 years old)

- It was particular, since we did experiments with things that can be found in every kitchen. I told dad and mum and they said that we could also try doing them at home.
  Natasa (8 years old)

- I have never had such a good day before!
  Zsüliett (9 years old)

Creative learners, creative models and experiments
Topic-based experiments

'It's fun to do experiments' – that's how we invited our students to our thematic scientific experimentation afternoon. At the workshop, scientific acquisition was presented in the scientific fields of geography, physics and chemistry. Both teachers and students were delighted to share their experiences with the participants: how the presented experiments help the intensification of the knowledge gained during lessons, how students can gain more knowledge by the recognition of correspondences and how experiments help to solve the raised problems. The participants were enthusiastic to listen to the suggestions and technical solutions, which are necessary for the successful fulfilment of the different experiments.

At the stall of the science of geography, the forces of nature revived.

The formation of trade winds and how the flow of magma carves the Earth's crust into plates, were presented through model experiments.

The magnetic field of the Earth and the direction of the magnetic poles were demonstrated. The role of water in the scarf of rocks was proven.

The soil erosion device made by the students themselves was quite popular.

The participants could learn how to make dripstone caves from a baking soda solution.

The science of chemistry was presented by a project on water.

The students made a daedal clarifier. They demonstrated the scale-model of the sterilization device under construction in Africa, which would help to supply the population with clean drinking water.

A simple experiment showed how water could be divided into molecules of oxygen and hydrogen with the help of a battery.

It was a surprising experience to see the periodic system, molecule-models and chemical instruments made by chocolate, candies and gingerbread,

as well as ‘ice cream’ made with polluted water.

The students also give help with the determination of the hardness of water and the solution to the everyday problems of the examination of dissolution.

Magic or physics? The science of physics was popularized by experiments, the realization of which the students thought unaccomplishable.

They were surprised to see that a pumped-up balloon can be poked through with a stick and it would not blow up,

a cork can be removed from a glass bottle with the help of a piece of cloth, the yolk of an egg can be separated from the egg-white with the help of a plastic bottle and

that approximately one hundred paper-clips can be put into a full glass of water without the water spilling from the glass.

They were amazed to watch paper flowers open on the surface of water and peas moving up and down in a bottle of mineral water.

They marvelled at the model of the function of the lungs, in which the diaphragm was substituted with a piston, the lung with a balloon and the chest with a PET bottle.

Teachers in the role of students – Trying an inquiry-based lesson

In the next part of the program, teachers were challenged from the students' point of view to do an inquiry-based experiment. Working in groups, they designed and implemented an experiment to prove where the salt volatile (baking powder) disappeared from the sealed bag. The experiment was led by two members of the research team, a chemistry professor and a doctoral student. At the end of the session, they discussed the experiences and the importance of developing reasoning and inquiry skills. They also talked about the methods of implementing inquiry-based learning, the role and tasks of the teacher, the organization and evaluation of the work of the students.

Reflection on the Workshop

This workshop is a platform of a fruitful professional relationship between the research team and its partner school. It is a good example of how the results of educational researches and developments can be transposed into teaching practice and integrated into the school's natural science education program. In the workshop, the dissemination and sharing of good practices took place in a diverse form among the participants. The children, the little ones and the big ones learned from each other, and the teachers, pre-service teachers and the researchers learned from each other too.