MOVING SCHOOLS CLOSER TO THE WORLD OF SCIENCE

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Innovative solutions for education from the EDUSCIENCE project

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Innovative solutions for education
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Warsaw 2015

The final report on the project entitled: ”Increasing school pupils' competence in the field of mathematics, natural and technical sciences with the application of innovative methods and technologies - EDUSCIENCE”

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Project co-financed by the European Union under the European Social Fund

HUMAN CAPITAL NATIONAL COHESION STRATEGY

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EUROPEAN UNION EUROPEAN SOCIAL FUND

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Dear Sir or Madam,

We are pleased to provide you with the report on implementing the EDUSCIENCE project. It includes many innovative educational solutions and has been tested for a 2 year period at 250 schools all over Poland. In the report you will find some basic information on the project and a summary of the evaluation of its effectiveness together with practical guidance on how to join the project and make use of its products effectively.

The EDUSCIENCE project aims to change Polish education by instilling pupils' joy in the process of learning

Polish schools are perceived by many school pupils as boring and not very relevant to the "real world". In the course of learning, students lose their childlike passion for discovering the world and asking questions. Their place is taken by exercises and preparations for tests. The EDUSCIENCE project aims to change the Polish education, primarily through putting joy back into the process of learning. We are committed to "infuse" school pupils with a passion for science and scientifics methods. We aim to persuade teachers to show the world in new ways, to get school pupils fascinated by natural phenomena, and to encourage them to enjoy acquiring new skills. Moreover, we equip teachers with advice on how to make use of modern technologies, and thus better reach young people.

The EDUSCIENCE project is unique and multi-dimensional. The project is unique, not only in Poland but also in Europe, and it is multi-dimensional because it reaches both school pupils and teachers as well as - in another dimension - research staff whom I represent. The project focuses on phenomena which are complex, and usually difficult to explain and understand - making use of words which are tailored to young audience. In the project we illustrate many novelties in science, we demonstrate scientific findings about our planet, physics, mathematics, and the natural world.

On the other hand we wish all our students to be instructed in such a manner as to make them not only understand science but also get fascinated and enthused by it. We hope that they will wish to "imitate" scientists and explore the world because it is only through their active participation that science will become really interesting for them. The EDUSCIENCE project is unique in our education system because it aims to demonstrate the world of science from the students' perspective. Pupils are allowed to visit laboratories, participate in research projects, and cooperate directly with researchers at the Hornsund Polish Polar Station in Spitsbergen, which is particularly exciting for them.

The results of our evaluation studies - after 2 years of practical implementation of the project at selected schools - show clearly that it has been effective and has been well received by teachers and students. The project is available free of charge and without any restrictions. Therefore, I warmly encourage you to start your adventure today with EDUSCIENCE.

Prof. Paweł Rowiński Ph.D.
Director of the Institute of Geophysics
Polish Academy of Sciences

The project ”Increasing school pupils' competence in the field of mathematics, natural and technical sciences with the application of innovative methods and technologies - EDUSCIENCE” is the largest innovative project implemented in the range of mathematical and natural sciences. It has been co-financed by the European Union under the European Social Fund.

Adhering to the project - we have strived to ensure that new methods of learning and teaching lead to an increase in children and young people's interest in mathematics and natural sciences, information technology, and technical sciences as well as in foreign languages (so necessary in the today's world). We encourage school pupils to participate in the process of factual research, to observe the world around them, to independently ask questions and seek answers by applying research methods at their schools.

We know young people are open to technical innovations, to information technology, and enjoy making use of high-technology electronic equipment, so we provide them with state-of-the-art tools which they can use in their school work and in the development of their own personality. By involving specialists in modern teaching methods we are able to help students learn in an enjoyable and, above all, efficient manner.

In the project we have paid special attention to the issue of gender equality. By promoting the project in a gender-sensitive way, and also by conducting lessons and constructing the teaching curricula in a gender-sensitive way, we strive to increase girls' interest in mathematics and natural sciences as well as to provide them with equal access to them.

Since the 2014/2015 school year we have invited teachers from all Polish schools to participate in the project free of charge

June 2014 saw the completion of testing the project at 250 educational units all over Poland. The testing took 2 years and covered all educational stages. It has enabled us to tailor the final product to users' expectations and at the same time has confirmed this is an effective and comprehensive product, a perfect tool to be applied in the increasingly changing and modern environment of Polish schools.

This report is a summary on the project. You will learn the benefits of joining the project in the next stage, i.e. at its dissemination. Since the 2014/2015 school year we have invited teachers from every Polish school to participate in the project free of charge. Every school which is interested in the use of the educational platform, its collections of resources, visits at observatories and scientific institutions, getting connected with scientists from the Polish Academy of Sciences, participation in live coverages from the Hornsund Polish Polar Station in Spitsbergen may join the project by signing up at the following website: www.platforma.eduscience.pl.

We encourage you to get acquainted with the report. Apart from some basic information on the project and its final products, you will also find practical information on how to make use of some of the solutions we have developed to make work at school not only enjoyable, but also beneficial.

The project tailored to meet the needs of schools

- Innovative project put to the test
- Why EDUSCIENCE?

Innovative project put to the test

How can we make the teaching of mathematics, natural sciences and technical subjects more appealing for school pupils and teachers? How can we trigger children and adolescents' interest in these school subjects, stimulate their curiosity and their passion for learning and research? And how can we make more students than ever wish to get educated at higher schools and universities in these areas?

The authors of the EDUSCIENCE project have sought answers to these vital questions. Their pursuit for these answers has led them to develop new, effective solutions which are just coming into the mainstream of school practices.

Their search was launched in March 2011. A preparatory stage of the project was run till October 2011. During this stage the problem of insufficient interest by senior secondary school graduates in studying mathematics, natural sciences and technology was diagnosed and analysed. It was also at this stage that an initial version of the project together with its strategy for implementation was developed.

The implementation began in January 2012 and will last till May 2015. This stage involves: testing the project in schools, development of the final product, analysis of the actual effects derived from introducing the offered solutions (external evaluation), validation and, finally, dissemination of the project and getting it into mainstream schools.

The developed final product is a new and unique solution. It consists of several elements which are described in details in the chapter entitled: "Why participate in EDUSCIENCE?". Some of these include: the e-learning platform, the popular science website and an extensive set of excursions. Pupils attending schools all over Poland are the target audience. During the testing phase more than 5000 students and more than 1000 teachers have been involved.

The key objectives of the EDUSCIENCE project are as follows:

- to increase interest in mathematics, natural, computer and technical sciences as well as foreign languages - thanks to fundamental changes in the existing ways of teaching,
- to enhance students' skills of recognising and specifying research problems and their ability to apply research methods within both mathematics and natural sciences - thanks to their deeper involvement in research methodology,
- development of skills in the use of information and computer technologies in the process of learning thanks to the application of e-learning and blended learning methods,
- to increase girls' interest in mathematics and natural sciences thanks to the application of gender-sensitive forms of promotion of

the project, conduct of lessons and construction of teaching curricula.

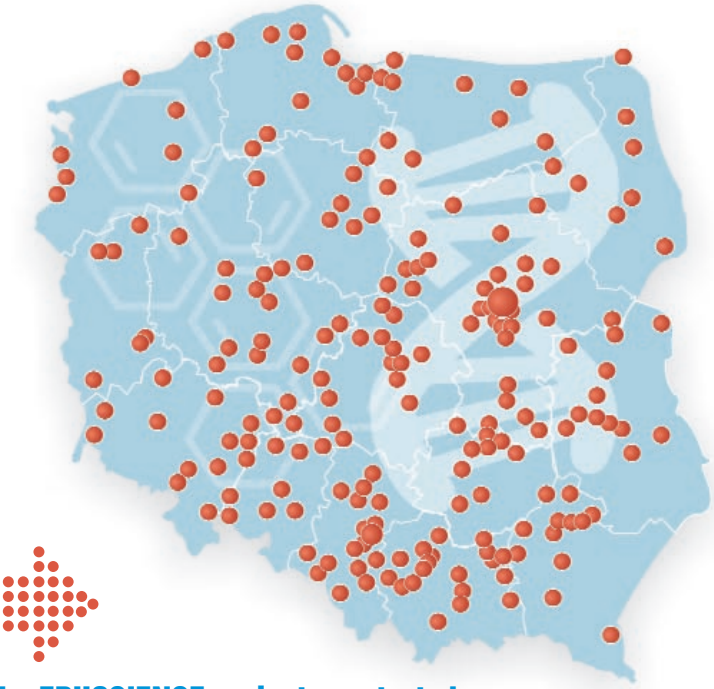
Prior to the EDUSCIENCE becoming the final product, it was verified that these objectives were achieved. It was tested at 250 schools at all educational stages. The principal testing was conducted from September 2012 to June 2014 at lessons in the following subjects:

- in 1-3 grade classes at primary schools: early education (mathematical and natural science education),
- in 4-6 grade classes at primary schools: mathematics and nature subject,
- at junior secondary schools: mathematics, geography, chemistry, physics, biology,
- at senior secondary schools: mathematics, geography, chemistry, physics, biology and the Earth science.

Additional lessons durring which teachers had an opportunity to use the e-learning platform were as follows: information technology, computer and English language classes. In total, during 2 years of testing the project, more than 55,000 lesson hours were run.

The EDUSCIENCE project offers:

- **learning by experiments** - the project focuses on engaging school pupils in the conduct of experiments tailored to their age and skills,
- **different ways to transfer knowledge** - there are various types of materials (films, audio files, images, animations, quizzes, cross-words etc.) to be found at the e-learning platform,



The EDUSCIENCE project was tested at 250 schools all over Poland at all educational stages

To see what the EDUSCIENCE project really is, you must get into it. I encourage all teachers because I have already been 'into' it a year and a half. Making use of the access to information provided by the project, the interactive board and platform are beneficial for both school pupils and teachers. They help school pupils to acquire knowledge and assist teachers in their work and persuading school pupils to learn.

Witold Wojciechowski
teacher of geography at the Senior Secondary School in Turek

- **direct contact with scientists from the Polish Academy of Sciences** - video-conferences, on-line lessons, and visits at observatories give school pupils an opportunity to ask questions, and have an influence on the conduct of studies or experiments,
- **getting to know various aspects of science** - there are satellite broadcasts run from the Hornsund Polish Polar Station in Spitsbergen and from geophysical observatories in Poland,
- **modern teaching techniques** - school pupils are not only recipients of methods applied by teachers but also themselves get to know their abilities and learning styles, thus they are consciously and actively involved in the process of learning.

All of this makes the EDUSCIENCE project an innovative project which meets the requirements and expectations of Polish schools, their pupils and teachers.

Why EDUSCIENCE?

Before starting the EDUSCIENCE project, the standing of Polish schools and the challenges faced by young people after completing education were analysed in details. The report entitled "The young people in 2011" drawn under the scientific editorship of Minister Michał Boni points out the problem that there is a mismatch between the outcome of education and the changing labour market needs in Poland.

Teachers focus more on communicating the facts than on the development of reasoning skills and research-based approaches to problem solving

Study subjects which are most frequently chosen by young people do not match the existing market needs, and this is particularly evident in a shortage of skilled graduates in scientific and natural science specialisations. Whereas these areas are considered to be specialisations of key importance to the knowledge-based economy.

The analysis of data on the number of students undertaking education in mathematical, natural science and technical specialisations leads to the following conclusion: in spite of the fact that there has been a slight increase in the percentage of students in these specialisations recently, still these numbers are unsatisfactorily low.

According to the Central Statistical Office, education in mathematics, natural sciences and technical specialisations in 2010 was undertaken by only 11.40% of all persons starting higher education. The data for the last years, i.e. for 2011 and 2012 confirms the same conclusion - in 2011 this percentage was at 11.95% and in 2012 - at 12.60%. There continues to be a slight increase in this percentage, but its growth rate has still been far from what was expected. In the light of such data, it should be concluded that the project objectives are still valid and relevant.

Additionally, it is worrying that in 2010 women accounted for less than 37% of the total number of students in these subjects, while in the total number of students this percentage reaches 59%. In 2011, it appeared more or less the same: women accounted for 37.2% of the total number of students at these specialisations,

Still an insufficient number of people undertaking education at higher schools select mathematical, natural and technical specialisations

and in 2012 - 37.69%. There is no doubt that actions to stimulate young people's interest in studies in the scope of scientific and natural specialisations are needed.

Some actions in this area have already been undertaken (among others: mathematics was restored as an obligatory subject to be passed for graduation at senior secondary schools; and scholarships for persons selecting these specialisations). However, they are still insufficient and, above all, they do not cover all educational stages, just the oldest school pupils. There is relatively little action directed to develop interest in mathematics and natural sciences from the earliest school classes. This is a serious issue as - according to the psychology of education and the process of competence formation - first classes at primary schools are a very sensitive period when it comes to the shaping of future educational interests.

Moreover, teaching in the current system of education is aimed at preparing schools pupils for external examinations, thus teachers focus more on communicating facts than on developing logical thinking skills and research based approaches to problem solving. There is

no comprehensive approach to this problem at any of the stages of education.

The above problem was also raised in the 2009 PISA report in which it is stated that - in spite of the continued positive trends in the equipment of schools and some improvement in the overall performance of pupils in natural science subjects - in Poland there is still a relatively small group of good and very good pupils in these areas. The percentage of school pupils attaining the highest results (level 5 and 6 according to the PISA report) in natural sciences was lower than 8% and for mathematical sciences it was slightly over 10%. And these school pupils are potential students of mathematical, natural specialisations (the 2009 PISA study report). On the basis of the 2012 PISA studies it was concluded that there was a significant increase in the percentage of students achieving the highest scores (level 5 and 6) in these areas: to 10.8% in natural sciences and to 16.7% in mathematical sciences.

Most likely this improvement results from increasing investments for education and numerous projects in this area. However, on the other hand, additional results from these studies published in April 2014 in reference to solving problem based tasks, indicate that Polish students have significant difficulties in solving this type of tasks with the use of computers. These tasks were closer to everyday life (e.g. purchasing a ticket in a ticket machine, setting up air-conditioning equipment, selecting the most optimal route) than standard tasks solved at schools. However, they proved to be more difficult for school pupils. The reason behind these relatively worse results at Polish schools may be due to their too-scarce use of computers to solve educational tasks and the insufficient shaping of their general skills in abstract thinking which require creative approaches to non-standard tasks going beyond the school curriculum.

At Polish schools computers are too rarely used for educational purposes. The EDUSCIENCE project has a chance to change it”

The problem does not seem to refer just to computers. As it is evident from the PISA studies, Polish young people are able to use them for the purpose of seeking information or entertainment, e.g. for social networking or playing computer games. It seems that the problem is that in Polish schools computers are too rarely used for educational purposes.

The EDUSCIENCE project - by making use of modern technologies in the process of learning - has a chance to change this situation. A broad spectrum of tools available in the platform and its contents tailored to every level of education allow teachers to have diverse selection of appropriate paths to reach school pupils and get them interested in that what is being taught. Thus pupils have been provided with a range of interesting alternatives to the more conventional ways of increasing their knowledge and developing skills, and the application of modern tools and technologies are a part of this process.

At the same time pupils naturally get used to computers as a tool for work and learning, which increases their chances for a more creative and constructive application of this tool in future, both for educational purposes and in their daily lives.

The EDUSCIENCE project as seen by its creators and developers

Interview

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Agata Goździk, Ph.D., the project manager (the Institute of Geophysics, Polish Academy of Sciences), **Leszek Lotkowski** (Edukacja Pro Futuro) and **Tomasz Juńczyk** (American Systems), representatives of the institutions implementing the EDUSCIENCE project, talk about the project, its objectives and stages.

Wojciech Piotrowski: What inspired you to implement the EDUSCIENCE project? Where did the idea come from?

Agata Goździk: The Institute of Geophysics has been involved in various kinds of activities which have promoted science for many years. It all started from a small project entitled: "Geophysics at school" consisting in getting pupils acquainted with earth sciences through workshops ran by scientists at schools and through visits at our observatories. More than that, in 2007 prof. Piotr Głowacki, head of the Polar and Marine Research Department, came up with an idea to enable schools to get in touch with the Hornsund Polish Polar Station in Spitsbergen. Anybody who has ever visited the station knows that this place is unique. At the beginning, school pupils got connected with the station via Skype, however there were some problems with communication and, in addition, no educators were permanently present at the station. As the project developed further, the national geophysical observatories were invited to join it, with the institutes associated at the GeoPlanet Earth and Planets Research Centre becoming also involved. The project concept grew month by month. In fact, more and more ideas are still coming.

Leszek Lotkowski: For many years - while actively participating in our school life - I wondered how I could use scientific resources to improve the quality of my work. When in 2009 I happened to carry out a trial on-line broadcast together with the Institute of Geophysics, I knew that was it. At that time, I was with my "Pro Futuro" pupils at a green school organised in the region of Lower Silesia. Invited by the Institute, we came to the seismological observatory in Książ. At the castle our pupils ran experiments together with scientists which were then broadcasted via a commercial platform. Not only could their parents watch lessons but also, most importantly, other classes. It inspired me to introduce such activities in our school. However, at that time it turned out that such an educational platform was very expensive. I still remember that we were offered to use a commercial platform for 200,000 PLN per year. Such costs seemed beyond our means then.

During our expedition to Spitsbergen in 2010, it turned out that pupils at Polish schools can be taught directly from the Hornsund Polish Polar Station (in the picture) - and it can be done under the regular school curriculum as opposed to just learning fun facts

Tomasz Juńczyk: In 2009 in the Province of Warmia and Mazury I ran a series of trainings for teachers on obtaining EU funding. One of my training sessions was attended by a teacher of geography who had cooperated with the Institute of Geophysics and taken part in the expedition to the polar station in Spitsbergen. Later on, he got in touch with me and said that the Institute would be eager to engage in a project which would promote mathematics and natural sciences via a web platform. And so it all started. American Systems had implemented educational platforms before, mainly in schools for adults though, but its experience kindled our interest in platforms for primary and secondary schools.

Leszek Lotkowski: Moreover, in 2010 we sailed to Spitsbergen and at that time we got convinced that from there we could run classes for pupils in Polish schools under the core school curriculum, not just by presenting fun facts. It turned out that there are a lot of topics which may support teachers' work at school. Obviously, even before the expedition, we had established some foundations of this joint project; however, it was prof. Piotr Głowacki - the guiding spirit of this expedition and the originator of satellite broadcasting from the Polish station - who gave us the impetus to speed up our work. The establishment of the transnational partnership between American Systems, dealing with technological issues, and

Agata Goździk, Ph.D. – a graduate of the Faculty of Geography and Regional Studies at the University of Warsaw, Doctor of earth sciences. She wrote her doctoral dissertation on hydrodynamics under the guidance of prof. Paweł Rowiński from the Institute of Geophysics, Polish Academy of Sciences. She has been working in the field of education for several years. She worked as a deputy director in the Department of Ecological Education at the Ministry of Environment, where she arranged the technological exhibition accompanying the UN Climate Change Conference in Poznań and was also involved into the "Partnership for Climate" project. On behalf of the Ministry of Environment she ran 11 foresty technical schools. She also gave lectures on ecology at the University of Warsaw. Currently she holds the position of Head of the EDUSCIENCE project run by the Institute of Geophysics, Polish Academy of Sciences.

Leszek Lotkowski – a graduate of the Academy of Physical Education and the Faculty of Foreign Trade and Marketing at the University of Gdańsk. He is passionate about the world of education. He started teaching as early as during his studies. Then he was given a managerial position in one of Elbląg schools. At the Board of Education in Olsztyn he supervised schools and educational units as well as co-founded a province-wide system to measure the quality of their performance. He promoted the European Socrates program as well as worked as a lecturer at the State Higher Vocational School in Elbląg and the Academy of Special Education in Warsaw. More than that, having a long-standing school headmaster's experience, he is currently overseeing the performance of the "Pro Futuro" Educational Complex in Warsaw. He is a coordinator of the EDUSCIENCE project on its behalf.

Tomasz Juńczyk – a graduate of the Faculty of Social Sciences (psychology) at the Adam Mickiewicz University in Poznań and the Faculty of Humanities (sociology) at the Nicolaus Copernicus University in Toruń. He says about himself: "I am passionate about life, other people, search for the meaning of life and all mental activities. "To do" is my favourite verb. I relax by reading, mostly Latin-American authors. Life captured by them is full of emotions, just seething with them". In the EDUSCIENCE project he is a coordinator of the project on behalf of American Systems and an expert in the field of gender equality.

Accelerated Learning Systems, with Colin Rose implementing effective methods of learning into the project, made it complete.

Wojciech Piotrowski: What is so innovative about the project and what are its benefits for Polish schools?

Leszek Lotkowski: I would split "innovativeness" into three pillars. The first one refers to the methodology of effective learning which can be combined with modern technologies. It integrates such elements as: cooperation in a group, opportunities of physical movement in lessons, application of interactive boards, etc. in the educational process. The second one refers to the technology applied in schools making the school reality come closer to the world known to pupils and the one in which they live. The third pillar involves attracting people of authority, incorporating the world of science into the world of education.

Agata Goździk: There are many educational projects which make use of modern technologies, however there are few ones which offer "keeping in touch" with high-level science. Our distinguishing feature is that we can show the work of scientists to school pupils, including what they do every day, what fascinates them, etc. The platform is equipped with a broadcasting module which allows you to get connected with observatories located in different parts of the country and with the Hornsund Polish Polar Station. As it is stressed by teachers and pupils, it is appealing for them that they can connect to Spitsbergen, find out what weather conditions are there, what polar explorers eat, what they do, what measurements they run, when they last saw polar bears, etc. This is something unique that no one else in Poland can offer. Also visiting the observatories - that you can go there, do experiments by yourself, observe seismometer records, is also a precedence in the Polish education.

Our distinguishing feature is that we are able to show the work of scientists to school pupils, what they do every day, and what fascinates them

Tomasz Juńczyk: Some functionalities of our IT tool alone make this project innovative. Of course, we could not have created this extensive platform without tripartite or even quadrilateral cooperation. I am talking here, for example, about education curricula, which means that educational curricula are created automatically and promptly with their simultaneous assignment to resources or materials which teachers may use during lessons. I am also referring here to our editor tool designed to develop full-scope lessons allowing integration of audio, video, and interactive games within them. It significantly increases the technological innovativeness of this project.

Agata Goździk: It is also worth mentioning that the platform offers lots of opportunities to teachers themselves. On the one hand, we provide them with good quality, ready-made resources of various kinds which have already been verified in terms of their content and methodology. On the other hand, this is an incredible tool for active teachers, allowing them to prepare their own materials tailored

to their needs, i.e. exactly adapted to what is being discussed at a given time or how they accomplish the core school curriculum, as well as adjusted to their work with pupils, which increases the efficiency of both learning and teaching.

Wojciech Piotrowski: What are the main objectives pursued by the project?

Leszek Lotkowski: In the EDUSCIENCE project we were challenged to disseminate science in a simple and comprehensible way for today's pupils and students as well as to use multimedia resources at the same time. Initially, scientific staff, when tackling their tasks, used a language which often was mystifying to pupils, especially to younger ones from primary schools. However, we learned very quickly to use it appropriately. In this manner we accomplished and have continued to accomplish one of our objectives - the dissemination of science.

Our project participants got an unusual opportunity to learn directly from the best people who themselves are engaged in exploring the secrets of the natural world and who have direct access to the latest research results. Thanks to these contacts, school pupils got absorbed into the world of science. The opportunity to make observations, ask questions, listen and look for answers is one of the most important issues in learning and personal development. I hope that this experience will have an impact on their whole future life.

Agata Goździk: When I think about the objectives, I recall one of the conferences during which Colin Rose, the outstanding expert in the field of education, our partner in the UK, stressed that we must realise what we prepare school pupils and students for. Probably in several years, when our pupils and students enter their professional, adult life, they will perform professions names of wchich we have not known yet. They will challenge problems facing the world which have not been defined yet. Thus, the main objective of the project is to ”equip” school pupils and students with skills which will be helpful in a few or even several years; to get them realise that knowledge is not enough, facts are not enough but there are various skills which will be useful. In the project we focus on such skills which - from our point of view - are very important for the future generation: skills in logical thinking, analysing facts, drawing conclusions and solving problems in the way scientists do it. So we teach them to use scientific research methods to solve new problems.

A scientist may propose a wrong hypothesis, but proving that this hypothesis is wrong is also an answer from a scientific perspective. When we realise it, we look at the process of searching for new solutions in science from a completely different view. So we encourage pupils to ask questions and come up with very peculiar and unusual ideas. I remember scientists saying that they were impressed by questions asked by very young children at their meetings with primary school pupils. One of these scientists spent a few sleepless nights wondering how to answer the

The best evidence on the quality of the EDUSCIENCE project partners' cooperation is that they are already thinking about our next joint EDUSCIENCE 2 project

following question - what is the smell of the Universe? When we talked about it in a larger group, a lively debate followed. It turned out that each of us had their own idea of how to answer it.

Young children are very curious about the world. I would like our project's most important message for pupils to be - not to lose this curiosity, not to be afraid to ask questions, and to seek their own answers in the process of their education.

Leszek Lotkowski: For most schools and teachers the EDUSCIENCE project was a prelude to the concept of Digital School. Thanks to equipping schools with interactive boards and providing extensive resources and modern tools, teachers are able to develop their skills and make use of digital resources wherever they are. In many schools such opportunities and solutions are considered to be a sort of Digital Revolution. At one of our regional meetings, teachers

cooperating with us said that they distinguish two worlds in their work: the world before the EDUSCIENCE project and the world after the EDUSCIENCE project, i.e. digital resources. There is some truth in that.

Tomasz Juńczyk: Looking at it from my perspective, I would split the objectives into three areas. The first one complies with our "formal" objectives - here I mean promoting mathematics and natural sciences among girls, the issue I am personally interested in. Moreover, for me the most important issue was to show some psychological aspects in education, for example the ones relating to the communication between the teacher and the pupil, as well as how pupils are taught to define failures, and in general - what a failure means to them.

I would also emphasise two objectives which are relevant for the institution I represent. First of all, we had to develop efficient mechanisms of cooperation with our partners. This was our first major project with such a partnership involved and we had had no such experience earlier. The knowledge-based objective was another relevant area for American Systems. The platform itself and the technical solutions proved to be so complex and innovative that it made our team take extra trainings and acquire more knowledge on the technology. It also significantly contributed to the development of the institution in terms of its know-how and certainly increased its technological innovativeness. At the moment, we are ready to implement innovative IT projects not only in Poland but also all over Europe.

Young children are very curious about the world. For pupils the point is no to lose their curiosity, not to be afraid to ask questions, and to seek their own answers in the education process

Wojciech Piotrowski: When we speak about our partnership and cooperation, it is worth asking what it is about and how you are getting along.

Agata Goździk: I cannot imagine that any of our partners would be able to run such a large undertaking alone. As the project brings different worlds together, it also requires some co-operation of these worlds. I am convinced that one institution would not be able to face all the challenges which have arisen throughout the project. It is also valuable that we come from different worlds and we learn from one another. Often it is necessary to work out a new path, which is not easy, but it allows one to have a look from a different perspective. If you have worked in a narrow field within your specialisation for a long time, you become set in your ways. Only with some suggestions from "outside", you go off your beaten tracks, which is a good opportunity to learn from one another.

Leszek Lotkowski: The partnership primarily combines four worlds: education, science, technology, and effective methods of learning. Now, at the time when it is vital to learn throughout all your life, each of our partners, as I believe, has learnt a lot from others. The most important thing, however, is that the synergy of our actions is beneficial to others.

Wojciech Piotrowski: What are the partners responsible for?

Leszek Lotkowski: Pro Futuro is responsible for contacts with direct beneficiaries - school

The target group includes school pupils and students at all educational stages

pupils, teachers, school headmasters and education policy makers. It is also important to develop - jointly with Colin Rose - the methodology of effective learning which is not only to be incorporated in guide-books for teachers but also directly applied at the platform. We are also responsible for the dissemination and application of our educational solutions into the school mainstream. We try to figure out how to make the project reach each and every school and make everyone benefit from it. At the stage of testing, we cooperated with more than 1,000 teachers, over 5,000 students and 250 schools at every educational stage. We have been in constant touch with this group.

Tomasz Juńczyk: American Systems is responsible for two key areas: technology, that is IT and software development of the platform and evaluation, that is monitoring of the project indicators and their achievement.

Agata Goździk: The Institute of Geophysics provides research facilities, contacts with scientists, equipment for on-line broadcasting, as well as preparation of teaching resources. We have organised EDUSCIENCE picnics at schools, scientific festivals and excursions to the observatories. In addition, we are responsible for coordinating the project and its financial settlements.

At this place it is also worth mentioning our transnational partner - Accelerated Learning Systems from the UK. Their role in the project was to identify effective methodological solutions applying the latest knowledge on the construction and operation of our brain and individual styles of learning.

To summarise our partnership, it can be added that in the case of this complex project its major challenge was to maintain good relations with the partners at all times. Perhaps the best conclusion on our cooperation can be that for some time now we have been thinking about our next joint project and we hope that we will manage to set up the EDUSCIENCE 2 project soon. If - after nearly four years of the project implementation - we want to work together for the next few years, it means that we have managed to develop a good model for our cooperation.

In the EDUSCIENCE project the key is to bring back the fun and joy derived from exploring the world into the educational process”

Wojciech Piotrowski: Who is the EDUSCIENCE project directed to?

Leszek Lotkowski: The project target group primarily includes school pupils and students at all educational stages. The project was tested in 1-, 2-, 4- and 5-grade classes at primary schools, 1- and 2-grade classes at junior-secondary schools as well as 1- and 2-grade classes at senior-secondary schools. The project users include teachers at all educational stages. When it comes to early-school education, they include leading teachers (mathematics and natural sciences). At this stage we also cooperate with teachers running English and computer lessons. The next group includes teachers of natural subjects, mathematics, English at 4-6 grade classes. At the third and fourth stage, they include teachers of biology, physics, mathematics, chemistry, geography, English and computer classes; at the fourth stage - in addition - Earth sciences. This is the core group of teachers who use the platform today. But this tool can also be used at other lessons. At the moment, there are no resources in this range but this is only a matter of time.

Agata Goździk: The platform can be used by teachers with various IT skills and different approaches to resources. Some of them will use ready-made resources, while others will create their own materials. Having completed the testing phase, we have extensive resources developed by scientists. But it should be emphasised that there are also lots of inspiring materials created by teachers. Since such

materials are created and teachers are willing to create them, it means that the tool appeals to them. Some want to use what is ready-made and available ”at hand”, but others wish to actively participate in the process of creation and development of our platform.

Tomasz Juńczyk: It is worth mentioning the project recipients who are not explicitly specified in the application for the project co-financing. They include parents, representatives of education authorities, and local government units being responsible for education. They participate in initiatives including knowledge-disseminating conferences. The project does not target them directly but, when informed on the project and its effects, they may change their way of thinking about education in general.

Leszek Lotkowski: It is also our goal. At the moment, at the stage of dissemination, we wish to kindle interest in the project in regional authorities

The IT tools developed under the project can be used by teachers with various levels of their computer skills

which are responsible for cooperation with educational policy makers.

Wojciech Piotrowski: How would you encourage school principals, teachers, school pupils and students to benefit from the effects of the project?

Leszek Lotkowski: A school in the 21st century should have a friendly approach to the use of new technologies and educational resources created by science-oriented people. While using the platform, teachers can give impetus to changes to their school's approach and use of technology. Teachers, by using such tools, give school pupils and students an opportunity to make use of appropriate methods of learning, to develop their interest in exploring the world in the classroom environment, as well as to naturally apply this knowledge in practice.

Agata Goździk: We have been trying to meet teachers' expectations. The activities which we planned at the stage of dissemination, such as workshops for teachers as well as lectures in schools which can be ordered by school principals and teachers, will allow one to see in practice how to use the platform. It is relevant that teachers have such guides through the platform and various features offered by the project. These guides include teachers who tested the product with us for two years, being the best ambassadors of our project with their knowledge of the ins and outs of the platform. They participated in the process of changing the platform, they were with us when we were launching games and new features, and they helped us to improve it by giving us their opinions.

Leszek Lotkowski: We endeavour to ensure that teachers are active users of the platform. It has a lot of features but also contains extensive supporting materials: instructional videos, user manuals and FAQ. Users can also ”go out” further as schools can communicate with one another. On-line broadcasts which are run under the project from various scientific centres may take place also between and among schools. It is also important that teachers from various places in Poland can share their good practices.

Tomasz Juńczyk: It is also worth mentioning that we have strived to ensure that the educational platform, in spite of its many extensive features, is intuitive and easy to operate, does not require any advanced IT knowledge and thus becomes a friendly tool for all teachers.

Agata Goździk: I would like to summarise our conversation recalling words said by prof. Paweł Rowiński, the director of the Institute. According to him, the key issue in the EDUSCIENCE project is to bring back the fun and joy derived from exploring the world into the educational process. And I think that if the project arouses this curiosity to explore secrets of the world and the joy of learning, then all of our goals will be achieved.

In search for innovations

- Science festivals
- EDUSCIENCE picnics
- Educational excursions
- EDUSCIENCE in the Arctic
- Competitions
- Accompanying events

25

The EDUSCIENCE project aims to increase school pupils' interest in mathematics, natural, computer and technical sciences, as well as foreign languages thanks to fundamental changes of the existing educational formula. During testing, actions were undertaken to persuade teachers that it is possible to shift from teaching facts, presenting "dry" information to forms of teaching in which school pupils themselves - through experiments - ask questions and then - assisted by their teacher - try to answer them. For this purpose activities were performed in the form of on-line lessons as well as exercises with the use of resources gathered at the platform. Our science festivals, EDUSCIENCE picnics and two-day educational excursions to the observatories held by the Polish Academy of Sciences (PAS) were an alternative to lessons spent at school desks.

In order to meet the needs of most Polish schools which are not adjusted to the requirements of modern teaching, every school taking part in the project was equipped with an interactive board together with appropriate software and web camera. Thanks to them it was possible to attractively present the platform and its resources as well as to participate in web broadcasts run by scientists employed in the observatories located in different places around Poland. Broadcasts from the Hornsund Polish Polar Station in Spitsbergen aroused particular interest. Educators from the EDUSCIENCE project participated in the 34th, 35th and 36th Polar Expedition organised by the Institute of Geophysics, Polish Academy of Sciences. For two years, day and night, they created interesting materials on the Arctic and its research, recorded videos, and wrote web logs. The term: "day and night" takes on special meaning as our polar explorers spent two long polar nights at the station.

Additionally, school pupils were engaged into regular conduct of their own measurements and observations of natural phenomena. For this purpose, each of the schools was equipped with a professional meteorological station which allowed taking measurements of basic weather parameters. The atmospheric measurements were enhanced with observations covering both meteorological parameters as well as changes in animate nature. School pupils also had a chance to take hydrological measurements of flowing water level changes as well as water acidification and pollution. They published all the data on the portal, which made it possible to create daily reports on weather conditions in Poland.

Our contests tailored to every educational stage were a great incentive for the project participants to explore and describe the surrounding world. A chance to win attractive prizes provided extra motivation for school pupils to undertake activities related to learning on the world of science.

Our festival participants could learn what a small amount of liquid nitrogen can do

Science festivals

Science festivals stand for very attractive meetings with science targeting pupils at primary as well as junior and senior secondary schools. During the testing phase, they were held in 12 towns which had expressed their willingness to co-organise this type of events. The festivals were two-day events. On Friday, young and fully enthusiastic scientists visited one of the schools taking part in the project. On that day, the project class pupils had completely different lessons. They could take part in spectacular experiments with the use of materials which are - in principle - unavailable at Polish schools, including dry ice

I am the person in charge of the EDUSCIENCE science festivals and their organisation. At the very beginning I set the goal to impress people attending these festivals. We called it the Wow! effect. If these first pupils' meetings with real science are engraved in their memory as an exciting, interesting and enjoyable experience, I am convinced that in the future it will help them to start studies with mathematics and natural sciences, so welcome in the current labour market and maybe some of them, in their adult life, will become involved in the world of science, e.g. at the Polish Academy of Sciences.

Justyna Buczyńska

Organiser of the EDUSCIENCE science festivals

Scientific demonstrations were accompanied by performances of local groups prepared by the town co-organising the festival

or liquid nitrogen. Pupils constructed a small electric motor on their own; they could also analyse in detail what owl pellet contains. They did experiments, asked questions, looked for inspiration, discovered not only what has already been explained but also searched for what is still unattainable in the world of science and waiting to be discovered.

Our Saturday festival was a festivity for the whole town. We would meet at frequently-attended places: in parks, at markets, and at the foot of castles. Local governments of the hosting municipalities co-organised these events. Therefore, it was possible to combine science-promoting shows with cultural events and performances of local groups. There were scientific shows on stage - with explosions, colourful smoke and noise makers. And all of that was used to let the participants witness amazing experiments and - above all - to enable them to explain the principles of nature. When their excitement wore off after performances on stage, other attractions prepared in separate tents awaited them. Everyone could try to solve logical puzzles, make "toothpaste for an elephant", make electric current runs out of a lemon or experience first-hand what it feels like when their hair stands on end.

Our science festivals were held in the following towns: Pisz, Police, Brodnica, Lębork, Łapy, Rogów, Krotoszyn, Racibórz, Nowy Dwór Gdański, Nowy Targ, Starachowice, and Legionowo.

However, our festivals organised under the EDUSCIENCE project are not only events

Our scientific festivals have demonstrated that - contrary to the general opinion - young people are interested in science and gaining knowledge. However, the manner of its demonstration is relevant. The idea which inspired the EDUSCIENCE project and science festivals' originators turned out to be attractive and it perfectly catered for the needs of young people - though not only them.

Sławomir Janowski, Ph.D.
Headmaster of the Mechanical School Complex in Racibórz

The town of Racibórz took great pleasure in co-organising these great events which have promoted the development of science. In cooperation with the Institute of Geophysics seated at the Polish Academy of Sciences in Warsaw and the 'Skala' Association for Geophysical Observatory in Racibórz, the Days of Science and Technology were organised throughout 2008-2012 and the Festival of Science in 2013 [...]. The very interesting programme of the EDUSCIENCE Science Festival, including opportunities to participate in scientific shows, workshops and meetings with scientists from the Institutes of the GeoPlanet Consortium and Colin Rose, a guest from the UK and expert in the field of science and methods of effective learning, attracted a great response and enthusiasm of Racibórz and the surrounding area residents, turning up in great numbers.

Mirosław Lenk
Mayor of Racibórz

During the festival of science in Legionowo, school pupils participated in experiments with liquid nitrogen

Participants of the festival in Lębork explored the human body and its mysteries

Electrical phenomena fascinated the young and older participants of the festival in Nowy Targ

for pupils and their parents. They are also an excellent opportunity to promote knowledge about modern educational methodology. At selected towns, meetings were organised with Colin Rose, the world-renowned psychologist and specialist on methods of effective and fast learning. The meetings were attended by teachers, school educators, headmasters and representatives of school managing bodies. They aroused a lot of interest, testimony to which was the meeting in the beautiful, almost palatial, interiors of the H. Kołłątaj Comprehensive Secondary School in Krotoszyn attended by about 170 people. More than 150 participants also attended the lecture by Colin Rose in the Conference Room of the Piastowski Castle in Racibórz.

EDUSCIENCE picnics

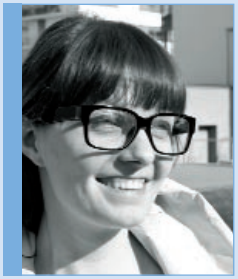
Our EDUSCIENCE picnics were another (just behind the mentioned scientific festivals) attraction of the EDUSCIENCE project aiming to bring the world of science to school pupils in an interesting way. Due to the time of their implementation - from October to June - they were held at gymnasiums, school auditoriums and nature workshops. Just like in the case of our festivals, these picnics could be attended by schools pupils who did not participate in the EDUSCIENCE project.

EDUSCIENCE picnic at the Primary School in Budzów

The key objective was to organise activities with a view to impress school pupils by teaching them on natural phenomena through experiments. When the process of learning stops being boring ”swotting” of textbook facts, school pupils are faced with new opportunities, new insights into physics, mathematics, biology, chemistry, and geography. They start to wonder why phenomena take place in this way and not in that way. Only then referring to the existing principles, rules and formulas allows them to sort out all which was previously observed.

This form of science popularisation proved to work well and you could realise it by observing the participants' involvement, their participation in experiments and questions asked by them during the picnics. Also teachers reported

EDUSCIENCE picnics were an unusual opportunity for school pupils to meet science



Over two years spent on organising these picnics, I travelled tens of thousands of kilometres, that is the whole country back and forth. I met a lot of people involved in the EDUSCIENCE project, which was an extremely interesting experience. I am very glad with all these meetings and conversations with educators, headmasters, local authorities, education staff who had their heads full of ideas and willingness to transfer knowledge. However, our participants' reactions (both children and adolescents) at our picnics were the most motivating. I think that they were very satisfied with the workshops, experiences, experiments and demonstrations provided by us.

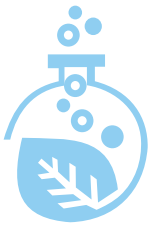
Aleksandra Mikulska
Organiser of EDUSCIENCE picnics

that organisation of such events at schools was needed. Over the last dozen or so years, there has been a predominant tendency to close down specialised school workshops, resulting in the emergence of a gap in the education of strict subjects (where it is essential to get to know natural phenomena empirically).

Our picnics aroused a lot of interest and we decided to increase their number from 64 (initially planned) to 89. They were held at schools which had appropriate premises to organise such events and passed our recruitment process. Other schools had a chance to participate in these events as guests, and many classes participating in the project took advantage of this option, which significantly increased the attendance.

In many cases, our EDUSCIENCE picnic was a full-day school day-off event. It started with an open-for-all scientific show. Then bottles filled with liquid nitrogen were made to explode on stage, a fire was burned in a variety of colours, cans imploded and large amounts of foam were produced. When the show was over, its participants could take part in scientific workshops at which - under the guidance of experienced instructors - they learned about, among others, properties of substances, examined the pH of everyday liquids, got familiar with the fascinating world of the magnetic field, made a Möbius strip, measured the speed of light, isolated their own DNA and did many, many other fascinating things. Also a mobile planetarium was provided, thanks to which the youngest participants - when its demonstration was over - learned the Kepler's Laws, while the older students could find basic constellations and point out larger stars and their shoals. To make it possible for the students to perform independent observations of physical phenomena, self-service stands were set up. Blowers, which familiarised them with the Bernoulli's principle and "nervometres" i.e. simple electronic networks, attracted the largest interest.

In many cases our EDUSCIENCE picnics were full-day school day-off events



In addition, school pupils participated in innovative lessons. Various opinions were voiced by the students; there was a girl saying: "Picnic, picnic, no food though". However, opinions like the ones below prevailed:

Sandra Gostomczyk
- school pupil from the Senior Secondary Complex no. 1 in Chojnice:

When leaving the educational picnic, we were excited with all the acquired knowledge and new experiences. Throughout this time, it did not occur to anybody that learning had actually taken place. Learning through play is the best way to acquire knowledge because then we are completely unaware of the fact that we learn new things. And for secondary school students this smart transfer of knowledge is relevant. When sitting over books, they would have never learned all of that so fast. It was a nice and pleasant getaway from school and our approaching final exam which we hear about at each and every lesson. All of us agree that we would be glad to take part in it one more time.

Anna Czajkowska
- teacher in the Primary School in Tłuszcz:
The picnic turned out to be our incredible adventure and an extraordinary meeting with science which still astonishes and surprises us. It aroused our curiosity of the world and passion for research; it will certainly contribute to a rise in the number of young scientists.

Marta Szajna
- teacher in the Preschool and School Complex in Lipinki Łużyckie:
An extraordinary meeting of school pupils with the world of science took place at the picnic. This meeting considerably inspired the attendees to explain phenomena occurring in everyday life they are aware of but often find it difficult to explain.

Martyna Nowakowska
- school pupils from the Primary School in Babięta:
The EDUSCIENCE educational picnic was very cool. We loved the planetarium most because we learned how many planets there are in our Solar System, what constellations there are and that the Sun is a big star which 'has lived' for more than five billion years. We also liked the classes with the use of the interactive board. We learnt there why we see some colours but do not see others! That day was the coolest of all.

Educational excursions

Over the two years spent testing the project in schools, all the project classes took part in two-day educational excursions. Their main purpose was to bring school pupils closer to the work of scientists and get them interested into mathematics and natural sciences. In addition, the participants had an opportunity to visit places of interest from the perspective of Poland's touristic attractiveness. All the project participants were provided with activities conducted at observatories and institutions, local transport, food, accommodation, and entry tickets to all visited places, thanks to which all school pupils, regardless of their financial situation, could participate in it.

Botanical Garden in Powsin. Learning beyond school walls allows students to re-enjoy exploring the mysteries of nature

School pupils extended their knowledge on seas and oceans thanks to, among others, classes at the Institute of Oceanography, Polish Academy of Sciences in Sopot

On the basis of the experience gained during the organisation of excursions throughout 2012-2014, a plan of educational excursions was drawn up, offering a variety of activities in the scope of mathematics and natural sciences run at the observatories and institutions involved in the EDUSCIENCE project in Poland. The programme is described in detail in the chapter entitled: "Why participate in EDUSCIENCE?".

Świder

Students, 1B grade, the Forestry Technical College named after the Polish Forestry Society in Biłgoraj:
The excursion met our expectations. It was not only a form of recreation but most of all an interesting manner to expand knowledge on the local nature as well as methods of running observations and geophysical surveys.

Kraków i Ojców

5 grade, the Prof. Jan Sajdak Primary School in Burzyn:
The excursion was very successful and abundant with experiences and impressions. We still recollect it and we will certainly remember it for a long time. It was out of the ordinary to have an opportunity to participate in this event, namely our meeting with science and the people who familiarised us with their exceptionally interesting work. We wish to thank all the people thanks to whom we could take part in this extraordinary expedition.

Sopot

Ola Pieńczuk, 2A grade, the Junior Secondary School in Poświętne:
In my opinion, it was one of the best excursions (if not the best) I have taken part in. Interesting lectures, herring autopsy, and delicious food just like at home - these are what I remember as the great advantages of this excursion. Thanks to it, I learned a lot of new and interesting things, thanks to which my knowledge on the Baltic Sea has expanded significantly.

"Horyzont II"

5C grade, the Primary School within the School Complex in Radzyń Chełmiński:
Our stay on the "Horyzont II" ship was what impressed all of us most. We had an opportunity to go to the captain's bridge and the engine room. The leading officer showed us how to operate the ship and after supper

The visit at the "Horyzont II" ship managed by the Maritime Academy in Gdynia, the activities at the captain's bridge and the engine room, as well as accommodation in the cabins were a great attraction for school pupils

we had a chance to listen to his richly-illustrated lecture on the "Horyzont II" polar voyages. Then we went to our cabins to spend an unforgettable night among the waves. (...) Thank you for the opportunity to participate in this exciting excursion.

Borówiec

Ewa Szczęsna, schoolgirl, 2C grade class at the C. K. Norwid Comprehensive Secondary School in Wyszków:
The knowledge which we gained during our excursion will certainly be useful to us at school and in everyday life, it also gave birth to what is most important - it awakened our curiosity to explore the world around us.

Książ

5 grade, the Public Primary School in Praszka:
These classes took the form of workshops and it was loved by "young scientists". The fifth-graders were genuinely interested in the classes delivered by educators from the Geophysical Observatory of the Institute of Geophysics, Polish Academy of Sciences on the first day of the excursion.

Belsk

2 grade, Junior Secondary School in Elbląg:
We loved the classes prepared by the educators at the Geophysical Observatory in Belsk and at the Institute of Geophysics, Polish Academy of Sciences in Warsaw. (...) We liked that some classes were conducted in laboratories. In one of them we had an opportunity to examine magnetisation of various substances. (...) We feel honoured. It is not often that a 'real' scientist delivers classes for us. It is not often to have an on-line chat with participants of the expedition to Spitsbergen.

Racibórz

5 grade, Primary School in Ciółkówko:
The classes were combined with experiments and educational games. Also here, the scientists from the Institute demonstrated their extensive commitment, knowledge and with great patience answered all our questions. From the excursion we brought a wealth of knowledge and skills, great memories and trophies - log book in which we collected stamps in the shape of polar bears.

Observance of nature turned out to be an exciting task for a lot of young people (photo: the participants of the Racibórz excursion)

The organisation of 250 two-day excursions was certainly a massive undertaking. But what is impressive is not only the large number but also, or perhaps above all, a very wide scope of works - from drawing up programmes, through running methodical workshops for the educators, preparation of tenders, up to laborious work to prepare all documents. It also included numerous trips across Poland, guidance over the course of excursions, meetings with school pupils and students, and long talks with their supervisors. Thanks to all that we created a very good, close-knit team. We managed to successfully complete the task, as evidenced by the abundant positive feedback from those taking part in the excursions.

Katarzyna Przygodzka,
Karolina Branicka,
Piotr Stankiewicz
Organisers of educational excursions

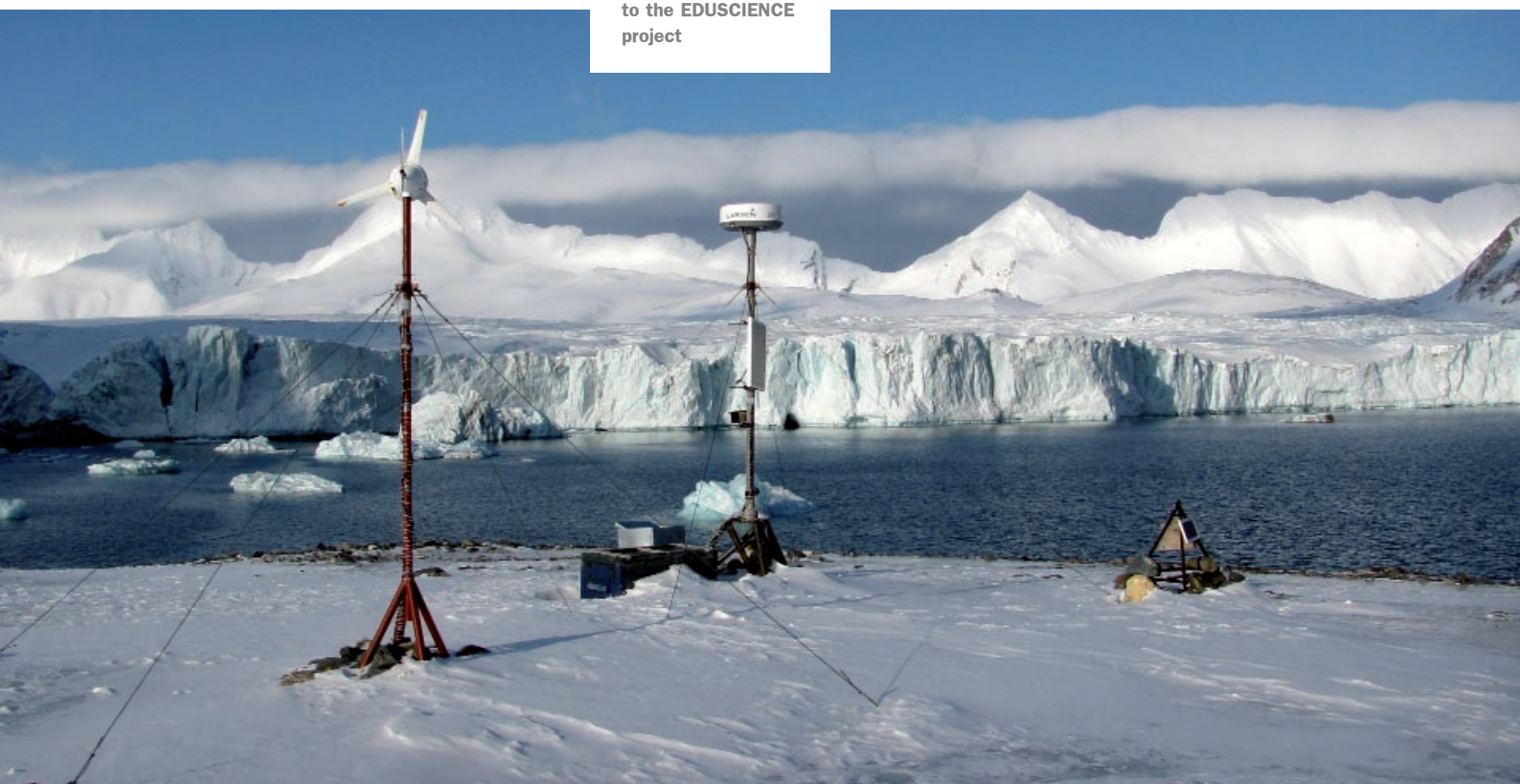
5A grade, the Primary School no. 6 in Siemianowice Śląskie:

In spite of the participants' fatigue, physics lessons at the Mechanical School Complex at the excellently-equipped laboratories proved to be the biggest attraction of the excursion. The interesting and innovative manner of transferring knowledge on electricity combined with the valuable safety rules as well as the induction of thunders will remain forever in the memory of all the participants.

EDUSCIENCE in the Arctic

Until recently, the Hornsund Polish Polar Station has been known only by people closely associated with the Arctic and research conducted there. For 37 years, Polish scientists have been conducting continuous year-round measurements and observations in the area. For them, their stay in the Arctic is connected not only with difficulties of coping with the Arctic climate, dangers of moving around glacier crevasses and fears of meeting the most dangerous predator of the Arctic - the polar bear, but also with their separation from families and friends for several months. Thanks to the latest satellite technologies, the station has been web-connected for several years. Not only does it provide scientists with facilities to quickly transfer data and keep in touch with the world, but it also allows people who cannot participate in polar expeditions to keep track of what is happening in the Polish House on the Pole.

And it is the opportunity to take part in this Arctic adventure that has been one of the magnets encouraging school pupils and teachers to participate in the project. Thanks to the EDUSCIENCE project, the station opened its doors



A chance to take part in the Arctic adventure is one of the magnets attracting youths to the EDUSCIENCE project

The winners of the 1st edition of the "My dream Spitsbergen" contest during the expedition to the Arctic

for more than 6 thousand recipients and users of the project, with all school pupils and teachers from Polish schools being able to watch the polar life.

For the two years of testing the EDUSCIENCE project, the educators employed at the station in Spitsbergen created materials, ran video broadcasts, and reported on current events from the station in their web logs. When some unexpected guests reached the shore, or when a Norwegian helicopter landed with Christmas gifts - the users of our portal were the first to know. It was emotional when the polar explorers received traditional letters which pupils from Polish schools sent them several times during the year. The day when the cookies prepared by the pupils of the junior secondary school in Lębork reached the station is especially well-remembered by them.

In July 2013, together with the 36th Arctic polar expedition, Karol, Marcin and Piotr - the winners of the ”My dream Spitsbergen” contest - reached the Arctic. It was an unusual event. After a more-than-week trip by the ”Horyzont II” ship, they reached the Arctic, where they could watch live what the life at the station looked like. They could perform some measurements on their own, go through the slushy

tundra, climb the mountains surrounding the station, stand on the glacier, spend a night in a trappers' hut and finally dinghy-sail to the Gulf of White Bear. The winners of the 2nd edition of the contest: Ewelina, Magdalena and Kordian visited Spitsbergen during the summer expedition in 2014.

There are a lot of videos, photographs and reports from Spitsbergen on the EDUSCIENCE platform and portal. They will allow all school pupils to get to learn about not only the life and habits of the polar explorers participating in the consecutive expeditions but most of all get acquainted with the tundra and ice desert landscapes as well as animals which make the Arctic alive. Maybe it will inspire future geographers, biologists and physicists to take part in such expeditions and conduct their own research.

On the EDUSCIENCE platform and portal there are a lot of materials available showing the work of the Polish researchers in Spitsbergen

Contests

Our contests with awards aroused a great interest. For the two years of testing the project there were contests for individual school pupils at all educational stages as well as contests for all classes. Also teachers had their chance to compete.

For younger participants they often included art competitions. Older ones recorded videos, created comics and web gags. Pupils at all stages competed against one another in making systematic observations and meteorological measurements. There were some who did not miss any single day of measurement, even on Sundays and holidays. The ”My dream Spitsbergen” contest was an emotion-arousing event which was attended by pupils from senior secondary schools, including winners of some other thematic contests and competitions. A few-week participation in the polar expedition to the Hornsund Polish Polar Station in Spitsbergen was the grand prize. In its two consecutive editions six participants won their Arctic trip.

"Interesting natural phenomena" - the contest for 2-grade classes of primary schools

1st place - "Solar eclipse" Anna Senduła, the Primary School no. 7 named after National Army 7th "Obroża" District in Legionowo

2nd place - "Winter in Spitsbergen", Natalia Hudzik, the Primary School in Zgłobień

3rd place - "Tornado", Gabriel Matwij, the Gen. Stanisław Maczek Primary School in Boguchwała

"Natural and geographical records"
- the contest for 5-grade classes of primary schools

1st place - "Siberian tiger - the largest cat in the world", Gabriela Dąbrowska, the Zygmunt August Primary School no. 2 in Augustów

2nd place - "Hyacinth macaw and buff-faced pygmy parrots", Maja Herdon, the Zuzanna Morawska Primary School no. 7 in Mława

3rd place - Patrycja Dąbrowska, the Zygmunt August Primary School no. 2 in Augustów

"My adventure with the EDUSCIENCE project"

Patryk Jajkowski "Emyej" from the Junior Secondary School in Licze who prepared a video plus a song about the project was the winner of the "My adventure with the EDUSCIENCE project" contest

"Mathematical skirmish"

Paulina Marczak, a school pupil from the Primary School in Tłuszcz won the "Mathematical skirmish" contest

Accompanying events

The EDUSCIENCE project was presented several times at various events in Poland and abroad. In 2013, its authors participated in the Scientific Picnic organised by the Polish Radio and the Copernicus Science Centre which was held at the National Stadium in Warsaw, enjoying its record attendance. Our project stand's guests could play games on the platform as well as solve quizzes and interactive tasks. In 2014, following the invitation of the Ministry of National Education, the project was presented at the picnic on the occasion of the Children's Day organised by the Office of the Prime Minister. At the stand you could find out how the polar explorers get dressed and what animals live in the Arctic, as well as take part in broadcasts from the Hornsund Polish Polar Station in Spitsbergen. Children and young people willingly participated in our mathematical competitions with the use of "Laboratory of numbers", game available on the EDUSCIENCE platform.

The project was demonstrated several times at conferences organised by the National Supporting Institution and as part of a series of conferences entitled: "Upbringing and education in cyberspace - opportunities and challenges". It was also very well received by the representatives of education authorities and other participants of the 9th National Forum of Schoolmasters in 2012 in Kielce.

The EDUSCIENCE project was present at the picnic on the occasion of the Children's Day organised by the Office of the Prime Minister

Within the framework of the project, diagnostic meetings with teachers were organised, which allowed development of an educational offer best suited to the needs of Polish schools

Prof. Paweł Rowiński, the director of the Institute of Geophysics presented the EDUSCIENCE project at the "Science & Technology for the Youth/Public" International Conference in Bangkok, the capital of Thailand

The EDUSCIENCE project was presented at the fairs which accompanied the "Decide on innovation" conference held in November 2013 by the National Supporting Institution and the Ministry of Regional Development

In February 2014, on the scientific grounds of the University in Oulu (Finland), a meeting attended by a polar station representative was held. During the session on natural education issues, Agata Goździk, Ph.D. the manager of the EDUSCIENCE project, talked about Polish educational experiences, capabilities of getting connected on-line with the Hornsund Polish Polar Station, and polar broadcasts attracting great interest

Conferences under the EDUSCIENCE project have always attracted a large group of teachers, headmasters and promoters of science

Thanks to the cooperation with the Foundation for Advanced Technologies, there was a meeting organised with an accompanying video featuring the young scientists - winners of the E(x)plory contest

Andrzej Kruszewicz, Ph.D., the director of the Warsaw zoological garden, attended one of the special broadcasts held at the EDUSCIENCE platform

The project authors were happy to accept invitations from the Ministry of National Education and the Education Development Centre to present the project at conferences organised by them and exhibitions at their joint exhibition stands. Their participation in such educational events following invitations from important partners was a great honour for them.

Under the project, several dissemination conferences and nationwide meetings for schoolmasters and teachers taking part in the project and four meetings for teachers in every province were organised.

The project was also presented in the international arena. Already in the first year of its implementation, the authors were invited to demonstrate it at the "Networks for Transnational Cooperation" seminar as part of the European Social Fund initiative in Berlin (15-16 September 2011). During the seminar, some selected projects on transnational cooperation were presented aiming to enable its participants to exchange their previous experiences gained in their countries over the course of transnational cooperation.

Later the same year, during a visit at the observatory belonging to the University of Versailles (France), the EDUSCIENCE project was presented to French scientists. Its objectives and substantive principles were discussed and some exemplary educational materials were showed.

In subsequent years, the project was presented, among others, at the scientific conference in Florence and at the meeting of polar station representatives from across the Arctic in Oulance (Finland). The presentation of the project beyond Europe was a break-through event for its authors. At the "Science & Technology for the Youth/Public" international conference held in December 2013 in Thailand, various forms of science popularisation, festivals, exhibitions and fairs as well as oceanariums and planetariums were discussed. However, it was the EDUSCIENCE project presented there by prof. Paweł Rowiński, the director of the Institute of Geophysics, Polish Academy of Sciences, that aroused the greatest interest.

During the Scientific Picnic organised by the Polish Radio and the Copernicus Science Centre, thanks to the EDUSCIENCE project, you could see a volcano eruption in the centre of Warsaw

Everybody has a chance

Are mathematics and natural sciences gender-oriented?

47

Today the subject of gender equality is present in many aspects of life. We talk with **Tomasz Juńczyk**, a psychologist and sociologist, about how to avoid stereotypes connected with gender in everyday operation of schools.

Tomasz Juńczyk is a trained psychologist and sociologist. He is a co-author of post-graduate study programmes in the field of positive psychology. He runs a therapy practice within the framework of the Laboratory of Development. He has delivered more than one thousand hours of training and individual consulting in the fields of educational psychology, gender psychology and project work. He has participated in several educational conferences. He has written several newspaper articles, primarily on positive psychology. For more than eight years, he has managed staff teams in educational projects, including those connected with the implementation of modern organisational solutions at schools and educational units.

Agata Goździk: Are mathematics and natural sciences gender-oriented?

Tomasz Juńczyk: They are and are not. If you look at it from a statistical point of view, it turns out that they are - to a lesser and lesser extent - but none the less. It was researched in 2011 that women constitute approximately one-third of students at mathematics and natural studies but men are still the vast majority of these students. This trend is proven by statistics. It is also demonstrated in social life. When you ask a statistically average Pole what features women are associated with, it appears that these are the ones which strongly predispose them - in social terms - to perform other professions than the ones which are connected with mathematics and

natural sciences. A statistically average Pole says that a woman is: gentle, delicate, caring, well-suited for the care of children and it is evident that such features are reflected in students' statistics. At first glance it appears that teaching is the most female-biased job specialisation and building and construction - the least feminised one. It might seem that it is due to natural predispositions. Gender studies suggest though that these are not natural predispositions but the ones driven by certain cultural and social expectations which cause people of particular gender choose to pursue specific professions and - before that - to gravitate to specific fields of study. So, in response to your question - mathematics and natural sciences, as a matter of principle, are not gender-oriented, the gender bias of mathematics and natural sciences is created by society.

Agata Goździk: This is also reflected in the linguistic sphere. In Polish, there is a word: "inżynier" ["he-engineer"], but there is not "inżynierka" ["she-engineer"]; then the words: "asystentka" ["she-assistant"] or "pielęgniarka" ["she-nurse"] are used more often than "asystent" ["he-assistant"] or "pielęgniarz" ["he-nurse"] - though both terms exist. Some professions, for example: "inżynier" ["engineer'], "górnik" ["miner"] or "budolwaniec" ["builder"] are also in the linguistic sphere defined as masculine.

Tomasz Juńczyk: In the labour market or when studying mathematics and natural sciences, the subject of gender concerns not only issues connected with women but also with men. For example, we have no word for a man taking care of children in a nursery school. "Przedszkolanek" ["he-nursery school teacher"] sounds funny, "przedszkolanka"["she-nursery school teacher"] seems quite natural. The problem of gender in professions and careers generally affects women and men to the same extent, only within somewhat different areas.

Some professions are defined as masculine even in the linguistic sphere

Agata Goździk: Are any gender more predisposed to achieving success in mathematics and natural sciences?

Tomasz Juńczyk: It depends what we understand by the word: "predisposed". If we talk about genetic, natural, biological predispositions, then the answer is none of them. Our brain develops from the first days of our lives and psychological and neuropsychological studies show that the formation of our brain depends, among others, on prenatal stimuli received by a child. So I would say that there are no such predispositions - they are shaped from the beginning and these are psychological predispositions. For example, when a boy at the age of three is encouraged to explore reality, jump in trees, get dirty in mud, i.e. explore all his surroundings, then he is taught more courage, openness to stimuli, more readiness to accept failures or other manners of defining them. If a young girl brought up in a very stereotypical environment is taught to sit calmly, not to get dirty, not to run and shout too loudly, then it is inevitable that she is mentally prepared to develop a certain type of submissiveness towards the environment. The scientific

environment requires a certain level of perseverance, also competition, and the ability to successfully cope with defeats - without taking them personally, but as a natural consequence of operation in this environment. In this context, I can surely say that boys are more predisposed but not because they were born more predisposed to such activities, but because they were brought up to develop more perseverance - of course in a shortcut - to operate in this environment.

Agata Goździk: Then does it mean that through appropriate acting, directing the process of upbringing and formation of the child's personality, we are able to raise him or her to be a very good engineer?

Tomasz Juńczyk: Yes, I think that this is the case. If a child is taught perseverance in gaining knowledge, courage in exploring the world, and cognitive curiosity, then it will help him/her in the future professional development. And this is not about surrounding a child with pictures of mathematical equations and teaching to count from the first year of his/her life. It is very important to shape his/her so-called positive style of attribution, in which the general idea is to develop a child's belief that success (also educational) - to a large extent - depends of his/her actions and motivations, that failure is a natural element of development and that generalisation in thinking should be avoided (I will never succeed, mathematics is difficult and similar statements). I believe that appropriate management of a child's upbringing enables him/her to get motivated to acquire knowledge in various areas regardless of his/her sex.

It is not a person's natural predispositions, but social expectations that make people of a given sex select specific professions

Agata Goździk: And how can teachers do it at schools?

Tomasz Juńczyk: I think that teachers of first educational stages have the most opportunities. They deal with very "flexible" children. These children are able to absorb a lot of knowledge about the world, without being driven by their own rigid patterns. So there are a lot of guidelines here. From the simplest ones - when we talk about professions and when we show pictures, let's demonstrate that different professions are performed by different people and it is not only about gender but also about showing diversity in general. Let's show that there are women being involved in chemistry and black people being engaged in mathematics in order to avoid some stereotypes as much as possible. And I mean here the graphic message and the linguistic message - let's try, when possible, to avoid talking about he-chemists or she-chemists and let's talk about people involved in chemistry.

I know one portal which promotes women in computer science through showing famous women who have contributed to the development of this science. I was surprised myself how much in this area we owe to women. Why had not I known about it before? It is because this message did not exist in the mainstream of knowledge on computer science. When you are asked about computer science, then a man is the first association but it

Appropriate management of a child's upbringing causes that he/she will be able to get motivated to acquire knowledge in various areas regardless of his/her sex

turns out, for example, that it was a woman who developed one of the first programming languages, and that it was a woman who created the first LAP operating system, and that it was a woman who co-invented the zero-knowledge proof. So let's also show these women in science. Here the teacher's approach is very relevant. Even if the teacher has no sophisticated educational methodology in the field of gender, but he/she is open and not influenced by stereotypes, then he/she will communicate it to school pupils. On the other hand, if the teacher is stereotypical and even knows the methodology and tries to communicate it but doing it with an ironic smile or extra comment, then his/her message will lose its strength. I think that it is very important to raise teachers' awareness that perhaps they are driven by some gender stereotypes in their approach to school pupils and it will help them to control it.

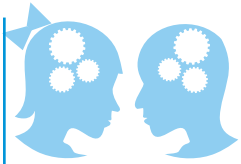
Agata Goździk: Can you give examples of stereotypes at school? Often when we act stereotypically, we are not aware of it and we do not realise that we can strengthen these stereotypes with our behaviours.

Tomasz Juńczyk: Here are some examples

from trainings given by teachers themselves. The first one refers to a she-teacher of physics who decided to analyse the content of classroom exercises. She stated that when we talk about exercises in physics, it is usually a Jaś or a Henio (boys in general) who appear in them. Girls occur as well but they are presented in their stereotypical roles: a Gosia is presented as a girl being a money-spender and then subsequently there is an exercise with a Jaś who is a money-earner. This is reinforcement of stereotypes - a money-spending woman and money-earning man - at the level of an exercise. It is one of the ways that we convey stereotypes.

Agata Goździk: I have heard about a similar mathematical task: Jaś is a bank director, he earns five thousand PLN per month, has saved two thousand PLN in a bank deposit at specific interest rate. How much money will he earn per year? And another task: Zosia is a cleaner, she earns one thousand five hundred PLN and would like to take a loan to buy a washing machine. How many months will she take to repay the loan?

Tomasz Juńczyk: This is a great example of reproducing gender stereotypes. The graphic message is also very appealing if it comes to stereotypes. I remember a picture given to school pupils at the first educational stage - it showed a family: dad watching TV and holding a remote control, mum watering flowers, grandma - crocheting, and granddad - gluing a ship model. When analysed, from the perspective of confirming the conviction of who is cut-out for what, it turns out to be an excellent picture of social stereotypes in a nutshell.



In the context of gender studies, it is not about equalising the psychological features of men and women, making us the same; it is about not lumping everybody together

Agata Goździk: Since attention is paid in some EU projects to making the graphic message gender balanced, sometimes it comes down to the same number of boys and girls being depicted in the graphic. But it should be about women being able to fully actively participate in the process which is presented in the picture.

Tomasz Juńczyk: Exactly, it is not about its quantitative aspect, it is about its qualitative aspect, about showing that their share is equal in the process. In the context of gender studies, it is not about equalising the psychological features of men and women, making us the same; it is about not lumping everybody together. If I say ”women are ...”, it means that I define all of them according to the same characteristics and I perceive all of them in the same manner, which is not the case. In fact, gender studies are on a quest for individualisation. If a woman does well and feels good in the role of a mother taking care of children and their home, and not working professionally, so be it. But if she wants to change her situation and become, for example, a well-known chemist, then also society should give her such an opportunity, as opposed to blocking her access to things saying: ”you are a woman and you are not so suited for it”. It is worth emphasizing the difference to demystify the myth of gender studies.

Agata Goździk: What has been done under the EDUSCIENCE project in the area of gender equal opportunities?

Tomasz Juńczyk: First of all, we took care to ensure that the graphic message used at the start of the message is that a girl/woman is an equal participant of the processes connected with mathematics and natural sciences, be it an experiment or exploration of the world.

Moreover, we took care of the language, i.e. as for the documents provided to teachers, recipients, and users, we made sure it was balanced, to show at the linguistic level that there are he-teachers and she-teachers, he-headmasters and she-headmasters, and not just one gender.

We have also written a number of articles which in general focus on communication with school pupils in lessons. They are available on the www.eduscience.pl portal.

At our dissemination and project-promoting conferences we have talked about the index of gender and we have promoted this information. The guide on gender equality has been placed in the information bulletin published at the beginning of the project. I think that - though our project in fact does not specifically apply to this topic - we have done a lot.

Agata Goździk: We have some success connected with it. During the two years of testing the project at schools, we ran the "My dream Spitsbergen" contest for senior secondary school students. In the first edition in 2013, the three winners, who went to the polar station, were boys. In the second edition in 2014, two girls and one boy were the winners. Moreover, there were 50/50 of them at the very end - the juries talked with six girls and six boys, while a year before girls accounted for just 30%.

Women account for only 1/3 of the students in mathematics and natural sciences

Tomasz Juńczyk: I think that it proves that the situation is changing year by year. And some EU funds made these issues appear in various areas, and public awareness is slowly changing. It also depends on our location. Stereotypes vary depending on where we live. They are much weaker in Warsaw, where there is a higher level of tolerance for diversity. It is different in the countryside where masculine and feminine roles are still very narrowly defined. I think that a huge change of the approach to this topic has taken place in large urban centres.

The first and easiest step in approaching this issue from the perspective of gender studies would be to have a look at myself - at how I address various types of groups of school pupils. In the 80's, the American psychologist Rosenthal did an interesting experiment in which he told teachers that there was one group of school pupils with a high IQ and there was another group, with a low IQ (the same can be also directly applied to gender). Both groups underwent the same cycle of training and education and then improvements in their IQ were examined. It was found that those school pupils who had been defined as cleverer at the beginning improved more in the course of education than those defined as less clever. And it was not because the former ones were actually cleverer. In fact, the selection of those groups was random. Rosenthal conducted a later series of additional experiments in which he developed a model of interpersonal expectations. He discovered that if in the beginning I define a person as talented, not knowing about him/her anything more, I will educate him/her like a talented person, expecting, praising and motivating more. If in the beginning I define a person as less talented, I will expect less, and ask and motivate him/her less. It appears that there may be (and actually is) a similar mechanism in mathematics and natural sciences. If I am driven by stereotypes and I think that girls are more talented in the area of arts, I will expect them to be better in the field of arts and worse in the field of mathematics. It means that I give them fewer opportunities to demonstrate their knowledge, thus giving them less praise in this field, and perhaps more criticism.

If teachers are open and are not driven by gender stereotypes, they promote the development of school pupils regardless of their gender

Going back to the first question: ”Are mathematics and natural sciences gender-oriented?” - based on the studies conducted by Rosenthal, it should be noted that they are not at all and this is the teacher - with his/her initial expectations who often genderises them saying that boys are good at mathematics and girls - at arts. And then he/she confirms what he/she assumed in the beginning. However, I would like to stress that saying ”a teacher” I do not, of course, mean the whole professional group. A lot of teachers, or even most of those I have met, are already highly aware of gender studies, controlling their cognitive diagrams and ensuring that girls and boys are treated equally. And this is – in my opinion – a very good approach.

Why participate in EDUSCIENCE?

- E-learning platform
- Popular science portal
- Methodology of the project
- Description of educational excursions
- Environmental monitoring

We provide you with innovative educational solutions developed under the EDUSCIENCE project. They were developed by eminent specialists in the field of teaching methodology followed by two school-years of testing in 250 schools across the country. School students benefited from the project at every educational stage. The developed solutions were well-received by school pupils and teachers. Nowadays they are available to all schools in Poland.

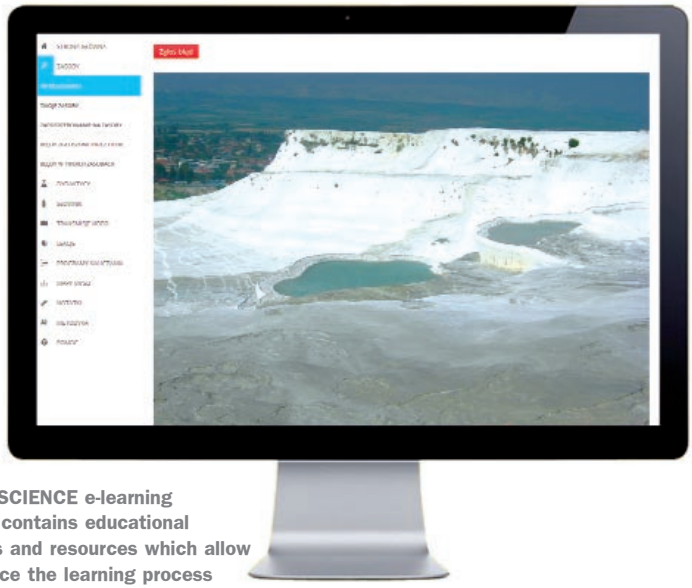
The innovative solutions under the EDUSCIENCE project consist of the following:

- **innovative e-learning platform** containing a base of materials from the range of mathematics and natural sciences and up-to-date tools required at teachers' work in 21st-century schools,
- **popular science portal containing** curiosities from the world of science and education as well as scientists' web logs which, thanks to its connection with social media, becomes the modern forum for exchange of thoughts and ideas,
- **methodological support** for teachers wishing to consciously create and develop the educational process of school pupils tailored to their individual needs and abilities,
- **educational excursions** with activities at institutes and observatories which are engaged in the project and help students better understand all observed natural phenomena,
- **environmental monitoring program presenting** - step by step - how to help school pupils learn their independence and responsibility required at the collection and analysis of data from observations and measurements.

E-learning platform

platforma.eduscience.pl

The web e-learning platform is the key product of the EDUSCIENCE project. It is primarily intended for educators teaching mathematics and natural



The EDUSCIENCE e-learning platform contains educational materials and resources which allow to enhance the learning process

Thanks to the EDUSCIENCE project, school pupils:

- **have access to our extensive library of resources** - materials prepared by scientists of the Polish Academy of Sciences were placed at the platform;
- **learn in an enjoyable manner** - interesting methods and techniques of work are applied in the educational process;
- **participate in on-line lessons** - thanks to the modern means of communication they can take part in lessons organised by both scientists of the Polish Academy of Sciences as well as teachers from other schools from all over Poland;
- **visit observatories** - they may choose from among 9 excursion suggestions - activities organised at observatories and units of the Polish Academy of Sciences and the Gdynia Maritime University;
- **take part in satellite broadcasts** - the project provides an opportunity to have a look at what is going on

Young people from the school in Kętrzyn at the "Horyzont II" ship

at the Hornsund Polish Polar Station in Spitsbergen from which scientists run their satellite broadcasts as well as share their films, photos and results of their observations;

- **diagnose their cognitive potential** thanks to diagnostic tools included in e-guides and make use of strategies for more effectively and faster learning;
- **conduct their own measurements** - under the environmental monitoring each school may conduct its own measurements and observations as well as publish their results at the EDUSCIENCE portal.

Thanks to the EDUSCIENCE project, teachers:

- **make use of our extensive educational materials** - they are able to make use of them with the application of interactive boards, multimedia projector or at their computer labs;
- **may freely modify all the available materials** - adapt them to school pupils' age, educational level and their abilities;
- **independently make crosswords, puzzles and interactive materials** based on the platform tools;
- **share their ideas, experiences etc. with other teachers;**
- **create games tailored to their needs** - arranging any set of questions (or using existing one) which they can display in the form of multimedia games (12);
- **make use of our intuitive application to create their own teaching curricula** - after selecting specific teaching contents, objectives and methods, the application automatically enters them into a curriculum and generates it in the form of a ready-to--print pdf file;
- **have extensive methodological support,** including tools used to diagnose students.

subjects at all educational stages. It enables them to make use of ready-made resources prepared by scientists of the Polish Academy of Sciences as well as to develop and publish their own materials.

The platform provides lessons and resources which are useful to run teaching curricula in the range of: early-education mathematics and science at the 1st stage of education, mathematics and science at the 2nd stage of education as well as mathematics, physics, chemistry, geography and biology in junior and senior secondary schools. Our resources also allow teachers to conduct computer information technology, computer labs, Earth science and English lessons.

The resources also contain ready-made sets of questions which teachers may modify and supplement. They can also prepare them, adapting to their subject or school pupils' individual needs and then display their lessons with the application of 12 types of games tailored to school pupils' age. The platform was also equipped with extensive tools to create interactive materials.

Interactive games allow to check school pupils' knowledge being very entertaining for them at the same time

Our unique solution is that with the platform teachers can make use of teaching curricula previously prepared in the project itself as well as prepared by other teachers from all over Poland on an ongoing basis. These curricula include direct references to the resources gathered at the platform which makes it easy to implement the program based on the project resources. Moreover, it also enables teachers to quickly and easily create own teaching curriculum.

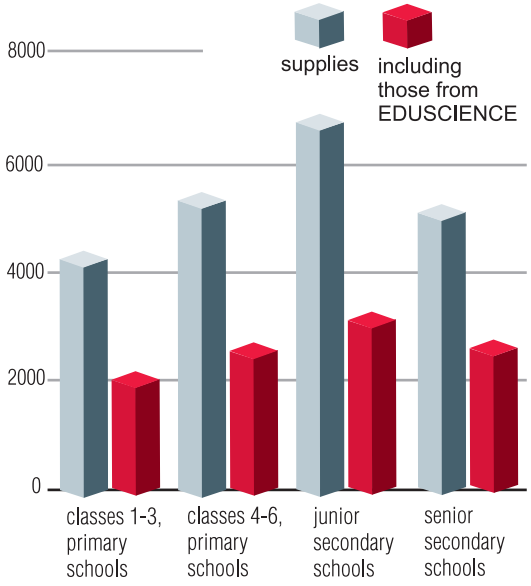
Apart from teaching resources and curricula, the third type of materials for teachers concerns teaching methodology. The platform contains 4 guides

which cover methods of effective teaching being developed with our transnational partner and prepared for every educational stage. The platform also provides guidelines for school pupils and parents - also divided into educational stages - and lectures by Colin Rose, our transnational partner and British expert in the field of education. These lectures are available in the form of video files.

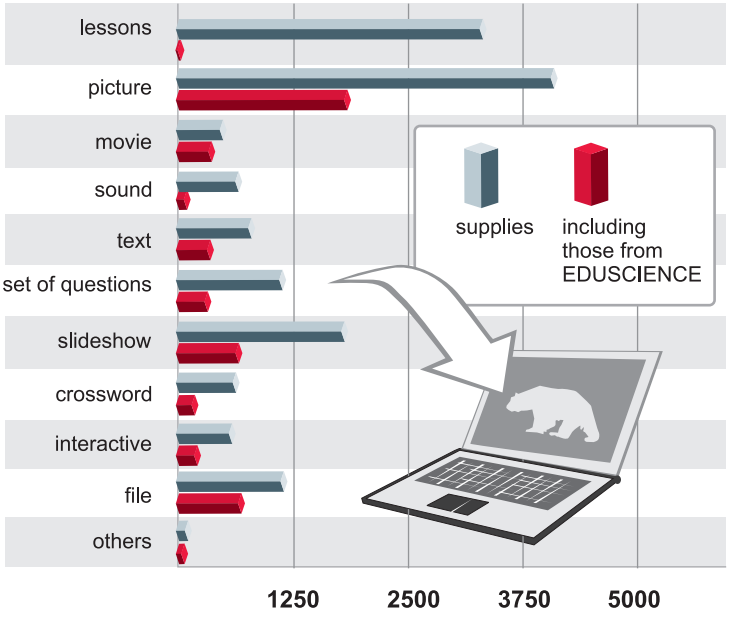
The EDUSCIENCE project combines the world of science and education. Therefore, the opportunity for school pupils to participate in on-line meetings with scientists is a relevant element of the platform. The staff from the Institutes of the Polish Academy of Sciences prepare broadcasts in the form of lessons which can be participated through the platform. At such meetings with scientists school pupils may ask questions, conduct experiments suggested by them and solve problematic tasks. The list of broadcasts suggested by scientists is very extensive. In addition, it is possible to appoint meetings arranged for a given class.

Some teachers appreciate the EDUSCIENCE platform for a chance to make use of the extensive base of previously-prepared materials, for others it will be the flexibility which it provides them with. Apart from creating their own quizzes, interactive materials or adding resources, the platform also enables teachers to organise classes, add school pupils' ac-

The number of supplies for the different stages of education



The number of supplies by types



counts and share lesson materials. Such features may revolutionise work e.g. with ill school pupils who stay a large part of their school-term at home. With access to the platform they can make use of the same resources, videos and tasks just like their classmates.

A form of work with the platform which is willingly used by teachers refers to asking questions and suggesting tasks to school pupils in the form of games from which they quickly receive feedback on the abilities and skills acquired by school pupils.

For users logged on at the platform with teacher's authorisation, the following tabs are available:

- **Homepage** - at the tab there are links to the most current events connected with the project, news from the portal, invitations to festivals, conferences etc. and the platform statistics.
- **Resources** - via the tab it is possible to have access to the extensive base of materials prepared both by scientists as well as all teachers engaged into the project implementation. Thanks to the search engine it is possible to gain easy access to the resources. Searching is made easy as it is possible to select a particular type of resource from the following criteria: lesson, image, video, audio, text, set of questions, slide show, interactive material, chart, collection of resources, crosswords, file, experience. It is also possible to select a specific subject and educational stage. Thanks to this tab it is also possible to create and organise your own resources.

There are mathematical tasks which we solve with the use of the platform. We launch an interactive board and every child has to move at least one puzzle and take part in putting all the puzzles together.

Fragment of an individual interview with the teacher (from the report on external evaluation)

- **Educators** - this tab identifies persons performing activities under the project. Here it is possible to find information on their scientific interests, suggested lesson topics, recommended resources as well as to arrange for on-line transmission.
- **Glossary** - it enables you to find popular phrases related to mathematics and natural topics together with a feature to listen to their English wording. Recordings were prepared by a native speaker.
- **School pupils** - thanks to this tag it is possible to organise your own classes at the platform, contact with school pupils and analyse class tests.
- **Video broadcasts** - this tab allows viewers to take part in broadcasts organised by scientists. It is also possible to run broadcasts by teachers, e.g. in the form of demo lessons.
- **Lessons** - in this place at the platform teachers can organise their own lessons. They can create their lessons, edit and share them with school pupils as well as publish them for other users of the platform.
- **Curricula** - a teacher has access to teaching curricula which are prepared in such a manner that their accomplishment was made possible based on the platform. These curricula include teaching objectives, learning and teaching strate-

gies and contents as well as assigned resources which are available at the platform. Therefore, while implementing an individual teaching curriculum, it is possible to easily access ready-made materials assigned to subjects without having to search for them by a search engine.

❄ **Mind maps and Notes** - this is a convenient tool to create mind maps and prepare simple text notes.

❄ **Methodology** - this is a special tab developed for teachers who wish to implement up-to-date solutions (prepared by methodologists, including Colin Rose, the outstanding British psychologist) into the educational process. This tab contains interactive methodological guidelines for every educational stage as well as diagnostic tools for school pupils and their parents plus lectures by Colin Rose prepared in the form of videos.

❄ **Help** - this tab includes instructions on the platform and its operation, instructional videos which facilitate to use this tool, contact with technical support as well as answers to the most frequently asked questions (FAQ).

Thanks to the web logs on the Hornsund Polish Polar Station, participants can tract the work and daily life of polar explorers in Spitsbergen on a regular basis

Working in the EDUSCIENCE project gives me a lot of pleasure. I have always tried to improve the quality of Polish education - previously as a teacher, later as an editor in a large educational publishing house, now working in the project based on innovative teaching methods.

Anna Ostrowska
Editor of the www.eduscience.pl website

Popular science portal

www.eduscience.pl

The popular science portal is one of the main EDUSCIENCE project products. This is an up-to-date tool created for school pupils and teachers aiming to expand their knowledge and develop their abilities and skills plus enhancing teachers' work. The whole project portal is public. It consists of tabs which are directly connected with activities resulted from the project implementation:

❄ **About EDUSCIENCE**, Events, Picnics, Excursions, Festivals and Contests - they include information related to all events organised for 250 schools taking part in the project testing - event announcements, reports, broadcasts, summaries.

❄ **For teachers** - it includes educational articles written by experienced methodologists, including psychologists, and teachers connected with the project, videos and interviews on innovative teaching methods, among others, lectures by Colin Rose, our EDUSCIENCE project partner.

❄ **Articles** - they cover publications from a variety of mathematical and natural subjects written by academics and science enthusiasts. These articles - being prepared for school pupils and teachers - make difficult nature-related concepts and problems more interesting and understandable. The evaluation studies show that the tab with these articles is the most visited

The greatest interest at the portal is attracted by scientific articles which show scientific knowledge in an accessible and interesting manner

one by teachers and that the assessment of its visual attractiveness and contents is very positive.

❁ **Web blogs**, just like articles, stand for very interesting texts which extend school pupils' knowledge. Each of them is written by a different scientist or group of scientists associated with a specific research centre:

- **Hornsund Polish Polar Station in Spitsbergen** - current information on living at the station is published at the web log;
- **Astronomy** - this is the web log on astronomy, astronautics and artificial satellites;
- **Geology** - this is the web log on broadly-understood geology, geologists and 'geo-crazies';
- **Sky observer** - this is the log on phenomena in the starry sky and atmospheric phenomena;
- **Amazing nature** - this is the web log inspired by travels to unusual, distant nooks of the globe, and sometimes by 'ordinary' walks to parks, forests or meadows.

❁ **Environmental monitoring** concerns observations and measurements of selected components of the environment.

❁ **Interactive materials** - it contains materials from various subjects represented in an interesting and inspiring way.

Methodology of the project

One of the EDUSCIENCE objectives is to provide teachers at schools across Poland with guidance on the latest methods of effective learning. Today most teachers when asked if it is useful to teach facts or skills will probably respond that skills are the key. However we have still been looking for answers how to do it efficiently. Under the EDUSCIENCE project we cooperate with Colin Rose, the world-renowned expert on effective learning and British government advisor in matters of education. In the methodology offered by us we often refer to his experience.

The methodology of the EDUSCIENCE project is aimed to facilitate and improve the learning and teaching of all participants in the educational process: both teachers, school pu-

pils and parents. We have prepared a lot of tools to be used in day-to-day work at school. The project is also to raise awareness of children commencing their school education how they should learn to make use of their intelligence, abilities and skills to solve problems at their best. The project will help children to develop abilities and skills to interpret the world and the symbols used for its description.

The suggested ways to develop children's abilities and skills are intended to lead to positive changes in their personality. Children start to plan, organise, enjoy, openly present their point of view, and above all, believe in themselves as well as their abilities and skills.

Methodological support in the project is multi-faceted. The main components which comprise it are as follows:

- methodological guides for teachers,
- e-guides - diagnostic tools for school pupils and parents,
- methodical materials at the www.eduscience.pl,

- interactive tools which are available at the www.platforma.eduscience.pl,
- teaching curricula.

Methodological guides

Four methodological guides were prepared for teachers - one for each stage of education. The theory contained in them is partly based on the idea of multiple intelligences by Howard Gardner. We believe that every school pupil has specific potentials and talents and it is teacher's role to use such educational methods and tools to find these potential and talents. The Gardner's concept has extremely practical educational application. It brings a lot of interesting methodological solutions with it.

These guides also contain tools to diagnose pupils' potential, their preferred learning style and talents. They also offer specific methodological solutions and various types of learning techniques which facilitate the acquisition of knowledge, abilities and skills by school pupils with regard to their development stages. These guides are available at the EDUSCIENCE platform in the Methodology tab.

Does knowledge at school come from school textbooks only? Can schools be closer to the reality in which today's children live? May children learn in their preferred style? A contemporary senior secondary school pupil has knowledge comparable to that of a scholar from the Middle Ages! A contemporary eight-year-old knows more about the world than his/her peer 15 years ago! It is so because children absorb information from a variety of sources, schools and teachers are no longer the main source of knowledge - as it was in the "Before Google" period.

The project methodological offer includes, among others, recorded lectures by Colin Rose

Four e-guides were prepared for school pupils, one for each educational stage. The exception refers to a guide for 1-3 grade primary school classes directed to parents who have a direct impact on children and who are their greatest authority. Three diagnostic tests on school pupils' abilities and skills were planned for each stage. They include tests of dominance portrait (brain hemisphere dominance and lateralisation), learning styles and multiple intelligences. Depending on their results, after their completion, the specification of child' potentials and talents emerges. The third step of diagnosis refers to a selection of methods of learning which are favourable to children with specific potentials and learning styles.

E-guides - diagnostic tools for pupils and their parents

E-guides were developed as guides for teachers in order to enhance their interactions with school pupils and close cooperation with them. They are based primarily on the diagnosis of school pupils' profiles, becoming aware of their own potential, strengths and selecting appropriate methods of learning which facilitate learning new school material.

Diagnostic tests allow school pupils to adapt working methods to meet individual needs

Our interactive tools facilitate the work of teachers and school pupils

Methodical materials at the portal

At the portal we provide teachers with selected teaching methods presented in our methodical guides for all stages of education. We also publish materials based on the experience of our methodologists on their work at school. These related to, among others, the methods of learning, effectiveness of using interactive boards in the educational process, methods of work with above-average school pupils or recommended web resources. Our articles provide guidance in the field of educational psychology. The Multimedia section contains methodological guidelines presented in the form of multimedia demonstrations. In addition, we prepared short methodological videos with the help of our expert.

Interactive tools at the platform

Mind maps are an interesting tool to use during lessons. The platform provides an application which - in an easy and accessible manner - allows to visually organise different concepts, phrases or processes in the form of mind maps. The tool allows them to vary colours, forms, fonts and sizes. School pupils can print and update such images in the course of their learning.

Pass-in and pass-out testing materials are another element. These are interactive materials which directly relate to the ways of working with school pupils suggested in methodological guides. They are to organise school pupils' process of learning and checking their knowledge hold before lessons and acquired during them. This is also a useful tool for teachers in the process of evaluation of their own work.

At the platform lessons can be created in a special editor. This is an intuitive tool to create lesson plans together with appropriate resources which are arranged in the order in which teachers plan to display them at lessons. The editor has an built-in base of lesson objectives and contents resulting from the core school curriculum thanks to which teachers can prepare lesson plans. This tool enables teachers to organise existing materials and easily use them at lessons. The tool also allows teachers to enter changes on a regular basis (e.g. searching for additional materials) if any need arises during lessons due to their course or pupils' questions.

The editor used to create teaching material available at the platform is a revolutionary tool. It enables teachers to write their own program with regard to teaching methods derived from our teaching guides. Users, while creating a curriculum, can select specific contents and activities from the core school curriculum in the range of general education and methods of work with school pupils. They are then transferred to their generated document. Teachers can also add suggested objectives, contents and methodological guidelines. Moreover, they can also enter specifications of assumed school pupils' achievements prepared by them and methods of assessment being applicable in their schools. The computer program formats the material into a print-ready file. Teaching curricula may be published and made available to other users.

Teaching curricula

The project includes four exemplary teaching curricula which can carried out, making use of educational resources from the platform. Teaching curricula, apart from teaching objectives, contents, target school pupils' achievements and suggestions on evaluation methods, also include methodological guidelines for their accomplishment based on the methods suggested for each educational stage in our methodological guides. In addition, for teachers' extra convenience a summary of teaching contents with selected educational resources available at the platform is provided. In this manner teachers can quickly prepare attractive lessons without having to search for materials.

Description of educational excursions

Based on the core school curriculum, direct observations and field activities are one of the forms and methods of work with school pupils which are recommended by the Ministry of National Education. This approach towards children's education is also one of the premises of the EDUSCIENCE project. All the observatories of the Institute of Geophysics, Polish Academy of Sciences and other institutes cooperating in the project implementation were made available for school pupils at all education levels. As one of its forms, school pupils were invited to participate in a two-day educational excursion. During two years of the project testing, effective educational solutions were developed to help to provide school pupils with necessary knowledge in an efficient, and still enjoyable manner.

After the end of its testing period at schools, the observatories will continue to admit school pupils being interested in expanding their know-

Our educational excursions taken under the EDUSCIENCE project were most appreciated by school pupils

ledge in the scope of mathematics and natural subjects. All the schools which declared their willingness to participate in the project will be able to take part in free workshops conducted with the application of scientific back-up facilities provided by the institutions participating in the project.

Apart from such activities performed using the scientific back-up facilities provided by the institutions participating in the project, additional activities which can be conducted at the cost of schools will be suggested. These activities were tested during educational excursions under the EDUSCIENCE project. They often supplement teaching materials at the observatories

Virtually all our school pupils speak enthusiastically about the excursions organised under the EDUSCIENCE project. They perceive the positive value of knowledge acquired during them. This is by far the most appreciated value of the project.

Fragment of the report on external evaluation

and help to better understand the complexity of natural phenomena. They also extend pupils' knowledge in the range of Poland's cultural and natural values.

For schools participating in the project nine excursions were suggested in the following provinces: mazowieckie, małopolskie, wielkopolskie, pomorskie, śląskie and dolnośląskie. In order to apply to take part in individual activities, it is necessary to contact their organisers (using email addresses listed for the observatories).

When told to join an educational excursion, many school pupils react in the same manner - anything but that! Who wants to take a trip to learn? Every day we have got too much of it at school. At the beginning we have reacted similarly, however after reading the suggested activity topics, it came to our minds that it may be cool though. And you know what? We have not been disappointed.

Sandra Gostomczyk
Senior Secondary School in Chojnice

The excursion has provided us with lots of emotions, aroused our higher interest in natural subjects, in particular natural phenomena associated with thunderstorms and lightnings.

Students,
Technical College from Augustów

Suggestion 1. Geophysical Observatory in Świder

Geophysical Observatory in Świder
ul. Brzozowa 2, 05-402 Otwock
edu.swider@igf.edu.pl

Lesson topics in the observatory:

Magnetic and electric fields of the Earth

School pupils learn the history of geophysical research studies, get familiar with the equipment used for these measurements: the magnetic and electrical fields of the Earth, meteorological parameters, air pollution and get to know what electrical phenomena occur in the atmosphere.

Field activities in the valley of the Świder river

During field activities they learn about the Świder river - one of the right tributaries of the Wisła river. Moving along its valley, they perform basic measurements on the river. During this course some issues related to the morphology and geology of the river valley as well as the transport of materials in the river bed will be discussed. Excursion participants will be able to perform: a morphological profile of the valley, measurements on the river characteristics (speed of its current, water ripples and larger forms).

Geophysical research studies in the Arctic

The Institute of Geophysics runs polar research studies, among others, based on its own base - the

Hornsund Polish Polar Station in Spitsbergen. One of the buildings within the observatory in Świder, called ”the Larch House”, hosts a polar exhibition at which the following will be presented: measuring instruments used for Arctic research and everyday equipment required by polar explorers to survive difficult conditions of the Arctic climate. After visiting the exhibition, school pupils can watch films presenting the life at the polar station, the Arctic wildlife as well as reports and coverage on expeditions.

Suggestion on complementary activities to be performed at the cost of schools

Botanical Garden, Polish Academy of Sciences

www.ogrod-powsin.pl

The Botanical Garden in Powsin provides visitors with plant collections, both naturally occurring within the territory of Poland as well as usable, ornamental, tropical and subtropical plants. At the Garden in the Nature and Ecology Education Centre it is possible to organise courses and workshops for schools.

Museum of the Earth, Polish Academy of Sciences

www.mz-pan.pl

The Museum of the Earth collects Polish geological heritage collections, runs scientific research studies and popularises the Earth sciences. In the museum there are lessons held for students at every level of education.

During the field activities, school pupils perform measurements at the Świder river

Suggestion 2. Central Geophysical Observatory in Belsk

Central Geophysical
Observatory in Belsk
05-622 Belsk Duży
edu.belsk@igf.edu.pl

Experiments on solar panels show that the Sun is an important source of energy

Activity topics:

Magnetic field of the Earth and its secrets

Activities concern various aspects of research on the Earth's magnetic field. Participants learn about the sources of magnetic field of internal and external origin and get to know the methods of modern observations of the Earth magnetism. When visiting the observatory they learn the history of magnetic observations in Belsk, get to know how the Polish observatories cooperate with the global network of geomagnetic observatories and become familiar with practical significance of magnetic observations. In the demonstration hall they get acquainted with selected instruments used for magnetic observations.

Fascinating atmospheric phenomena

The observatory runs comprehensive research studies in the scope of atmospheric physics. During this part participants will learn what atmospheric observations and measurements are, as well as how they are performed. When visiting its measurement pavilion and meteorological garden, instruments aimed to perform measurements in the scope of atmospheric physics will be presented. Getting to know the principles governing the atmosphere and the weather allows scientists to predict i.e. forecast weather. During this course school pupils will learn how synoptic maps are created. In the section on weather engineering, they will seek answers to the question how and to what extent it is possible to interfere with the weather.

Sun as an invaluable source of energy

It is impossible to overestimate the role of the Sun in the development and maintenance of life on the Earth. Numerous processes taking place on the planet have their source in the energy derived from the Sun. Activities on solar energy are prepared in such a manner that school pupils can discover the laws of nature while making experiments. A series of experiments related to solar radiation await them here. They will be able to see that even on a cloudy sky you can get electricity from solar panels. They will also learn how a leading scientist can fry scrambled eggs using a satellite dish.

Suggestion on complementary activities to be performed at the cost of schools

Museum of the Earth, Polish Academy of Sciences

- see Suggestion 1 for its description.

"Modrzewina" Nature Reserve Area

(Information: the Grójec Forest Inspectorate, Podole 91, 05-600 Grójec)

The nature reserve covers more than 300 hectares of forest area where there are oaks, pines, horn-beams and limes and species of Polish larch being unique for this place. Within the strictly-preserved reserve area, you can see trees which are about 200 years old and more than 30 metres high. The Grójec Forest Inspectorate staff show participants around the area.

Suggestion 3. Institute of Geophysics, Polish Academy of Sciences in Warsaw

Institute of Geophysics, Polish Academy of Sciences,
ul. Księcia Janusza 64, 01-452 Warszawa
edu.instytut@igf.edu.pl

Activity topics:

Magnetism of rocks - what do they tell us about the past?

Paleomagnetism is the only method by which quantitatively (numerically, mathematically) we are able to determine the position of lithospheric plates in the Earth's geological past. During this course some grounds for the theory of continental drifts will be discussed. Various methods of determining the position of an individual continent within geological epochs, with particular emphasis on paleomagnetic methods, will be demonstrated. School pupils will learn what magnetic memory of rocks is and how rocks acquire it. During the workshop part, participants will visit the paleomagnetic laboratory and learn various methods of measuring the magnetic parameters of rocks and minerals.

Polar research

In the Institute, based on the Hornsund Polish Polar Station in Spitsbergen, research studies on the dynamics of environmental changes within the polar zones are run. This part of excursion

During a visit at the Institute of Geophysics, school pupils participate in classes at the paleomagnetic laboratory

will be led by participants of polar expeditions who will talk about living in the Polish House near the Pole, about research studies conducted there as well as everyday life and extraordinary meetings with polar bears.

Suggestion on complementary activities to be performed at the cost of schools

Botanical Garden,
Polish Academy of Sciences
- description like in Suggestion 1.

Museum of the Earth, Polish Academy of Sciences
- description like in Suggestion 1.

Suggestion 4. Geological Museum of the Institute of Geological Sciences, Polish Academy of Sciences in Cracow

Geological Museum of the Institute
of Geological Sciences,
Polish Academy of Sciences
ul. Senacka 1, 31-002 Kraków
edu.muzeum@igf.edu.pl

Activity topics:

The Earth crust - a mosaic of minerals and rocks

The outer part of the Earth - the Earth's crust - is a fascinating mosaic of various minerals and rocks characterised by a variety of colours and features, created in very different climatic and tectonic zones. The aim of classes at the Geological Museum Polish, Academy of Sciences in Cracow will be to familiarise participants with methods which are applied by geologists to identify the origin of examined rocks. Activities will be based on the geological structure of Cracow, its surroundings and positions at the background of large geological structures in Europe at present and in the geological past as well as to get familiar with the history of changes in physics, climate and life at our planet for 650 million years.

Polish House near the Pole

Polish House near the Pole - this is how polar explorers call the Hornsund Polish Polar Station

Visiting the Museum of the Earth you can learn, among others, to read geological maps

in Spitsbergen. It was established thanks to the Polish Academy of Sciences' staff. School pupils visiting Cracow will have a chance to meet with polar expedition participants who will vividly tell, among others, about that what the climate in the Arctic is, what plants grow there and how animals have adapted to the harsh Arctic winter and the polar night.

This meeting with polar explorers will be a great opportunity to ask questions about some basic issues connected with living at the station, how, for example, you can talk via a mobile phone, what a walkie-talkie is, what crampons are for and why scientists when going out have weapons on them.

Excursion via the route of Cracow stone monuments

This excursion via the route of stone monuments in Cracow will be aimed to turn attention to rock materials used in the construction of buildings as well as monuments and other elements of the Old Town in Cracow. Historic towns and cities are typically visited without paying attention to that what individual structures are actually made of and what can be seen in the materials used. They are often unusual rocks containing a large amount of beautiful-embedded fossils or minerals which cannot be found these days. This excursion will show how important ”good eyes” are when watching or visiting cultural monuments.

In my opinion, this EDUSCIENCE excursion was very interesting. We learned more about volcanoes, earthquakes and caves. We have visited the geology museum of geology and watched a 'real' quarry! Our stay in Ojców was great, although we did not have TV. I liked the 3D film most which we watched in the history museum.

Kacper,
Primary School in Babięta Wielkie

Geological excursion via the route of Cracow quarries

Within the area of Cracow there are lots of old quarries which are now no longer in operation. They enable us to learn more on the geological construction of the area at which the city is located. Bonarka is one of its more famous quarries. An inanimate nature reserve was established there. Here you can watch rocks with their various geological structures - recesses and abrasion platforms which stand for preserved rocky seashore. Zakrzówek is another quarry which is a part of the Twardowski Rocks Park. Within the park there are also geological structures of tectonic origin and karstic forms (the Twardowski Cave is one of them).

Visiting the cave interiors allows to have a look at lithosphere from a different perspective

Suggestion on complementary activities to be performed at the cost of schools

The Ojcowski National Park

www.ojcowskiparknarodowy.pl

The Ojcowski National Park, located in the małopolskie province, is the smallest national park in Poland. It includes fragments of the Prądnik and Sąspołowska valleys. The park can be visited when assisted by a licensed guide only.

Educational and Museum Centre at the Ojcowski National Park

Visiting the museum in Ojców helps to understand phenomena taking place in the national park. Thanks to the modern form of presentation, school pupils and students of all ages can benefit from it. The visit starts with watching a 3D film.

Suggestion 5. Astrogeodynamic Observatory in Borówiec

Astrogeodynamic Observatory in Borówiec
ul. Drapałka 4, 62-035 Kórnik
edu.borowiec@igf.edu.pl

Lesson topics in the observatory:

What is the Astrogeodynamic Observatory engaged into?

The Astrogeodynamic Observatory in Borówiec is a part of the Space Research Centre, Polish Academy of Sciences. During this course at the observatory excursion participants learn the history of research studies conducted in this place. They will also have a chance to visit the observatory, among others, the only laser station in Poland and one of the few ones in the world. They will get acquainted with the methods of conducted research studies and applied instruments.

Laser measurements and the wandering continents

At the Observatory there is a GPS station which is engaged into satellite observations as required by the Global Navigation Satellite System. Thanks to the cooperation of the observatory with more than 200 global agencies it is possible to obtain the most accurate measurements. At the excursion, school pupils will learn the use of laser and GPS equipment to determine the direction and

Sky observations can be an exciting adventure

In Borówiec school pupils learn about instruments used in astronomy

speed of movements of the lithospheric plates and vertical movements of the Earth's crust.

How do we discover space?

The laser station at the observatory in Borówiec carries out laser measurements of distances from the Earth to artificial satellites. During this course school pupils will learn what laser light is, how it is different from other types of light and in what manner laser observations are conducted.

School pupils will have an opportunity to learn about the contribution of Polish scientists in discovering the mysteries of space. Some practical activities - a construction of the BRITE satellite model - await the youngest ones. Students of senior classes have a chance to run night sky observations. All of them will be able to learn interesting facts related to physics and astronomy.

International Space Station

The International Space Station is the only place beyond the Earth where people live. It is the largest artificial satellite and the largest space laboratory which has ever gone around the Earth. How is life at the ISS, what does the Earth and space look like from aboard the ISS and why do we need this space lab? The answers to these and other questions are found by school pupils during this part of the course. It is also possible to get connected live with the station and watch what is happening on board the ISS.

There are a lot of practical activities which await visitors at the observatory in Borówiec. Many of them take place in the open air. They are particularly appreciated by the youngest school pupils. The type of activities and their

At the Observatory in Borówiec we have been provided with lots of information on satellites and time; we could also see the laser which shoots up to the satellites and the huge professional telescope. We saw the castle in Kórnik at which - according to the legend - you can still meet the White Lady; personally more than the legend we liked its antique furniture, old herbals, armorials and military exhibits. The "green lesson" at the Kórnik Arboretum was the last spot of our excursion. During the lesson - solving the 'Wielkopolski Quest' puzzles - we could get to know and admire many species of trees and shrubs. We came back from the excursion in high spirits, enriched with new knowledge.

Karolnia Falba and Klaudia Zdunek
Comprehensive Secondary School in Wyszków

duration depend on the age of a particular group and atmospheric conditions.

Practical activities:

- Mini-orienteering within the area of the observatory.
- Observations of sunspots.
- Gluing a model of the BRITE satellite or the Solar System.
- Finding and recognising the observed objects through a telescope.
- Night-sky observations.
- Astronomical quiz.

Suggestion on complementary activities to be performed at the cost of schools

The Castle in Kórnik

www.bkpan.poznan.pl/muzeum

The castle is undoubtedly the major tourist attraction of Kórnik. It is located just a few kilometres from the observatory in Borówiec. This is not only the seat of the Działyński ancestral library but also a wonderful object of architectural heritage.

Arboretum at the Institute of Dendrology, Polish Academy of Sciences in Kórnik

www.idpan.poznan.pl

"Green lessons" await course participants at the Kórnik Arboretum. School pupils may also go the "Trees of the World" touristic and educational path along which they encounter 25 outstanding species of trees.

Suggestion 6. Institute of Oceanology, Polish Academy of Sciences in Sopot

Institute of Oceanology,
Polish Academy of Sciences
ul. Powstańców Warszawy 55,
81-712 Sopot
edu.sopot@igf.edu.pl

Activity topics:

Phenomena in the coastal zone

The activities organised at the Institute are aimed to get school pupils familiar with the basic elements of oceanographic research studies. When discussing phenomena in the coastal zone, excursion participants will learn about the mechanism of local winds (sea breezes) and their formation. The Institute also runs research studies beyond Poland, among others at places which are at risk of tsunami. It has an impact not only on the lives of people living within coastal areas but also is a relevant influential factor on the animate and inanimate nature within them. School pupils learn about the mechanism of formation of tsunami and its effects. They will also think about what steps should be taken to minimise negative effects of this phenomenon.

The ocean-atmosphere system

These activities are aimed to familiarise school pupils with the basic elements of the ocean-atmosphere system and its role in shaping the climate.

Education excursion to the shore will allow you look at it from the perspective of a researcher

Excursion participants will learn on the impact of radiation balance on the climate, its parameters and changes. They will also learn on the impact of formation of our climate and the effects of winds onto sea surfaces as well as get to know how to distinguish between concepts of weather and climate.

Shore as a habitat

A shore is a coastal stretch of land covered with bulk material lying at the bank(s) of water reservoir. For tourists it is mainly a place for relaxation, sunbathing, playing. This time excursion participants will have a chance to look at a shore from the perspective of a researcher. They will be assisted by the Institute of Oceanology staff who will prove that a shore is the place where numerous microscopic organisms live. During these activities school pupils will be allowed to go out to the shore to make observations and do some sampling.

Marine animals

School pupils will learn some curiosities, among others: on plankton, and methods how marine animals escape from predators. They also learn about ”breaking records” of marine animals in the following categories: the largest, the fastest, the deepest diver etc. School pupils - together with their educator - will perform experiments with floating and sinking objects aimed to see the way in which various marine organisms maintain their buoyancy.

What is hidden in sea water?

Some selected components of sea water and their significance are discussed during this part of the excursion. The following are planned under the experiment: going out to the shore, taking samples of water, measurements of its salinity, pH, temperature, coming back to the Institute, seepage of seawater and freshwater, pointing out differences and measurements of its salinity, pH, temperature (by means of different methods). It is also possible to organise activities on one of the following topics:

- the Baltic Sea and its pollution (trash, sunk weapons, eutrophication);
- the Baltic Sea and its utilisation (its coastal zone, wind plants);
- Climatic changes. The Baltic Sea case (acidification of seawater).

Suggestion on complementary activities to be performed at the cost of schools

The Blue School in Hel at the Maritime Station, the Institute of Oceanology at the University of Gdansk
www.hel.univ.gda.pl

A visit at the Hel sealarium offers an opportunity to meet a fascinating Baltic mammal - a grey seal. Throughout the year you can enjoy watching these animals during their special show - while feeding and medical training. In addition, under the Blue School there are also marine workshops run for school pupils.

Suggestion 7. Geophysical Observatory and School Complex in Racibórz

Silesia Geophysical Observatory in Racibórz
ul. Chłopska 1, 47-400 Racibórz
edu.raciborz@igf.edu.pl
Mechanical School Complex in Racibórz
ul. Zamkowa 1, 47-400 Racibórz

Activity topics:

Earthquakes and seismic shocks

Workshops on earthquakes are organised at the Racibórz seismological observatory. This is a unique architectural scientific and research complex at which since the early 20th century seismic shocks have been recorded. This is also the place at which in the mid-20th century measuring instruments were constructed. You can find them at the small museum exhibition. The observatory manager will speak passionately on the causes of formation of earthquakes and on manners of recording seismic shocks.

Electrical discharges and their formation

How is an electrical impulse generated, how is a thundercloud formed, what are causes of lightning, can we build an "artificial storm" in the laboratory? - these are just few issues which will be discussed during this meeting at the Mechanical School Complex in Racibórz. The school has an extensively equipped lab for mechanics, mechatronics and electronics classes. They

The Mechanical School Complex in Racibórz has extensive labs in the scope of mechanics, mechatronics and electronics engineering

make it possible to run experiments both in the form of demonstrations as well as workshops for school pupils and students. During this course the causes and consequences of lightings will be discussed and the operation of Tesla transformer will be presented.

What squeaks in a brushwood - natural workshops in the Łężczok nature reserve

The Łężczok nature reserve is located in the municipality of Nędza in the district of Racibórz. It was established in 1957. It has an area of 408 ha and covers species-abundant riverine forests and post-Cistercian fish ponds. During this course in the reserve nature school pupils will have an opportunity to observe numerous species of birds, in particular wetland birds. In terms of the number of residing species of birds, the reserve takes second place in Poland.

Suggestion on complementary activities to be performed at the cost of schools

The Piastowski Castle in Racibórz

www.zamekpiastowski.pl

The Castle in Racibórz comes from the 13th century. The Gothic chapel named after St. Thomas Becket of Canterbury (called the Silesian Saint-Chapelle) is its most valuable part.

The Łężczok nature reserve takes second place in Poland in terms of the number of birds residing here

The Arboretum of the Moravian Gateway

The Arboretum covers a fragment of the Obora Forest located close to the Moravian Gateway, i.e. the area in the mountains separating the Carpathians from the Sudety Mountains. This place constitutes migration corridors for many species, so you can marvel at species originating from outside Poland, e.g. from the southern regions of Europe.

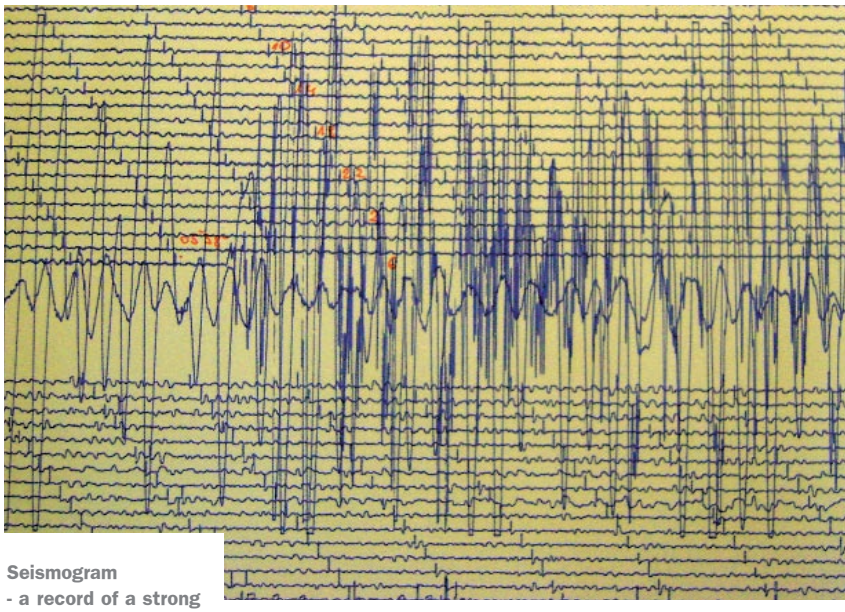
Suggestion 8. Geophysical Observatory in Książ

Geophysical Observatory in Książ,
Institute of Geophysics,
Polish Academy of Sciences
ul. Piastów Śląskich 3,
58-306 Wałbrzych
edu.ksiaz@igf.edu.pl

Lesson topics in the observatory:

Observatory in Książ - from the historical times to the present

The monumental castle in Książ is the third largest castle in Poland. Very few people know, however, that there are accurate measuring instruments located in its underground area. They enable to record all the parameters which are key for understanding the Earth and phenomena governing our planet. In this part school pupils will learn how the castle underground corridors were created, what was their original function and what type of measuring equipment is located there. Further the observatory will invite school pupils to attend lectures on the Earth, tell about fascinating seismological research studies and quest for sources of earthquakes as well as discover the secrets of the Earth gravity.



Seismogram - a record of a strong earthquake registered at the observatory in Racibórz

The Lower Silesian Geophysical Observatory in Książ was established in 1970 and initiated by prof. Roman Teisseyre. Its main task was to run current recordings on earthquakes. During this course, the following topics will be discussed: propagation of seismic waves, learning about the Earth on the basis of seismic research studies, methods of location of earthquakes, theory on tectonics of lithosphere plates and their boundaries.

History of geophysics and application of mathematics

Most of the participants of our excursions prior to entry into the observatory knew only Mikołaj Kopernik (Nicolaus Copernicus) and Maria Skłodowska-Curie, the two renowned Poles in the field of exact sciences. After our workshops at the Observatory they will know two more: prof. Maurycy Pius Rudzki and prof. Jan Łukasiewicz. Both of them left their footprint in the history of geophysics and mathematical logics. In this part school pupils will also learn about the history of geophysics and its development.

Practical application of mathematics

Workshops in the field of practical applications of mathematics will be run by a graduate of the Institute of Geodesy and Mathematical Application who will show with great commitment what benefits we can get from mathematics and its applications. And school pupils will learn: whether you can determine a river width when you just have a capped hat; whether a radish and cucumber will help us to distinguish a circle and ellipse; when "+", "-", "=" mathematical symbols were established; whether a sign of equality is necessary; who gave rise to the Reverse Polish Notation (RPN) system. Participants of these workshops will also have an opportunity to use a calculator with the RPN system.

Field excursion

At the end of this course school pupils will go along one of the educational paths within the area of the Książ Castle. They will observe various land forms and learn how they were created. They will go around the area making use of a topographical map and they will get oriented thanks to it.

Observation of solar spots are an additional attraction during the excursion to the Książ Castle

Suggestion on complementary activities to be performed at the cost of schools

Książ Castle

www.ksiaz.walbrzych.pl

The Książ Castle (its oldest part) dates back to the 13th century. Over the years the castle changed its owners several times, was extended and reconstructed. When visiting the castle you should turn your attention to its Second World War history when its underground tunnels were built. Currently in the castle undergrounds, measuring instruments are located.

Suggestion 9. "Horyzont II" training and research ship owned by the Gdynia Maritime University

Gdynia Maritime University
ul. Morska 81-87, 81-225 Gdynia
edu.horyzont@igf.edu.pl

Activity topics:

The floating university - the "Horyzont II" vessel

At the "Horyzont II" vessel, trainings are run by students of the Gdynia Maritime University. They learn how to operate the ship and - while taking part in sea voyages - they get to know about the sea life and its principles. The participation in the EDUSCIENCE project allows them to join this elite community and get to know answers to the following questions: how it is that a ship keeps afloat and why it does not sink; what "the inside" of a ship looks like - where its crew and passengers live; where its engine is located; how a ship kitchen looks like and how cooking goes on there when the ship "swings on waves".

Basics of navigation in sea shipping

The captain's bridge is the most important place at the ship. Here key decisions on a given course are made. To ensure that these decisions are made consciously and professionally, the ship is equipped with a range of modern communication and navigation equipment. On the "Horyzont II" vessel, at the captain's bridge, also practical trainings on navigation for the Gdynia Maritime University students are also run. School pupils visiting the ship learn the basics of navigation as well.

Suggestion on complementary activities to be performed at the cost of schools

"Horyzont II" vessel

Arranged with the Gdynia Maritime University representatives, school pupils can get accommodated in the ship cabins and eat meals in the captain's mess room which were prepared by the ship cook.

School pupils visiting the "Horyzont II" ship learn, among others, the basics of navigation in maritime shipping

Such natural monitoring learns regularity, orderliness and responsibility for all the prepared data

Nautical Centre at the Gdynia Maritime University
www.ozam.pl

The Nautical Centre at the Gdynia Maritime University was established in 2009. It is mainly aimed to promote broadly-comprehended nautical and water education. The Centre is involved in various types of sailing rallies and regattas. It also runs training activities.

The Blue School in Hel
at the Maritime Station,
the Institute of Oceanology
at the University of Gdańsk

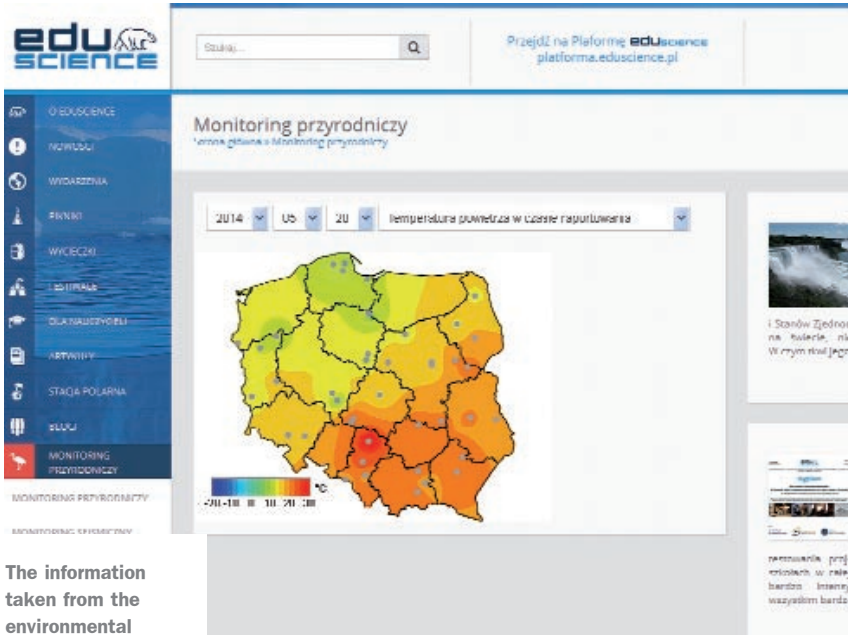
- see Suggestion 6 for its description.

Environmental monitoring program

The schools participating in the project at the testing stage ran environmental monitoring. On a daily basis observations were performed by school pupils close to their schools. The results reported via the portal were collected in the database and presented at the maps of Poland. During two school years pupils regularly conducted meteorological observations and recorded their results at the portal. The 'record-breakers' also ran their observations on Saturdays, Sundays and days-off as well as during summer and winter holidays. Now we would like to encourage all teachers to join the EDUSCIENCE nationwide environmental monitoring.

Why to run the environmental monitoring

The main objective of running observations and measurements is to bring social utility professions (under the so-called service work) closer to school pupils and students. For many professions special requirements are set for candidates (such as flexibility to work on days-off and holidays and high responsibility for data quality, e.g. in meteorological services at airports). Additionally it is aimed to broaden students' skills to make use of scientific observations in everyday life. In addition, thanks to such conducted measurements and presentation of their results in the form of thematic maps at the EDUSCIENCE portal, school pupils will be able to analyse varied natural conditions in Poland on their own and teachers will be able to use the data collected from all over the country to prepare materials in the field of geography, biology and mathematics.



The information taken from the environmental monitoring is published at the portal in the form of colour thematic maps

Environmental monitoring at individual educational stages - differences

Schools participating in the environmental monitoring program should get equipped with basic equipment used to run measurements specified below. Obviously the monitoring can be introduced at schools in its partial scope and then - in the course of time - extended and extra equipped (e.g. their "meteorological gardens"). The scope of the run measurements - adjusted to individual stages of education - requires an adequate set of measuring instruments. Every school, which at the registration at the portal provides its geographical coordinates, will be

A lot of fun. Kids run environmental monitoring every day. They keep reporting every day, even on weekends and holidays and at Christmas. We got the seismograph which has become our local attraction. Apart from that we run lessons via the platform, kids take part in on-line classes. We were also on a trip in Książ. Incredible fun. I would recommend it to all.

Anna Rzepa

Teacher of chemistry, administrator of the project in the Junior Secondary School in Lębork

able to send their observations and measurements in the form of reports and all the sent data will be automatically processed and presented in the form of colour thematic maps for Poland.

Scopes of measurements and observations at individual stages of education were defined below.

1ST STAGE OF EDUCATION

In primary schools, at the first stage of education, such monitoring covers getting accustomed to making observations of the surrounding nature at certain periods during the day and remembering or recording their most relevant phenomena. Such monitoring should include day-to-day specification of some basic meteorological conditions (measured at the same time during the day):

- cloud coverage - in three categories: sunny day, completely cloudy day and mixed day;
- wind - to determine if there is any wind, and in case of wind, to determine whether it was strong or weak;
- precipitation - in two categories: to determine if there is any precipitation, and in case of precipitation, to determine whether it was rain or snow;
- if there were any storms or lightning during the last 24 hours; whether a water reservoir (if there is any at the location) is covered with ice.

All these observations should also refer to elements of the surrounding animals and nature:

The main objective of running observations and measurements is to bring social utility professions closer to school pupils and students

- records on arrivals/departures/flights of storks;
- occurrence of first flowers (forsythias, chestnuts and elders);
- occurrence of yellow leaves at birches and their falling;
- records on falling chestnuts and acorns.

2ND STAGE OF EDUCATION

At the second stage of education students should be addressed with additional requirements. At this stage every observation made by pupils must be jointly agreed before the data in the group is further passed on to their teacher. Students, by providing or disseminating such information, must assess it in terms of its reliability. Such monitoring should include:

- measurements on air temperature by one standard adopted;
- if there is wind, determine its direction and force (light wind, gusty wind, hurricane);
- records on atmospheric precipitation, its type if any (drizzle, rain, rainstorm, hail, snow, hoar frost);
- measurements on snow coverage (its thickness) if there is any in the courtyard school.

This monitoring should also refer to elements of the surrounding living nature:

- recordings on arrivals/departures or flights of birds (storks, wild geese and starlings);
- blossoming tree flowers (cherries, apples, rowan trees);
- occurrence of irritating mosquitoes;

- if there is a water reservoir or watercourse near the school, changes can be monitored in water surfaces levels at some marking gauges prepared with their teacher;
- observations on grass/cereals (rye, oats, wheat) harvested at meadows and fields;
- loss of tree leaves and needles (birch, larch, fruit trees).

3RD EDUCATIONAL STAGE

Students should become accustomed to their regular duties, even on days-off. The observed and recorded phenomena as well as measured and reported results of measurements and observations must be verified and presented as average values of all the measurements made by various students. The reliability of each and every result should be determined after analysing errors which can be made during its measurements. Also the personal responsibility for all entrusted tasks or taking the role of an observer should be required. Such monitoring should include the daily specification of some meteorological conditions: measurements of air temperatures (average, max. and min.) as adopted by one standard:

- determination of wind speed and directions;
- records on types and volumes of atmospheric precipitation;
- collection of precipitation;
- determination of pollution (contamination) by means of colour-based two indicators (tests) (e.g. acidification and dissolution of particulate substances);
- measurements on snow cover, its thickness and density by means of special scales;
- if there is a water reservoir or watercourse near the school, its water quality can be tested (in the same way as for precipitation).

The environmental monitoring also covers examination of the quality of surface waters

This monitoring should also refer to elements of the surrounding living nature:

- records on flights of migratory birds;
- flower bloom (snowdrops, magnolias, poppies, limes and at water reservoirs);
- occurrence of irritating wasps;
- collections of strawberries, cherries, mushrooms and grapes observed nearby;
- traces of earthworms to greens and lawns.

4TH EDUCATIONAL STAGE

The monitoring program for senior secondary schools may constitute a part of manual and technical training which is required to develop skills in science and technology.

For the monitoring of natural phenomena, there should be measuring methods and instruments used which meet the basic requirements set for the environmental monitoring systems.

The comparison of own results with the results published at the EDUSCIENCE portal by other schools as well as making use of the data (e.g. web-based) from other monitoring system will be the key to associate many facts and to predict changes which may occur in the surrounding environment.

Such monitoring should include day-to-day specification of some basic meteorological conditions:

- measurements on air temperature (average, max. and min.) by one standard adopted;
- measurements on near-the-ground temperatures;
- determination of wind speed and directions;
- records on types and volumes of atmospheric precipitation;
- collection of atmospheric precipitation and determination of its extent of pollution (contamination) using the following instruments: pH meter, conductivity meter;
- measurements on water thickness and accumulation in snow coverage;
- if there is a water reservoir or watercourse near the school, its water quality can be tested in the range of temperature, pH, soluble salts and pollutants as well as oxygen content.

This monitoring should also refer to elements of the surrounding living nature:

- records on arrivals, departures or flights of particular species of birds within some selected testing area;
- comparison of blooms of selected plants depending on their location (in built-up and open areas);
- periods of occurrence and spread of beetles and hornets;
- dependencies between harvests of fruits, vegetables and agricultural products observed nearby and their prices in trade.

The detailed specification of all the measuring methodology and reporting of observations and their results was included in special instructions and demonstration videos available at the EDUSCIENCE website (www.eduscience.pl/strony/monitoring-pomoc).

Effectiveness of the project

- How do we know that the project is effective?
- Results of the evaluation studies
- EDUSCIENCE develops pupils' competences

How do we know that the project is effective?

In the course the project implementation all its participants could share their opinions and suggest their own solutions. The project was highly praised by school pupils and teachers. However, in order to state with certainty whether or not the objectives set at the start of the project implementation have been achieved, professional evaluation studies needed to be conducted. An external company was engaged to objectively assess the set indicators and their degree of achievement.

The evaluation studies under the EDUSCIENCE project covered:

- three editions of mathematics, natural and language tests conducted by means of computer methods (CAWI) among all school pupils taking part in the project,
- three editions of surveys checking the project users' and recipients' satisfaction and their opinions on individual products, as well as monitoring all the suggested changes by means of computer methods (CAWI),
- 120 in-depth personal interviews with school pupils and teachers (IDI),
- 24 group surveys with school pupils and teachers (focus surveys).

The project evaluation studies aimed to assess if participation in the EDUSCIENCE project contributed to the development of skills in the range of mathematics, natural and technical subjects among children and adolescents. The following questions were sought to be answered:

- What build-up of knowledge and skills in mathematics, natural sciences has there been among the school pupils participating in the project?
- Have the school pupils developed abilities to practically make use of skills acquired in the course of the classes?
- To what extent have their analytical and synthetic thinking skills been improved?
- Have their skills of using specialised English in the area of sciences covered by the project improved?
- Has there been any change in the school pupils' general approach to mathematics and natural sciences?

Results of the evaluation studies

The diagnostic material gathered in the course of the project implementation was impressive. In total the following was obtained: 5,579 CAWI surveys from school pupils, 914 surveys from teachers, 26,142 completed competence tests (mathematics and natural sciences - 13,492, English - 12,650), as well as 120 individual in-depth interviews and 170

opinions from focus-based group surveys. The conducted studies show that the most relevant benefits of the EDUSCIENCE project's final products include: high content-related quality of the educational materials available at the platform, very good organisation of the educational events and excursions, and visual attractiveness of the EDUSCIENCE platform.

The indicators examined were achieved to the following extent:

- average build-up of knowledge and skills taken for entire units for mathematics and natural sciences - the assumed target value: 20%, the achieved value: 20%;
- development of abilities of practical use of skills acquired in the course of classes (they refer to, among others: application of research methods, analysis of results, drawing logical conclusions, and data synthesis) - the assumed target value: improvement in 70% school pupils, achieved value: improvement in 72% school pupils;
- improvement of analytical and synthetic thinking skills among school pupils - the assumed target value: improvement in 70% school pupils, achieved value: improvement in 76% school pupils;
- improvement of skills of using specialised English in the area of sciences covered by the project - the assumed target value: improvement in 30% school pupils, the achieved value: improvement in 62% school pupils;
- change in the school pupils' general approach to mathematics and natural sciences - 88% of the teachers participating in the EDUSCIENCE project consider that there has been an increase (or even a dramatic increase) in mathematics and natural sciences among the school pupils.

I am glad that my students may develop their abilities and skills thanks to the EDUSCIENCE project. They come from small towns from the region of Pomerania, and the project gives them an opportunity to take a different look at the world. I think that for children from my project group this has been a real adventure. They cannot afford to take trips. Not all of them have money to satisfy their basic needs - even to buy school books. I am happy that they may take trips and participate in such interesting events.

Małgorzata Józefowicz
Project administrator at the Senior Secondary School Complex in Słupsk

Without any doubt the EDUSCIENCE project and platform have been positively assessed. According to the school pupils as well as the teachers, they have led to increasing the attractiveness of classes and raising their potential to expand knowledge. A considerable impact of the project on an increase in the school pupils' interest in mathematics and natural sciences - regardless of their education and sex - has also been perceived.

Our participation in the EDUSCIENCE project was a completely new experience both for the school pupils and the teachers. On a daily basis, we learned to take advantage of our interactive board and the platform providing lots of resources from various fields. My school pupils regularly conduct environmental monitoring, take part in on-line broadcasts, as well as enjoy direct contacts with the scientists running scientific research at the Hornsund station. We experienced interesting scientific moments at the excursion to Warsaw and Świder, as well as at the provincial conference in the Wrocław Humanitarium. As a teacher, I particularly appreciate the methods of effective learning presented by Colin Rose. Our school has certainly seized the chance created the EDUSCIENCE project.

Małgorzata Cholewa
Teacher at the Public Junior Secondary School in Jordanów Śląski

The development of interest in mathematics-natural sciences, indication of their practical application and improvement of analytical-logical thinking skills are due to the implementation of new, interesting methods of knowledge transfer which have engaged school pupils. As surveyed, the highest value in this respect is generated by: real life experiences, excursions, picnics and science festivals during which the school pupils and students can personally take part in experiments. The teachers often and willingly make use of the EDUSCIENCE platform, its resources, and features available at the platform; they positively assess their quality and quantity. In the course of the qualitative research, there were repeated voices in favour of keeping up the project and including other classes in it, which is its best recommendation.

The full scope on the evaluation is available on the project website: www.eduscience.pl/strony/ewaluacja.

EDUSCIENCE develops pupils' competences

The EDUSCIENCE project was favourably assessed by Magdalena Kołodziejska, a methodical advisor of the Mayor of Warsaw in the field of chemistry. We publish her opinion on the following pages.

Participation in the project has increased the school pupils' interest in mathematics and natural sciences

Warszawskie Centrum Innowacji Edukacyjno-Społecznych i Szkoleń
Instytucja Edukacyjna m. st. Warszawy

Warsaw, 23rd of May 2014.

Magdalena Kołodziejska
Methodical advisor of the Mayor of Warsaw in the field of chemistry

I prepared my opinion after getting acquainted with the materials available on the EDUSCIENCE educational portal and familiarising myself with the EDUSCIENCE educational platform.

We live in the world dominated by new technologies. However, their use should not be an end in itself. School pupils and students must be aware that technologies are not only for fun and games; they may also promote learning and mental development.

The EDUSCIENCE project takes advantage of the ease with which young people use new technologies in their daily lives. It allows teachers to meet school pupils in the digital domain, which may result in improved results in their education through school pupils' raised activity, commitment, and motivation for learning.

The EDUSCIENCE platform supports school pupils in gaining and deepening their knowledge and skills needed in the 21st century. It enables individualised work with school pupils with special educational needs. The resources available at the platform can be used both at work with school pupils with lower educational capabilities as well as with gifted school pupils in order to deepen

some areas of their knowledge. The numerous sets of questions available at the platform facilitate continuous and rapid evaluation of pupils' and students' progress. The interdisciplinary educational games will present the learning process as an integral whole. They allow for shaping pupils' and students' creativity. They are helpful in acquainting them with concepts, rules and laws which are difficult to present in the real world. The EDUSCIENCE educational platform has got all educational features which stimulate and develop pupils' and students' digital and social competences.

However, it should be constantly borne in mind that even the best resources will be no substitute for students' interaction with their 'real' life. This is especially important for nature-oriented school subjects. Self-conducted experiments will remain in the memory much longer than the best animations or videos. Tools applying information and communication technologies should assist educational objectives but they should not be exclusively relied on. These tools and their intelligent application are a relevant task to be accomplished by today's teachers.

Final conclusions:

The EDUSCIENCE educational platform and portal may be is a valuable tool in teaching mathematics and natural sciences at all educational stages.

Warsaw, 23rd of May 2014.

Magdalena Kołodziejska
Methodical advisor of the Mayor of Warsaw
in the field of chemistry

Doradca metodyczny m. st. Warszawy
w zakresie chemii
Kołodziejska
Magdalena Kołodziejska

Science opens doors

- Institute of Geophysics, Polish Academy of Sciences with its observatories
- Institute of Geological Sciences, Polish Academy of Sciences
- Space Research Centre, Polish Academy of Sciences
- Institute of Oceanology, Polish Academy of Sciences
- Gdynia Maritime University

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INSTITUTE OF GEOPHYSICS, POLISH ACADEMY OF SCIENCES

Instytut Geofizyki Polskiej Akademii Nauk

The project office is located within the premises of the Institute of Geophysics, Polish Academy of Sciences in Warsaw. This is also the location of the main web broadcasting centre, from where meetings with interesting people, lectures on teaching methodology and lessons developed by the scientists are held. The subject matter of the classes is very diverse, also including issues in the field of animated nature which are not dealt with by the Institute on a regular basis.

The project participants include scientific staff of the Institute of Geophysics, Polish Academy of Sciences employed on a regular basis at its observatories located all over Poland and at the Hornsund Polish Polar Station in Spitsbergen. Thanks to the co-operation of the Institute with other scientific units of the Polish Academy of Sciences, some scientific institutes belonging to the GeoPlanet Earth and Planets Research Centre (the Space Research Centre, the Institute of Geological Sciences and the Institute of Oceanology) were successfully incorporated into the project implementation. The project also engages the Gdynia Maritime University, equipped with its "Horyzont II" training and research vessel used on polar expeditions to the Arctic.

The scientific staff taking part in the project develop educational materials, receive school pupils participating in the project excursions and run lesson broadcasts (a detailed specification of classes available within excursions is included in the chapter entitled: "Why participate in EDUSCIENCE?").

Selected topics of on-line lessons:

- *Why a penguin does not meet a polar bear (stage I, II)*
- *The beauty of the underwater world (I)*
- *Fossils for children (I, II)*
- *The Fool's Day in nature, or how plants and animals cheat (I)*
- *A few words about noise (I)*
- *A visit to bisons in the national park (I)*
- *Hibernating bears in space (I, II)*
- *Bacteria - friends or foes? (I, II)*
- *What you need to know about Easter eggs (I, II)*
- *Can plants move? (I, II)*
- *What is the link between Chile and Alaska, or where do earthquakes occur? (III, IV)*
- *Which collection has more elements - situations where intuition fails (III, IV)*

- *Iceland - at the top of the Atlantic Rift (IV)*
- *Exploring the Grand Canyon (in English - III, IV)*
- *Numerical curiosities - from playing with a calculator to discovering a mathematical theorem (III, IV)*
- *Mathematical paradoxes - numbers and geometry (III, IV)*
- *Paradoxes of probability (III, IV)*
- *The pigeon-hole principle (III, IV)*
- *Meteorology beyond the Arctic Circle (III, IV)*
- *Destructive and constructive activities of glaciers (III, IV)*

Central Geophysical Observatory in Belsk

The observatory in Belsk - just 50 km away from Warsaw - captures a series of phenomena required to learn about processes taking place inside the Earth and on its surface. The observatory boasts some of the world's longest continuous measurement series of atmospheric ozone and the intensity of solar radiation, including ultraviolet radiation. In its meteorological garden basic measurements on the atmosphere and its parameters are conducted together with examination of pollutants and their content in the atmosphere (very relevant from the point of view of human impact on the

The Geophysical Observatory in Belsk captures phenomena which make it possible to learn about processes taking place inside the Earth and on its surface

environment). In Belsk also operates the Department of Geomagnetic Observatories, where, where measurements of the Earth's magnetic field are conducted on an ongoing basis.

Additionally, the Central Geophysical Observatory runs measurements of seismic shocks used to identify risks connected with earthquake occurrences.

Selected topics of on-line lessons:

- *Addition and subtraction of numbers (positive and negative ones) (stage I)*
- *Where do clouds come from? (II)*
- *How is rain formed? (II)*
- *Weather engineering - nothing can be done about the weather - is that for sure? (II, IV)*

Geophysical Observatory in Świder

The establishment of the Geophysical Observatory in Świder dates back to the 18 th century. In 1911, Stanisław Kalinowski made first efforts to build an observatory which was to be set up mainly thanks to private funds. Construction works started three years later. Two small houses were built with special structures to run magnetic measurements. The construction of the observatory was completed in spring 1915. Thus the first magnetic observatory in Poland was established, where continuous measurements on the Earth's magnetic field started.

The "larch house" - one of the historic buildings of the Świder observatory - currently houses a polar exhibition.

Gradually, the Observatory launched other geophysical measurements: electricity in the atmosphere, including examinations of lightning and blade-generated electricity, air pollution, and gam-

ma radiation background. After railway lines were built nearby, which had a major impact on the measurements carried out, research studies on the Earth magnetism were moved to Belsk. Since then the observatory in Świder has primarily dealt with research studies of the Earth's electric field. As required by the EDUSCIENCE project, a mini-museum showing magnetic measuring instruments and a polar exhibition were established in its historic buildings.

Silesia Geophysical Observatory in Racibórz

In the 20s of the last century, at the suburbs of Racibórz a wooden building was constructed in which measurements of seismic phenomena were launched. It was of high relevance, given that mining activity brought about seismic shocks in the area. Prof. Karl Mainka was the initiator of the development of seismic measurements in this part of the country and the founder of the observatory. He constructed instruments used to measure and record earthquakes. Today, even though they are antiquities now, they are still in operation and launched for demonstrations. Over subsequent years, measuring instruments and methods were improved. Today Racibórz hosts the Seismological Observatory of the Institute of Geophysics, Polish Academy of Sciences. There was an exhibition and workshop hall arranged in the historic building basement, which underwent a complete renovation in 2013.

At the Silesia Geophysical Observatory in Racibórz you can see instruments for measuring and recording earthquakes constructed nearly 100 years ago

Seismological Observatory in Książ

The observatory is seated in the area of the Książ Castle in Wałbrzych. The observatory conducts measurements of seismic shocks and preliminarily processes all its recorded data. Its state-of-the-art seismometers are installed at a depth of about 49 m below the main courtyard in the castle basements, drilled during the Second World War. The Observatory in Książ is a part of the Polish Seismological Network. Its recorded measurements are transmitted to the Institute of Geophysics, Polish Academy of Sciences in Warsaw. Its preliminary data reports are provided to the European and World Seismological Data Centre twice a week.

The measurements recorded at the Seismological Observatory at the Książ Castle are transferred to the European and World Seismological Data Centre

Selected topics of on-line lessons:

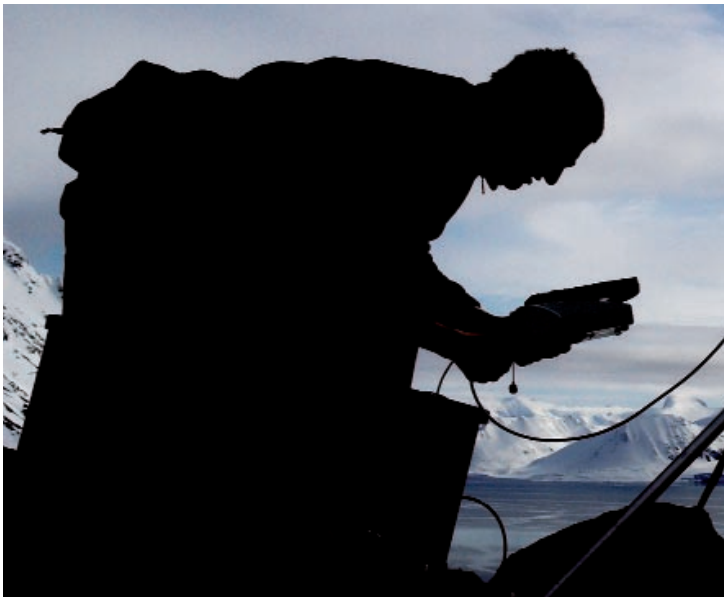
- *The Moon, the Sun and stars (stage I, II)*
- *Gold (II)*
- *Simple machines (II)*
- *Day and night (II, III)*
- *The Fermat points (III, IV)*
- *Geographical coordinates (III, IV)*

Hornsund Polish Polar Station in Spitsbergen

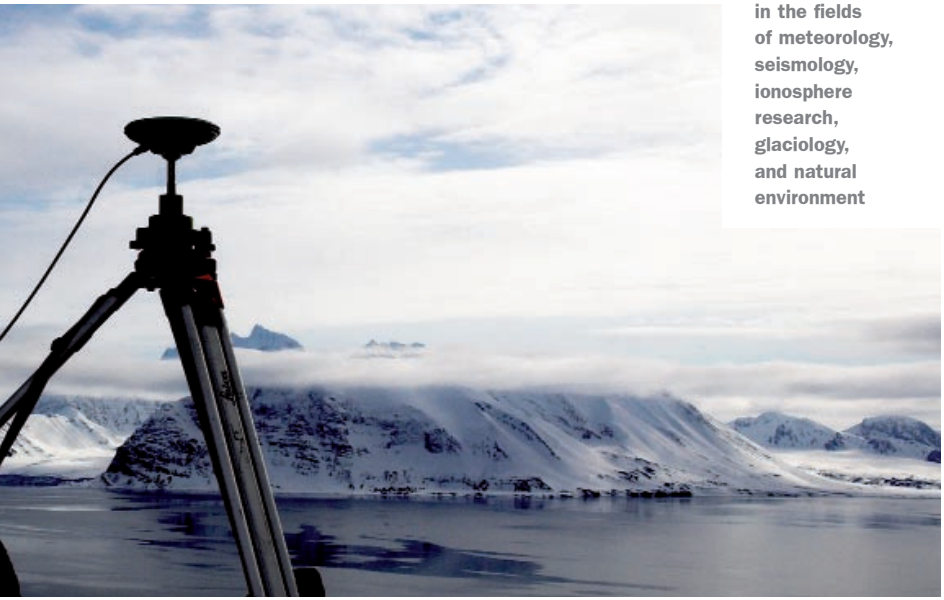
In 2007, the Institute of Geophysics, Polish Academy of Sciences celebrated the 50th anniversary of the Hornsund Polish Polar Station. The station is located in the Gulf of White Bear, the Hornsund fjord in Spitsbergen, the largest island of the Svalbard Archipelago. The Hornsund station is the northernmost research outpost of the Polish Academy of Sciences.

The Poland's accession to the 3rd International Geophysical Year and establishment of the research station in Spitsbergen was decided in 1956. In the same year, a reconnaissance expedition was made to locate the station and a year later Spitsbergen was reached by the "founding" expedition. Both expeditions were led by Stanisław Siedlecki. The station, on its 50th anniversary, was named after this famous polar explorer.

The founding expedition was the first one to spend winter there. Over subsequent years, research studies were run in summers only. In 1977, it was decided to initiate the inter-ministerial programme for comprehensive research studies of the



Arctic and Antarctic regions. One of the programme elements was to expand the polar station and re-establish all-year-round observations (since 1978). The subject-matter of the research and scientific studies conducted at the Hornsund Polish Polar Station in Spitsbergen was to examine and understand changes and interactions between and among the major abiotic components of the polar environment. The polar station in the region of Svalbard is one of the strategic Polish research infrastructures, which also monitors impacts and changes of inanimate nature onto marine and terrestrial ecosystems. It should be remembered that accelerated environmental changes in the Arctic have a significant impact on the climate and extreme phenomena within the mid-latitudes, including Poland.



At the Hornsund Polish Polar Station in Spitsbergen research studies are conducted in the fields of meteorology, seismology, ionosphere research, glaciology, and natural environment

The Polish Polar Station is the key component of the Polish Multidisciplinary Laboratory for Polar Research (PolarPOL) and observation networks in the area of Svalbard within the framework of the European Road Map of Research Infrastructures (Svalbard Integrated Arctic Earth Observing System).

Selected topics of on-line lessons:

- *Do you know how trappers of yesteryear lived? (stage I, II)*
- *Polar bear - the king of the Arctic (I, II)*
- *Spitsbergen animals - how did they adapt to live in the Arctic? (III, IV)*
- *"The Polish House at the Pole" - what do Poles do in the Arctic? (III, IV)*

INSTITUTE OF GEOLOGICAL SCIENCES, POLISH ACADEMY OF SCIENCES

ING PAN

Geological Museum in Cracow

The research centre in Cracow is a part of the Institute of Geophysics, Polish Academy of Sciences, established in 1956. It is engaged into studies

At the geological museum of the Institute of Geological Sciences, Polish Academy of Sciences in Cracow you can see abundant palaeontological, paleobotanical, mineralogical, and lithological collections

of rocks and minerals, their age, and origin, based on which the geological history of our Earth is reconstructed. For this purpose various methods including isotopic geochemistry, mineralogy, petrology, sedimentology, tectonics, stratigraphy, and hydrogeology are applied. The research centre in Cracow has its own museum. Within its resources it has got palaeontological, paleobotanical, mineralogical and lithological collections, made available to the public not only for scientific purposes but also to promote geological sciences.

Selected topics of on-line lessons:

- *Pretty and mysterious minerals (stage I, II)*
- *Where is a milk carton discarded? (I, II)*
- *Do moles predict the weather? (I, II)*
- *Evolution from the perspective of a palaeontologist (III)*
- *Ледники Арктики* *(lesson in Russian – III, IV)*

SPACE RESEARCH CENTRE, POLISH ACADEMY OF SCIENCES

Astrogeodynamic Observatory in Borówiec

The Astrogeodynamic Observatory in Borówiec is a part of the Space Research Centre, Polish Academy of Sciences. It is situated in the region of Wielkopolska, between Poznań and Kurnik. Initially, the key tasks performed by the observatory covered: studies on the Pole movements, specifying time corrections, and maintaining the coordinated international time standard UTC.

The Astrogeodynamic Observatory in Borówiec is involved, among others, in establishing the Polish atomic time-scale TA(PL) and laser measurements of the Earth's artificial satellites

Nowadays the observatory takes part in the establishment of the international time-scale UTC and the Polish atomic time-scale TA(PL). Other tasks include comparison of atomic clocks by means of the time transfer techniques and laser measurements of the Earth's artificial satellites.

Selected topics of on-line lessons:

- *What is life at a space station like? (stage I, II)*
- *Astrology from the perspective of an astronomer (III, IV)*
- *Physics of interstellar travels (IV)*
- *Why do stars jump and twinkle? (III, IV)*
- *ISS - the International Space Station (III, IV)*

INSTITUTE OF OCEANOLOGY, POLISH ACADEMY OF SCIENCES IN SOPOT

The origins of the Institute are related to activities conducted by prof. Stanisław Szymborski, who in the late 40s of the last century strived to establish a Polish institution dealing with basic research studies of the marine environment. In 1953, the Maritime Station started its operation at the Technical University in Gdańsk and after three years moved to the Department of Geophysics in Warsaw, where in 1971 it was transformed into the Department of Oceanology at the Institute of Geophysics, Polish Academy of Sciences. Since 1953, it has been in operation as an independent institution - the Institute of Oceanology, Polish Academy of Sciences in Sopot.

The Institute of Oceanology at the Polish Academy of Sciences in Sopot focuses on the study of phenomena and processes occurring in the marine environment

The mission of the Institute is to conduct research studies on the marine environment and deepen knowledge about phenomena and processes occurring within it. Its scientists' attention is focussed mainly on the Baltic Sea, however, some research studies are also conducted beyond it. On board of the "SY Oceania" research ship, cruises to the Barents Sea and Norwegian Sea are organised. Research studies related to biology and ecology of the Arctic are performed in Spitsbergen.

Selected topics of on-line lessons:

- Marine record-breakers (stage I and II)
- Physical states of water (II)
- Spring in the Arctic (II, III, IV)
- Electrical energy (III)
- Shore as a habitat (III, IV)
- Physics of football (III, IV)
- Are there any boundaries of knowledge? (III, IV)
- Sea breeze (III, IV)

Students of the Gdynia Maritime University are educated, among others, on board of the "Horyzont II" training and research vessel

GDYNIA MARITIME UNIVERSITY

"Horyzont II" vessel

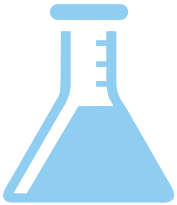
The Gdynia Maritime University is an academic public tertiary institution which educates highly-qualified staff for the maritime economy (in particular future merchant navy officers). It runs scientific research studies while being a significant national expert on safety in maritime transport.

Students are educated, among others, on board of the "Horyzont II" training and research vessel. It also actively takes part in the EDUSCIENCE project, thanks to which a lot of materials, including fascinating videos on marine expeditions are made. The "Horyzont II" is a unique ship. Its flag was raised in 2000 and since then it has been cruising the polar regions. Every year the "Horyzont II" carries participants of polar expeditions to Spitsbergen and other inaccessible regions of the Arctic - the kingdom of the polar bear.

Leader and partners

Institute of Geophysics, Polish Academy of Sciences Edukacja Pro Futuro American Systems Accelerated Learning Systems

The EDUSCIENCE project at its testing stage was directed to more than 1000 teachers and over 5000 school pupils. As this is a large undertaking, the project implementation by the Institute of Geophysics, Polish Academy of Sciences would not be possible without the cooperation of entities from beyond the world of science. Therefore, the Institute has invited partners for cooperation which are responsible for tasks which it would not be able to accomplish on its own. Edukacja Pro Futuro is accountable for education (cooperation with the "educational world", with schools as well as for promotion and dissemination). In addition, jointly with the transnational partner it assists in working out the best methodical solutions. American Systems in the project is responsible for technology, preparation of the platform and the portal in IT terms and provision of technical support. It is also accountable for all internal and external evaluation of the project. Then, Accelerated Learning Systems, the transnational partner, is responsible for the development of modern teaching methodologies and assists in the application of good educational practices (which proved to be successful in the UK) in Poland. On its behalf the project is conducted by Colin Rose, the world-renowned expert, who shows methods of efficient and effective learning which at the same time are attractive to school pupils. He provides them with hints on how to repeat school material to make them learn faster, more efficiently and with greater enjoyment.



Institute of Geophysics
Polish Academy of Sciences

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The Institute of Geophysics is a research unit within the Polish Academy of Sciences which deals with the study of various physical processes occurring on the Earth and below its surface. It runs research studies in the scope of seismology and physics of the Earth centre, geomagnetism, atmospheric physics, hydrology and polar areas.

The core statutory tasks of the Institute are as follows: conducting scientific studies, running development works as well as monitoring and educational activities together with dissemination of their results and their incorporation into the economy. Primarily the Institute aims to support people starting their scientific career as well as educate and train

scientific staff and experts with specific skills in the range of geophysical sciences, and also in the scope of anticipation of hazards, risk assessment and crisis management. Moreover, the Institute runs extensive cooperation with high schools, research centres and scientific societies, in particular in the scope of scientific research and development works. It also ensures continuous development of international scientific cooperation through establishment of scientific consortia and conduct of joint scientific research projects with foreign partners.

The Institute is also entitled to confer doctoral and post-doctoral degrees in the field of Earth sciences, in the specialisation of geophysics. At the Institute 4-year doctoral studies are led which serve the education of highly qualified personnel for the national economy, future researchers of the Institute and other research institutions in the country and abroad.

The Institute also performs publishing activities. Since 1953 it has published "Acta Geophysica", a bimonthly scientific journal which is highly valued all over the world and - in cooperation with the Springer publishing house - "GeoPlanet: Earth and Planetary Sciences" monographic series. The Institute of Geophysics cooperates with research centres in Poland and all over the world, participates in international research programs. Registration and measurements of global geophysical phenomena are relevant components of its operation. These measurements are made at the Central Geophysical Observatory in Belsk, the following seismological observatories: Górka Klasztorna, Kalwaria Pacławska, Książ, Niedzica, Ojców, Racibórz and Suwałki, the Atmospheric Physics Observatory in Świder, the Geomagnetism Observatory in Hel and the Hornsund Polish Polar Station in Spitsbergen. These observatories are among the leaders in the world. In addition, thanks to its mobile seismic stations, the Institute runs accurate seismic monitoring of so-

The EDUSCIENCE project office is located at the seat of the Institute of Geophysics

me selected regions of Poland. The Institute designs and makes unique measuring equipment used in seismology, magnetism and atmospheric physics.

Its comprehensive research studies on the Earth by means of various methods are possible thanks to the close cooperation with other institutes of the Polish Academy of Sciences, particularly thanks to the establishment of the Earth and Planets Research Centre (GeoPlanet). It is composed of five institutes of the Polish Academy of Sciences: the Institute of Geophysics, the Space Research Centre, the Institute of Geological Sciences, the Institute of Oceanology and the the Nicolaus Copernicus Astronomical Centre.

More information to be found here:
www.igf.edu.pl

International research projects

The Institute of Geophysics, Polish Academy of Sciences is involved in numerous research projects of international significance. Here are the most important ones:

SIOS - Svalbard Integrated Arctic Earth Observing System

The SIOS project is aimed to develop technical and organisational capabilities of running research studies on natural phenomena occurring in the Arctic. It includes all research areas ranging

First, what I feel thinking about the EDUSCIENCE project is a sense of pride that we have been able to prepare and run this fantastic educational project. Its beginning was not easy because we, as the institution, had no extensive experience on the implementation of such projects. And the project itself looked impressive in numbers - 250 schools actively participating in it, more than 5000 school pupils, over 1000 teachers, 17 science festivals, 89 EDUSCIENCE picnics, 250 educational excursions and over 43 000 hours of classes run with the use of innovative tools developed in the course of the project implementation. The additional difficulty, but also our organisational solution which yielded the synergy effect, was that the project was implemented in partnership with three non-public entities (including one foreign entity) which perfectly complemented us with their competences. In the course of the project implementation we observed - with great pleasure - favourable reviews on the EDUSCIENCE project which appeared in the media but also at the same time we were aware of the project team efforts and commitment which were required to achieve these effects. For this commitment, creativity and extensive efforts I would like to thank the entire team, including our partners.

Tadeusz Latała
Deputy Director for General Issues, Institute of Geophysics, Polish Academy of Sciences

The idea of the EDUSCIENCE project emerged out of a need to change a scientist's image who is often perceived by the public as a weird person with "a head in the clouds" and speaking a difficult, incomprehensible language. This stereotype can be changed thanks to personal contacts between school pupils and scientists. It can also be changed at teachers and parents of these pupils who come back from school being fascinated by new people and forms of conducting classes by scientists. People who are not engaged in education on an ongoing basis.
Thanks to the project modern laboratories have become available not only for elites but also may be visited by school pupils - maybe at the beginning of their scientific career. Experience in the project is also important for research staff. Contacts with young people, often inquiring, with absorbent minds have become an opportunity to get challenged in new life circumstances and inspiration to search for non-standard paths of solutions and inquiries in science.

Prof. Piotr Głowacki Ph.D
Head of the Department
of Polar and Marine Research,
Originator of the EDUSCIENCE project

The mission of the Institute of Geophysics, Polish Academy of Sciences refers to:

- examination of geophysical processes to understand mechanisms which control the Earth and its systems together with risk management,
- promotion of social and economic development,
- development and maintenance of strategic research infrastructure,
- conduct of geophysical monitoring,
- training of future leaders of the scientific community.

from space through atmosphere, hydrosphere, biosphere up to lithosphere. Poland - being represented in the SIOS project by the Institute of Geophysics and the Institute of Oceanology, Polish Academy of Sciences - is one of the 14 countries participating in the project. The Institute of Geophysics was entrusted with a role of coordinator of one of the major project packages. The participation of our country in the project strengthens our share in the global research and monitoring network of land and marine polar zones which is the key to understand the dynamics of environmental change on a global scale. Let's recall that Poland's high activity in the Arctic is connected with its maintenance of the Polar Station in Spitsbergen which is hosted by the Institute of Geophysics.

The results of basic research studies gathered under the SIOS project will be used for application needs, among others, in the scope of offshore resources of raw materials, utilisation of marine biological resources opening up new opportunities for shipping and tourist activities. In addition, the research studies conducted within

the framework of the project and its logistic-exploratory activities have an impact on the development of other fields of science such as medicine, new technologies and materials as well as humanities and social sciences. Not everyone is aware of the fact that Poland's scientific presence in the Arctic has economic and political dimensions.

Our cooperation with the partners beyond the world of science is very valuable, this is a new experience for us. We have been learning how other institutions operate and benefit from their extensive experience in the scope of education and new technologies. In our view the partners are essential in the project. They fulfil their roles in their specifically-defined areas but very often we jointly work out solutions for the entire project. The fact that we come from "different worlds" is an additional value of our cooperation because often - when acting in one area - we do not notice all aspects of a given issue. Just some comments "from the outside" may make us realise that this issue is likely to be more complex than we originally anticipated. Therefore, regular meetings with our partners help to jointly work out new ideas concerning e.g. the e-learning platform, manners of dissemination or cooperation with schools. This approach beyond the world of science is a very relevant value added to this cooperation.

dr Agata Goździk
Director of the EDUSCIENCE project

EPOS - European Plate Observing System

The EPOS project is the European largest infrastructural project in the solid Earth sciences. Its objective is to integrate disperced research infrastructure. The Institute of Geophysics is the leader of the working group wchich is concentrated on anthropogenic seismicity issues which accompany, among others, exploitation of raw material resources as well as issues related to their exploration.

In 2013 the Institute together with the "Cyfronet" Academic Computer Centre, the Central Mining Institute and Kompania Węglowa S.A. started to implement the project entitled: "Digital research space of induced seismicity for EPOS" (IS-EPOS). The project covers 2013–2015 and is financed from the "Innovative Economy" Operational Programme funds at the amount of about 3.5 million EUR. Under the IS-EPOS project the following units were established: the Research Infrastructure Centre for Induced Seismicity (CIBIS) and Anthropogenic Hazard Thematic Core Services (TCS).

The aim of the CIBIS is to gather available data and information being useful for research works on induced seismicity and making it available to all concerned parties. The CIBIS after its establishment led to integration of the Polish research infrastructure in this area and deepening the science-industry partnership.

The TCS will be made in the form of a web-based platform at which its users will be able to perform research works with the use of high-power computing facilities. The platform will be open to national and international research groups; it will also fulfil educational functions for universities and other educational centres. Its relevant users will include industrialists as infrastructure providers and recipients of scientific research results. Thanks to the science-industry interaction, science will have access to data on induced seismicity collected at industrial centres and industry - this is access to new but fully-tested solutions. Successive groups of users will include public authorities, crisis intervention centres, insurers and investors as well as inhabitants of areas where induced seismicity is observed. One of the TCS objectives is to increase public understanding and accurate assessment of threats resulting from anthropogenic seismicity while providing information and expertise in this field.

CHIHE - Climate change impact on hydrological extremes

The aim of the CHIHE project is to estimate the influence of climate change on extreme river flows (floods and droughts) in selected twinned catchments in Poland and Norway and evaluate the impact on the frequency of occurrence hydrological extremes.

The projected increase in global temperatures is thought to influence hydrological regimes by a reduction of snow storage, causing larger winter precipitation as rainfall (instead of snow) and a rise in potential evapotranspiration. These changes impact the frequency and magnitude of floods and droughts.

The scientific novelty of the project lies in the development and adaptation of new statistics approaches to the analysis of changes in quantiles of hydrological extremes on a catchment scale for past events and future climate scenarios. The project will address recommendations for an adaptation strategy for managing the impact of climate change on hydrological extremes in the context of the European Flood Directive.

Education and dissemination of science

Apart from its participation in numerous scientific projects, the Institute of Geophysics, Polish Academy of Sciences co-operates with the Polar Studies Centre and the Earth and Planets Research Centre. It also performs activities which disseminate science among school pupils and students at every educational stage.

KNOW - Polar Studies Centre

The Polar Studies Centre organises elite, interdisciplinary doctoral studies in the field of Earth sciences on polar areas. These studies are run by three units: the Department of Earth sciences at the University of Silesia (the leading unit), the Institute of Oceanology and the Institute of Geophysics, Polish Academy of Sciences.

The centre was the winner of the 2nd edition of the contest organised by the Ministry of Science

and Higher Education for the recognition of the status of the National Scientific Leading Centre (KNOW).

Within the framework of these studies students take part in shared lectures, seminars and workshops at the Faculty of Earth sciences at the University of Silesia (Sosnowiec), at the Institute of Oceanology, Polish Academy of Sciences (Sopot) and the Institute of Geophysics, Polish Academy of Sciences (Warsaw) as well as they have an access to modern laboratories and research equipment. Field activities and scientific expeditions to the Arctic and Antarctic are also planned.

Post-graduate students get prepared to take the leading role in the field of research, logistics, management and politics, development of technologies and education together with getting familiar with the polar regions and their effects onto the mid-latitudes.

The studies are run in cooperation with several foreign scientific centres dealing with research on the polar areas, which provides extra unique opportunities for making use of knowledge and experience of scientists from various parts of the world. The centre also offers unique specialised master's studies in the range of "Exploration of polar and mountainous regions".

GeoPlanet - Earth and Planets Research Centre

The GeoPlanet Centre supports and integrates research activities of its associated institutions which, apart from the Institute of Geophysics, include: the Space Research Centre, the Institute of Geological Sciences, the Institute of Oceanology and the the Nicolaus Copernicus Astronomical Centre. The major tasks of the GeoPlanet covers acquiring and coordinating research projects in the area of sciences concerning Earth and other planets. At the Centre, workshops for scientific staff are organised in the range of improving their own competences.

More information to be found here: **www.polarknow.us.edu.pl**

The Centre also undertakes various forms of dissemination of science in the fields of geology, geophysics, oceanology and planetary science, among others, taking part in scientific picnics organised by the Polish Radio and the Copernicus Science Centre, supporting the Sopot Youth Forum, organising scientific conferences, seminars and lectures on current research and science issues.

One of its important tasks is to disseminate information on the associated institutes and their activities so that they reach the largest possible audience.

Geophysics for school pupils and students

One of the significant elements of the Institute operation is to promote Earth sciences among school pupils and students. For many years the Institute has been active in this field. Earth sciences, though difficult, are extremely interesting and exciting and this is an inspiration to undertake various types of educational activities. The Institute takes part in science festivals and the Science Picnics.

For years it has run classes for schools under the "Geophysics at school" project. They include workshops conducted by scientists and doctoral students of the Institute as well as educational activities at observatories in the course of which school pupils are given a chance to meet scientists and get to know measuring instruments and their application.

The observatories hosted by the Institute allow to explore the natural sciences in a unique and exciting manner. No one else can offer lessons in the observatory at the castle in Książ, self-triggered mini earthquakes or direct broadcasts from the Hornsund Polish Polar Station for school pupils. And all of this is available for Polish schools under the EDUSCIENCE project implemented since 2011 by the Institute.

Scientix National Contact Point

In 2015 the Institute of Geophysics became Scientix National Contact Point. Scientix, the community for science education in Europe, promotes and supports Europe-wide collaboration among

The leader with its partners demonstrated the project at teachers' conferences

STEM (science, technology, engineering and mathematics) teachers, education researchers, policymakers and other STEM education professionals. It offers resources for innovative and engaging teaching, and best practices to attract pupils to science and related professions.

Scientix is financed under the European Union's Seventh Framework Programme for Research and Development and is run by European Schoolnet – a network of 31 European Ministries of Education. Thanks to the experience from EDUSCIENCE project the Institute got the invitation to be the Polish National Contact Point. It demanded a nomination by the Polish Ministry of Education and was a great award for the Institute.

Edukacja PRO FUTURO

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In EDUKACJA PRO FUTURO we promote and practically implement effective educational methods in modern schools and educational units. At schools we are willing to apply the achievements of science and wish to share our experiences with others. In the suggested methodological approach - in conjunction with Colin Rose, our transnational partner - we propagate knowledge on the human brain, we educate ”multi-intelligently” and strive to ”open young people's heads” while making use of the

The innovative EDUSCIENCE project implemented since 2011 jointly with the Institute of Geophysics, Polish Academy of Sciences, American Systems and Accelerated Learning Systems inspires us to act in favour of education. The development of the project methodology, organisation of meetings and conferences for the world of education together with the dissemination of innovative approaches towards it as well as direct contacts with groups of more than 1200 teachers and 5000 school pupils perfectly reflect the character of our openness to sharing knowledge, and at the same time show the changing nature of today's schools.

Leszek Lotkowski
Coordinator of the project on behalf of Pro Futuro

Learning through movement and fun is the distinguishing hallmark of Pro Futuro

achievements of up-to-date technologies. Lessons conducted and prepared by teachers with scientists, on-line broadcasts on experiments run by school pupils have proven that learning at school in the 21st century can be both interesting and inspiring. Thus emerged an idea to combine science, education, methodology and technology in the EDUSCIENCE project which we jointly wish to demonstrate in the Polish education sector.

Modern school

Edukacja Pro Futuro runs schools and non-public institutions (with public school rights) as well as propagates and implements numerous modern educational projects. Currently we have been the managing body for:

- Pro Futuro Non-public Primary School no. 61,
- Pro Futuro Non-public Junior Secondary School no. 54 with bilingual units,

- Pro Futuro Psychological and Pedagogical Guidance Unit in Warsaw,
- Pro Futuro Primary School in Łomianki.

Pro Futuro schools are designed to be knowledge-centres and information bases which operate throughout the year. Our mission is to make a school be a place projected to educate school pupils and support their individual development. 240 Pro Futuro school pupils at three educational and pre-school stages are educated by 60-person specialised teaching staff. In 2013 we introduced the "The Leader in Me" Programme by Stephen R. Covey at schools. This programme is aimed to invite every school pupil to take part in the advantage of being a leader in his/her life. It shapes independence, self-awareness, motivation and leads to success.

Pro Futuro with its education activities goes beyond school walls. In 2008 we co-organised the Educational Siege of Malbork - the nationwide conferences for teachers, schoolmasters, governing bodies, representatives of education authorities in the field of effective learning methods. In subsequent years we successfully organised the "Poland's Championship in memorising" competition and co-organised the "Let's take care of the environment, it's that simple" national ecological contest.

In 2009 under the "Multimedia school" project we changed the image of traditional schools bringing interactive boards to all our schools. We disseminate our activities as examples of good practice and we are identifiable in the educational market. In 2010 we run on-line lessons from research units, among others, from the Seismological Observatory in Książ.

We also organise the "We discover talents of the future" prestigious literary competition for children and young people. We work closely with high schools which results in the organisation (jointly with the Academy of Special Education) of postgraduate studies for early education teachers and the participation of our staff as trainers. We are also pleased - as partners - to participate in the "Good practices - good teachers - effective school" EU project.

In addition as partners we cooperate with the Institute of Modern Education in the "Fundamental education" project for preschoolers being co-financed from the European funds.

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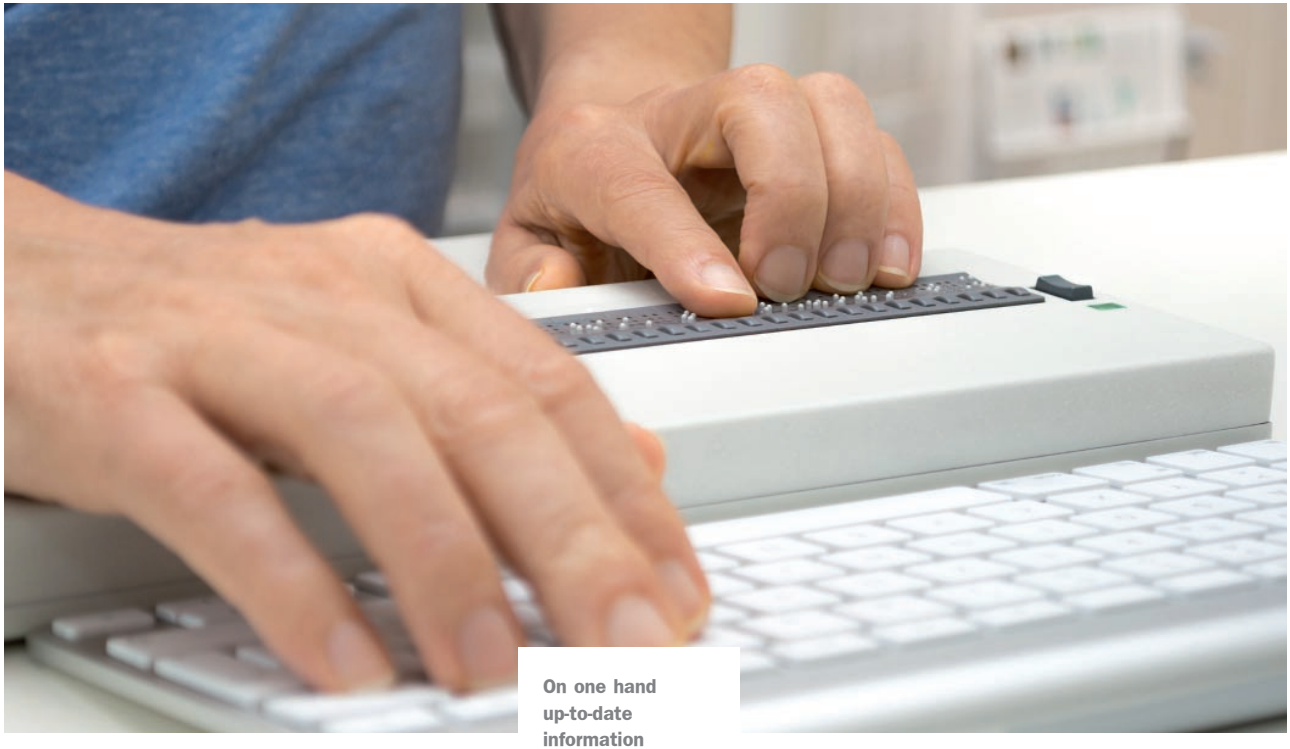
AMERICAN SYSTEMS has developed innovative, proprietary software to manage educational units, create interactive educational materials and conduct interdisciplinary lessons. We imple-



On one hand up-to-date information technologies, on the other - evaluation studies - these are the tasks of American Systems in the EDUSCIENCE project

mented our solutions in almost 1200 schools and for more than 119 000 users. In our team we engage programmers, graphic artists, computer methodologists, psychologists, vocational counsellors. Therefore, our perspective is comprehensive and includes various points of view. One of our latest achievements refers to creating the concept and starting works on an automatic tool for the diagnosis of occupational predispositions of junior secondary schools based on the theory of M.P. Seligman. This is an innovative tool on the European scale.

In the framework of the EDUSCIENCE project, thanks to the close cooperation with the leader - the Institute of Geophysics, Polish Academy of Sciences and the partner - Edukacja Pro Futuro, we have created a tool which allows, among others, to intuitively develop lessons with the application of multimedia resources, to make use of interactive educational games or to run video conferences. While creating the tool we wished not only to streamline teachers' work and increase efficiency of training, but also make the educational process more attractive and inspiring. We believe that we have succeeded!

accelerated learning

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ACCELERATED LEARNING SYSTEMS is a company which aims to bring closer the philosophy and practical implementation of solutions supporting effective learning. The company contributed to the development of the UK-wide project the motto of which is "Campaign for learning". The campaign highlighted the effectiveness of efficient learning as well as the importance of establishing deeper relations between and among high schools, teachers and parents.

The company was founded and presided by Colin Rose - a British educational researcher, the world-renowned expert in the field of modern methods of effective learning and the UK government advisor on education. In his work he considers it important to make use of multiple intelligences and to adapt educational methods to school pupils' needs. All of these can be achieved thanks to the specialised knowledge on the operation of our brain.

Colin Rose is the author of numerous books and publications, including: "Learn faster as suited for the 21st century", "the Atlas of effective learning", "Fundamental plays". He is also the author of the "Master it Faster" program and his proprietary method (Szybkiangielski.pl) used to learn foreign languages (the Colin Rose method). He is also the co-author of the "Fundamental education" educational program, the author of the "Champs" program and the "Academy of Digital School" program which is especially projected for teachers and school pupils and practically makes use of modern technologies. He participated in the creation of one of the most recognisable educational portals for parents (Edumaluch.pl). In the EDUSCIENCE project he is the co-author of methodological guides directed to teachers, parents and school pupils at four educational stages. He is also a frequent speaker at conferences and science festivals.

I am proud to be a part of such a really serious and ambitious program as the EDUSCIENCE project. The EDUSCIENCE project is aimed to provide education in a more motivating and efficient manner. It is not only about providing teachers with attractive materials and educational tools which will make school pupils become more active and interested, but also about helping them in becoming better learners who think logically and draw accurate conclusions.

Colin Rose

Useful addresses

www.eduscience.pl

Open-access popular science website portal of the EDUSCIENCE project containing natural curiosities from the world of science.

www.platforma.eduscience.pl

User-access database of resources and educational tools within the scope of mathematical and natural subjects. The platform is available for schools, teachers and students. You can use it free of charge.

www.facebook.com/pl.eduscience

The presence of the EDUSCIENCE project on Facebook makes it easy for direct contact with school pupils wishing to develop their scientific passions.

www.men.gov.pl

The website of the Ministry of National Education. The EDUSCIENCE project has been covered under the honorary patronage of Minister of National Education.

www.efs.men.gov.pl

The Ministry of National Education is simultaneously the Intermediary Body for the Priority 3 within the 'Human Capital' Operational Programme. At the Ministry website there are advertisements and notices on competitions and contests, guidelines and all the information on the EU funds needed by the education sector.

www.ore.edu.pl

The Education Development Centre (ORE) is run by the Ministry of National Education as the national centre for teachers' development. The Centre staff undertake actions aimed at improving the quality of education at schools and at supporting educational units in the implementation of the national education policies.

The Education Development Centre as the 2-level Intermediate Institution exercises supervision over the implementation of contest projects on education co-financed by the European Social Fund under Priority 3 within the "Human Capital" Operational Programme. The Centre signed contracts for the implementation of several hundred projects with their total value exceeding 1.6 billion PLN. The resulting products within the framework of these projects can be easily reached by search engines available on www.zasobyip2.ore.edu.pl

www.igf.edu.pl

The Institute of Geophysics, Polish Academy of Sciences - the project leader

www.profuturo.pl

Edukacja Pro Futuro - the partner responsible for contacts with schools and promotion of the project

www.american-systems.pl

American Systems - the technological partner of the project, also responsible for the project evaluation studies

www.acceleratedlearning.com

Accelerated Learning Systems - the transnational partner responsible for the implementation of solutions which support effective learning

MOVING SCHOOLS CLOSER TO THE WORLD OF SCIENCE

Innovative solutions for education from the EDUSCIENCE project

The final report on the project entitled: "Increasing school pupils' competence in the field of mathematic, natural and technical sciences with the application of innovative methods and technologies - EDUSCIENCE"

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AMERICAN SYSTEMS
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Edukacja PRO FUTURO

accelerated learning