



The Second Scientix Conference

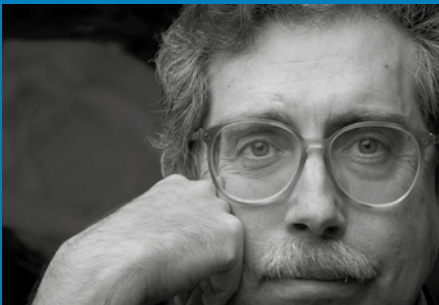
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THE RESULTS





IN MEMORIAM:
Professor Mariano Gago



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EXECUTIVE SUMMARY

Scientix is a key component of the European strategy to put STEM subjects on the centre stage of school curricula across the continent and beyond. It has also been an important factor in encouraging educators to adopt inquiry-based learning (IBL), and other innovative approaches to the daily teaching of science and mathematics in the classroom.

The 2nd Scientix conference built on the success of its predecessor by offering to almost 600 participants

70 talks, 14 workshops, seven roundtables and much more.

This results give an overview of the activities, providing details on every workshop, talk and roundtable. It also has information on the important keynote speeches that took place, competitions that were set, and even data on where participants came from and how popular the event was on Twitter.

We hope you will find it useful.



RATIONALE FOR THE 2ND SCIENTIX CONFERENCE

The 2nd Scientix Conference took place from 24-26 October 2014 in Brussels. With almost 600 teachers, project managers, policy-makers and science education researchers attending, it was one of the major networking events in STEM education in Europe.

Having these very different groups together at one science event was not only unusual, but also helped ensure the excellent dissemination and training value of the conference.

It provided a unique opportunity for project teams to showcase different tools, resources, methodologies and activities to teachers, and allow them to see a complete picture of STEM in Europe. The conference was also the ideal forum to align policies and practices between Scientix National Contact Points at national level with the Scientix community of science teachers in Europe.

Additionally, the event was a great occasion to promote the science portal and gain feedback on the many online services it provides.

Finally – and perhaps most importantly – the conference was the ideal forum for networking among the science education communities. All STEM stakeholders –

teachers, science museums, science educators, curriculum developers, inspectors, and decision makers at local, regional and national levels – were able to meet, discuss, exchange and progress on all the issues facing STEM education in Europe.

The programme itself featured 70 talks, 14 workshops, seven roundtables and 25 exhibition stands.

Parallel sessions covered a wide range of STEM topics: everything from curriculum innovations to school projects, from energy, engineering and nanotechnology to teacher training, from bio dances to listening and empowering children. Coding in education, out-of-school learning, mobile technology and games, plus competence learning and motivation were all covered, too.

The 2nd Scientix conference also saw the launch of the first Scientix publication, the Scientix video and the Scientix resource awards.





2ND SCIENTIX CONFERENCE IN DETAIL

This section is an in-depth report of all the events that took place at the 2nd Scientix Conference, including speeches, workshops, talks and roundtables.

KEYNOTE SPEECHES AND SPEAKERS

Professor Mariano Gago



Prof. Gago dedicated his keynote speech to the memory of Joan Saloman, who had such an important impact on STEM education in Europe for many years.

A former Minister of Science, Technology, Information Society and Higher Education in Portugal, he addressed a crucial question: how Ministries of Education should take up the STEM challenge.

As a physicist who has been involved with many studies on STEM education, he had a number of recommendations.

Policy makers should be clear about the objectives of a good science education. For Prof. Gago, it should address scientific and technological aspects of society at large.

STEM needs to be valued and promoted in culture he said, in order for long-term success in both research, and science and technology policy, generally. Promotion of science and technology must also mean a commitment to funding its education – both formal and informal.

Working in STEM is not just about making money, Prof. Gago was at pains to stress. In many countries, he asserted, the profit motive for choosing a STEM career was over-emphasised and this was actually driving young people away from science and technology. Policy makers should, instead, emphasise the human and ethical values of science.

Professor Mariano Gago profile

Professor José Mariano Gago is an experimental high energy physicist and Professor of Physics at the Instituto Superior Técnico (IST) in Lisbon, Portugal.

He has been closely involved in the activities of the European Organisation for Nuclear Physics (CERN) for many years, both as a researcher and as a member of the CERN Council.

As Minister of Science and Technology from 1995 to 2002, Prof. Gago was

responsible for science and technology and for information society policies. He launched the *Ciência Viva* movement to promote science and technology in society.

During the Portuguese European Union presidency of 2000, he worked with the European Commission to prepare the Lisbon Strategy for the European Research Area and for the Information Society in Europe.

Formal STEM education in schools is key to lifelong learning and to social adaptability. This adaptability is deeply rooted at school age, so it is vital that schools instil it.

But school-based education is not enough. Children also need exposure to the functioning day-to-day world of STEM – and so collaboration between education and industry is essential for the socialisation of science and technology.

Governments can help by promoting values in society overall and in schools, in order to reduce the level of dropout and exclusion. To implement an effective STEM policy in schools, Ministries of Education need to empower their teachers. As the frontline in science and technology education, their value to society needs to be recognised and championed by those in power.

Finally, in order to ensure their commitment to STEM is carried through to meaningful policy decisions, politicians need to be held to account, concluded Prof. Gago. He then recommended the audience read the reports from the European Commission called 'Science Education in Europe' and, from 2004, 'Europe needs more scientists', a report on the lack of human resources in science based professions.

During the question and answer session, Prof. Gago talked about the importance of teachers in promoting STEM and highlighted the fact that in some parts of the world science and technology educators are under attack.

His final observation on the subject was that it is a mandate of society, widely adopted around the world, that STEM education should be for all, as well as a culture of critical thinking, quality insurance and the essence of democracy.

Ewald Breunesse



"I've been a teacher, and I love it!"

announced Ewald Breunesse, Manager Energy Transitions, Shell Nederland, at the start of his keynote.

During the speech, he described how industry can contribute to make STEM education more attractive and he gave a number of specific examples of how his company is doing just that.

Ewald Breunesse profile

Mr. Ewald Breunesse is Manager Energy Transitions, Shell Nederland and Member of the Board of Directors at Shell Nederland Pensioenfonds Stichting.

Born in 1955, he has a PhD in economics from the Free University Amsterdam. He joined Shell in 1983, where he has held positions in market research, scenario planning, pension funds, electricity and, currently, energy transitions.

These included free courses for teachers, where participants gain valuable knowledge of the inner-workings of international corporations, as well as what they require from their future employees.

Another initiative encourages the creation of educational activities, by inviting teachers to produce industry-specific teaching material with direct feedback from industry.

In addition, the “Teach First” programme lasts a year and is aimed at persuading more people to become teachers by actively involving them in a team, tasked with the management of a company project.

Shell also provides presentations and relevant materials for the “World teachers’ day”, with the goal of presenting working for the energy sector as a viable career option.

At the end of his speech, Mr. Breunese extended an open invitation to the participants for the “Shell Eco-marathon 2015”, held in Rotterdam. Teams from schools all over Europe will compete to build the most fuel-efficient car possible. He noted that these types of cooperation showcase what can be done when school and industry work together towards achieving a worthwhile goal.

He concluded that teachers still have a big influence on students’ career choices, remarking: *“At the end of the day, it is all about you and your students”*.

Amber S. Gell



As Spacecraft System Engineer at Lockheed Martin and NASA, Amber S. Gell is a genuine rocket scientist. In her keynote, she spoke about the importance

of space technology and exploration, engineers and of STEM teachers in their education.

She used the ongoing Orion space capsule project, in which she continues to play a key part, as an example of how engineers, in her words: “turn dreams into reality”.

Ms. Gell made the point that her job involves working with the best and the brightest individuals from all over the world. She expressed her admiration for the teachers that had helped her and her colleagues to excel in their chosen STEM fields through their dedication and commitment to achieving and designing new ways of teaching, saying: *“You, the teachers, have a special appreciation and approach, that is the key to achieving great things”*.

Moving onto girls and women in STEM, Ms. Gell used her own experiences to illustrate the issues involved. In her class, the vast majority of students were male and, out of the 16 girls that started, just nine tried to become engineers and just one, herself, succeeded.

This was clearly a situation that needed to be rectified, but Ms. Gell was also concerned at the lack of young people choosing STEM careers, regardless of gender. She felt that industry was not investing enough in trying to make these fields appealing to young people.

Showing how exciting these careers can be is extremely important, as well as demonstrating how they have real-world benefits for society. In closing, Ms. Gell urged teachers to: *“Show them how engineers help people, and what real benefits engineering has in society”*.

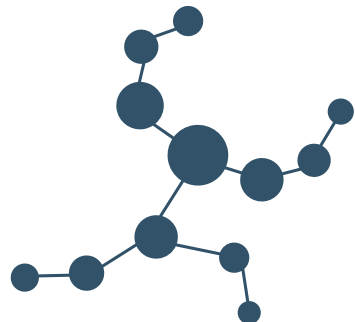
Amber S. Gell Profile

Amber S. Gell currently works for Lockheed Martin in Houston, Texas. She has always been extremely interested in space and exploration, especially human spaceflight, which is her ultimate goal.

She is currently part of the team designing and building the Orion Spacecraft, the Multipurpose Crew Vehicle (MPCV) which is NASA's new spacecraft for deep space exploration. Her activities also include numerous education outreach efforts, microgravity research and lifelong learning.

Ms. Gell studied at Embry-Riddle Aeronautical University in Daytona Beach, Florida, where she received a Bachelor of Science degree in Aerospace Engineering and a second Bachelor of Science degree in Aerospace Studies

She also received a Master of Science degree in Human Performance, a Master of Engineering degree in Space Systems Engineering, a Master of Business Administration (MBA) degree, specialising in International Business and a Master of Science degree in Finance.



WORKSHOPS

14 workshops took place during the conference. Enthusiastic teachers, researchers and project managers shared a variety of tools, topics, experiments, project and initiatives, involving the participants in hands-on activities.

The workshops were incredibly diverse in scope. Some participants were given the chance to discover a 3D augmented reality software “Linking the real world with the virtual world“. In another workshop, they were asked to create a working windmill, in order to understand the link between languages and science. In yet another, they learned how to use online labs with visually impaired students. Some also learned how to use Zondle, a free online tool supporting game-based learning.

Two workshops dealt with simulations. In one, the audience was invited to

build hypotheses about the Ice-Albedo-Interdependence and how polar ice may influence ocean streams. In the second, teachers were asked to measure the mass of an astronaut in zero gravity and learned how to implement that in class.

Find here detailed information about each workshop.

Use of Augmented Reality in education

Augmented Reality (AR) allows new and innovative ways to represent information. It gives us the possibility not only of transforming a 2D world into a 3D representation, but also of enriching plain pictures with more information like videos, 3D models or additional graphics. This exciting development is in its infancy – and currently beyond the scope and budget of



most schoolrooms. But now, say workshop conveners Daniel Aguirre Molina and Ascensión Robles Melgarejo, the time has come for schools to consider what AR has to offer – and to understand its potential. As well as looking at purpose-built AR devices in this workshop, they also demonstrated that the advances in processing power, as well as portability and camera technology, make every tablet and smart phone a potential portal into a new realm of possibilities.

The technological focus was on Layar (<https://www.layar.com/>), a pay to use, mobile software that integrates 2D pictures into a 3D augmented reality, and Aurasma (<http://www.aurasma.com/>), software that is free, but has the disadvantage of being trickier to use than Layar. Mr. Molina and Ms. Robles Melgarejo showed how the software could be used in the classroom

to, in their words: *“Link the real world with the virtual world”*.

As an example, AR can bring the shapes and formulae of geometry to life by converting 2D images to 3D. In physics experiments, students can observe first-hand the workings of the different forces on the natural world in biology, where complex cross sections of plants and animals can be seen in amazing detail. In geography classes, data can be overlaid in a complex, interactive way, over normal 2D maps.

More advanced AR devices such as Oculus Rift and Google Glass can go even further, by enriching any everyday experience with information and explanations – including those related to STEM education.

In closing, the workshop leaders made the point that, although there are substantial



barriers to AR in the classroom, it could be the biggest revolution in education since the widespread introduction of ICT – and now is the time to prepare.

Promoting language and STEM skills in primary school through theatre

Teaching language skills and STEM knowledge through theatre performances was the novel subject of this workshop from Petra Breuer-Kuppers and Mario Spies. The performances are biographical portrayals of nine contemporary scientists and engineers. Each life, with often amusing details, is performed to primary school children. The performances show how the individual came into the profession, describe their professional lives and the fruits of their practical scientific achievements.

“Language and science are very close to each other,” explained the presenters. By creating the correct context, these theatrical performances allow scientific ideas and vocabulary to be better understood by younger students.

Their workshop gave the theory behind the initiative, then a single performance to illustrate the practice. Part of this was a practical exercise in creating a working paper windmill. Mr. Spies and Ms. Breuer-Kuppers underlined that the importance of the exercise was not to build the best windmill, but to see the language that develops as a result of the collaboration of building it.



Exploring online labs with visually impaired students

Astronomy is one of the more visual fields in STEM – so how do you make it accessible to the visually impaired? In their fascinating workshop, Lina Canas and Rosa Doran demonstrated a fairly straightforward technique to bring the stars closer to this particular group of students, which also promotes activities such as collaborative working.

Rosa Doran, from Galileo Teachers, kicked off the session by walking the audience through some of the online portals for astronomy in schools – such as the Go-Lab tools (www.golabz.eu) and the Inspiring Science portal (<http://www.inspiring-science-education.net/>).

Then Fraser Lewis, the UK coordinator of the Go-Lab project, presented the Faulkes Robotic Telescope and demonstrated how it can be used for education.

The online lab Faulkes Telescope offers a database of astronomical pictures, as well as the opportunity for students to remotely operate the telescope and to take their own pictures of the cosmos.

For normally-sighted students this has obvious appeal. Next, Lina Canas, the NUCLIO project manager, explained how

to extend the experience to the visually impaired, using a type of photographic paper whose inked areas swell when heated – and she exhibited some stunning examples of the practical result. As well as helping to enthuse and involve this group of learners in an area of STEM that would normally be challenging for them to access, this initiative helps promote more general skills, such as collaboration.

Zondle – ICT game-based learning

Zondle is a platform focused on delivering a game-based learning (GBL) environment. The platform can be accessed on PCs, laptops, iPad and Android devices. It has also been designed for use on interactive whiteboards or with computer projectors and screens.

In this workshop, Bosiljko Derek demonstrated Zondle and allowed participants to try it out on the spot and navigate their way around the platform. After an informative tour around the different sections and possibilities that Zondle offers, the workshop provided a step-by-step guide on how to start using it in science and mathematics classes.

Finally, Mr. Derek provided information on such practical matters as registration, managing both students and content, and how to monitor student progress.

Sparkling IBSE:

Hummingbird seeks Bromeliad

What exactly is “sparkling” Inquiry Based Science Education (IBSE)? Organisers Sonja Eilers and Yvonne Matzick invited workshop participants to find out by investigating for themselves four experiments the pair consider to be truly remarkable in helping to teach STEM.

Expedition to Mount Kinabalu is a virtual journey to a real place, located in Borneo. The students “climb” up the mountain, move from station to station and investigate the biodiversity of its ecosystems. Students find that it is an interactive and practical way to practice information sharing in different but related STEM fields.

Hummingbird seeks Bromeliad is an activity based on the way different species of hummingbirds have adapted to pollinate different species of bromeliad plant species. Students design, conduct and analyse the results of experiments, and see if their results match their initial hypothesis.

Which apple variety to choose. Students look at a wide range of apples that evolution has produced, and get the chance to see the advantages and disadvantages that different apple species offer – all the while learning about economics, biology and other determining factors.

Gulf Stream in the aquarium is a practical, intuitive way to demonstrate the principles of the Gulf Stream to students. It uses an aquarium, ice and coloured ink.



BioDansciences Project
– Part 1 and Part 2 Workshop

Dance exists in all human cultures – and it is with this idea of total inclusivity in mind that Ana Guadalupe, Valenzuela Zapata and Gea Zazil Hernandez ran their workshop.

Its basic theme was that dancing can be used as a way to clearly and simply communicate complex ideas and concepts. As the three said themselves: *“We are going to be dancing research, recreating natural phenomenon by simple choreographies”*. And that’s exactly what they – and the workshop participants – did.

The session, billed as a “dance seminar”, involved participants in a Proteins Dance,

designed to emulate the movements of certain proteins in a cell – and with the added biological benefit of promoting fitness through movement.

Behind the fun lies a serious intent to “... *dance to promote curiosity, (because) curiosity is the best for education.*” The workshop at Scientix gave just a taste of the 30-hour course run by the trio, which consists of 70% dance and 30% theory. The goal of the course is to apply it to writing a scientific paper.

As an example, students can reproduce the working of a cell by simulating its different parts through dance, while being encouraged to be creative and describe their roles in free flowing ways. Thus creating new understanding and insights into biological processes.



Outdoor challenges

Making STEM practical and accessible need not involve the latest high-tech gadgetry and apps. There are almost limitless possibilities to be found outside the classroom on a school's doorstep, as Anna Ekblad's inspiring workshop amply illustrated.

It was also a chance for participants to get a breath of fresh air, as the event took place in a local park.

The first activity was to explore the area and look for smelly materials to be placed in plastic cup. After the time limit of three minutes had elapsed, the participants re-grouped and compared odours. More

importantly, those present had a serious discussion of what aspects of science were at work and how the activity could be utilised by different age groups.

A second activity then followed where participants were divided into groups of five. This time, the challenge was technical and the groups had to build a high tower from natural materials that could be found on the ground.

After debating the different choices of building materials, the group talked over the possibilities this type of activity would have for different students. All agreed that using the surrounding environment could help students exchange knowledge and experience, and that it could be used as a compliment to traditional education.



The mass of an astronaut in zero gravity

Space is a very attractive environment for encouraging interest in STEM, but until tickets into orbit and beyond fall considerably, educators need to find ways to simulate conditions in space here on Earth.

One such teacher (and teacher trainer) is Dominique Lambert. His workshop demonstrated a number of different activities and simulations he implements in his own classroom. These include the calculation of the period of rotation of Mercury and the calculation of the differential rotation of the sun by observing

sunspots. He demonstrated these activities to show how teachers can, indeed, blast their class into outer space – albeit virtually.

Also showcased was a free image processing software package called Leworks that can be used to make incredible calculations – such as the mass of a black hole.

Finally, the workshop ended with a demonstration of a tool that measures the mass of an astronaut in zero gravity. Mr. Lambert first showed a video of the experiment that had been conducted on the International Space Station and then presented it in real life.



Learning maths through new communication factors

"The idea is to take things that attract students and adapt them, like taking X-factor and transforming it into MATH-factor or theatre into MATHHeather," said Gregoris Makrides, introducing the workshop he co-hosted with Rosemary Strevinioti. One of the event's promises was to cover what usually takes four days to impart in just 40 minutes. Those 40 minutes focused on the two methods developed by the Le-MATH project.

The MATHFactor and MATHHeatre methods are guidelines that have been developed from best practices in more than ten European countries. The session, which included a video of a performance by pupils aged 9 to 18, gave an overview and hands-on experience to the participants – helping them understand the two methods and how they could improve the learning of, and change attitudes towards, mathematics.

Learn maths through code

Tullia Urschitz's workshop involved participants in an active learning environment designed to stimulate first grade and pre-school children to develop maths and problem-solving skills through coding activities.

What was rather different about these coding activities was that they did not require the use of computer.

Participants took the role of students and responded to simple "coding" instructions. Ms. Urschitz used the opportunity to demonstrate how the approach can be utilised to introduce a variety of STEM skills and concepts.

Imagine... science for your future

A disinfecting soap based on plants. A cheap way of purifying water. Strengthening bridges with micro-organisms. These are just some wonderful ideas that have come out of Foundation Imagine Life Sciences' Imagine School Competition.

Lotte van den Berg's workshop presented some of the innovative solutions that school children have suggested to help solve some of our most pressing problems, from water shortages to sustainable development.

Students cross and combine disciplines to consider science, society and economics, and use these fields to get an overall view of the work needed to be done to address these problems.

The workshop also included a practical activity called "Mushrooms", where the participants had a chance to design, implement and assess an innovative societal project.

Gender in STEM education

Like it or not, teachers greatly influence the decisions taken by their students. As a result, they can empower them, too. Chiara Tripepi and Jukka Rahkonen highlighted the role gender stereotypes can play in positively and negatively affecting the choice of a career in STEM research. Their first tactic was to discuss the “femininity” and “masculinity” of behaviour, products, technologies, environments and knowledge.

Next the pair involved the participants in two activities, the first of which asked the very basic question: “what are gender

stereotypes?” The discussions revealed that, firstly, gender stereotypes are quite difficult to put into words. Also, these stereotypes are very much connected with the psychological dynamics and unconscious reactions of the individuals who consider them.

The second activity brainstormed tips for motivating boys and girls. Ideas the participants came up with included taking time and encouraging students to research on their own; the use of field trips; considering the needs of the whole class; challenging students’ perceptions; and designing outdoor activities where students can work in teams.



Real-time experiments for the acquisition of science competencies: COMBLAB project

COMBLAB is a European project that aims to provide new research-based teaching materials to promote scientific competencies in secondary students using microcomputer-based laboratories.

This workshop, courtesy of Fina Guitart and Montserrat Tortosa, explored the possibilities COMBLAB has to offer by demonstrating two practical activities. As with all COMBLAB activities, they were both inquiry-based, with students being guided to solve an initial problem, plan, design and perform experiments, discuss results and draw conclusions.

And in keeping with the philosophy of inquiry-based learning, it was the workshop group, split into teams, that demonstrated the first activity for themselves. Entitled “How can we obtain ice cream without a freezer?” it looked at the cooling dynamics of different liquid solutions by taking careful measurements and readings using computer equipment. Participants had to design and experiment to compare freezing curves using mixtures, to optimise the process and make ice cream.

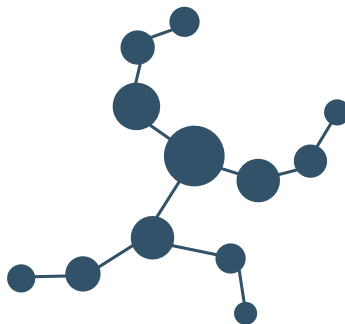
The second activity, “Which antacid is more efficient?”, dealt with acid, base and neutralisation concepts. Gastric juices were simulated using a diluted hydrochloric acid solution, which was mixed with various pharmaceutical antacids and active

ingredients. Graphs of pH versus time were obtained, allowing a discussion about changes in pH and the velocity of these changes.

Scientix and elevator pitches

“Imagine you meet the president of the European Commission in a lift. You see you will be travelling together for five floors. You have that time to convince him of the success of Scientix. What do you say? How do you say it?” Tatjana Gulić, Alojz Blazic, Ivan Đerek, Milorad Vučković and Bosiljko Đerek used this imaginary scenario to describe the work and experiences of Scientix Ambassadors in disseminating the project around Europe.

This was a highly interactive workshop, with the Ambassadors themselves playing the part of various stakeholders (a member of the media, a teacher, a project manager and even the president of the European Commission!). The participants then had to develop short, persuasive arguments to back Scientix.



ROUNDTABLES

Seven roundtables were organised during the conference. Participants enjoyed interactive discussions and exchanges between the panellists and the audience on a number of STEM approaches, teaching methods and learning paths. They also benefited from the many questions raised in order to gain insight on specific topics or issues.

The roundtables encompassed discussions on IBL methods through four elements; Mindcrawler; quality standards on educational resources; informal learning, science centres, museum and café; school-industry collaboration; science fairs and competitions; science education and gender as part of Responsible Research and Innovation (RRI).

The discussions also dealt with several crucial questions and recommendations, including:

- IBL does not introduce new methods but focuses on the active participation of students. Teachers should only be considered as guides in the lessons, while the students should take a higher/more active role.
- Robotics could be introduced in the subject curriculum in some countries, while the coding-programming should be implemented in a practical dimension with problem solving.

- The amount of educational content freely available on the internet is growing very fast; it is extremely important that the resources on the web are sustainable. Quality, relevance and localisation are also to be kept in consideration.
- *“For many of the students, to go in a science centre is a great experience, especially for the different learning context”* (Spanish teacher). Schools should have continuous interaction with the museums/research centres near to them.
- School-industry cooperation is not something totally new, but it can be improved from both sides. *“I must collaborate with industry to know what it is like being an engineer”* (Finnish teacher).
- Science fairs are an important part of promoting science, as they represent an opportunity to share knowledge, foster competition in an active way and, overall, motivate students to learn.
- Communication could be a facilitator of inclusion in RRI. Transparency, collaboration between all stakeholders and cooperative decision-making are also central tenets of RRI. Gender collaborative efforts – in education, research, industry and other organisations – is required to address current and future challenges that face the world.

There is a world outside to discover through IBL with 4elements

Inquiry-based learning involves exploring the world, asking questions, making discoveries and rigorously testing those discoveries in search of new understanding. IBL can have many faces, dependent on context, target groups and learning aims.

This session set out the main features of the IBL process in the 4elements international project run by seven schools from seven countries. The moderator for the session was Marina Jimenez of European Schoolnet and the panel of speakers consisted of Daniel Aguirre Molina of Colegio Pedro Poveda in Spain, Malgorzata Zajackowska of Zespol Szkol Integracyjnych no 1, from Poland, Mojca Orel of Gimnazija Moste, Slovakia and Carlos Cunha of Escola Secundaria Dom Manuel Martins in Portugal.

Each speaker took turns examining different aspects of the 4elements project, sharing examples of how they introduce this method in their lessons and of the resources that can be used in the classroom. All speakers agreed on the importance of giving students a more active role in classes, with teachers acting as guides.

Following a question from the audience, the speakers affirmed that the project was already having noticeable positive effects where it had been implemented. They also noted that many teachers and students

were involved in international activities and IBL for the first time in their lives. As a result of their participation the project, the students had become more open and understanding of other cultures and people.

Mindcrawler

Four schools, three countries, two technologies, one project – Mindcrawler is the result of a Scientix Teachers' workshop dinner in Riga in 2014. Conceived as an initiative to promote international cooperation, it equips Lego Mindstorm robots to give operators a first-person view of scenes and events happening in other countries, in real time.

The speakers: Hermann Morgenbesser of KIS Klosterneuburg in Austria, Gergely Nádori of Alternatív Közgazdasági Gimnázium in Hungary and Tullia Urschitz from IC Bartolomeo Lorenzi – Fumane in Italy, described the evolution of the initiative from over-dinner discussion to fully-functioning international project. Most importantly, they dealt with the positive impact it has had on children in Verona, Budapest and Austria. All agreed that Mindcrawler was a great way to introduce students to coding and robotics, and the concepts involved in both.

Important aspects in making this project a success in promoting STEM subjects and international collaboration was the unique way it encouraged interaction between participants, said the panel. They also

remarked that younger children – in the 7 to 10 year-old range – could benefit from the project, too.

Addressing future steps for the project, the speakers explained that further data would be collected and analysed to see where improvements could be made. In addition, there would be greater collaboration and added value from the use of Mindcrawler as a steppingstone between school and further education in STEM subjects.

Quality standards on educational resources

Thanks to the internet, there is an avalanche of educational resources for any teacher interested in searching for it. The downside to such a bewildering array of information is the lack of quality control. There is little standardisation and attempting to compare resources can be frustrating.

This roundtable, hosted by Pedro Russo, Project Manager at the UNawe International Project in the Netherlands, discussed how issues such as discoverability and quality to openness of the resources are being addressed by a variety of ongoing projects – such as the Open Education Resources (OER) framework Reuse, Revise (Alter), and Remix, Redistribute.

The panelists in discussion for this session were Erik Arends of Leiden University and Universe Awareness, from the Netherlands, Sofoklis Sotiriou of CTI in Greece, Premysl Velek from European Schoolnet, Belgium

and Jörg Müller of the Universitat Oberta de Catalunya in Spain. Their own experience of the subject comes from involvement in the astroEDU, Open Discovery Space, GenPORT and Scientix portals, which all provide large quantities of educational resources themselves.

Initially, the panelists discussed these initiatives in order to share their own experiences of the subject and how their own portals addressed the question of quality control. One key issue that emerged was the importance of respecting copyright – the portals filtered material, but the panel also emphasised the need for uploaders themselves to exercise strong professional standards.

Essential factors in content quality are suitability for specific curricula, languages, culture and geographical circumstances, said the panel – and, of course, addressing the specific needs of teachers.

Informal learning, science centres, museums and cafes

The speakers in this roundtable, moderated by Evita Tasiopoulou of European Schoolnet, Belgium, have different experiences – all connected with bringing science to the general public outside the formal education channels. From Micro Museums to programmes on art, science and technology for young people, from science centres to open researchers' nights. All these types of programmes also aim to interest youngsters in science

careers. How do they do it? What do they have in common? How can teachers or other organisations learn from them and replicate them in their own countries?

Gonzalo Abellán of MUDIC-VBS-CV, Spain, Patricia Barciela from Museos Científicos Coruñeses, also in Spain, Patricia Verheyden of Technopolis, at the Flemish Science Centre in Belgium and Ana Bedalov of Centar Zlatna Vrata, Croatia addressed these issues by answering the question: “Why should someone visit you?”

Unsurprisingly, the answers differed from speaker to speaker, but a common theme was that any learning centre had to impress visiting students in a long-lasting and meaningful way.

Different kinds of experiences and proposals were discussed, with the suggestion that schools near particular museums and science centres could have continuous interaction. In addition, there was a consensus that rather than building a large centre in any given area, it would make more sense to create several smaller ones, so that more schools could benefit from their resources.

The role of teachers in ensuring children get the most out of museums and similar establishments is, of course, pivotal and the discussion touched on different proposals, such as a workshop for teachers in the framework of a European Project that could connect Art Science and Technology.

School-industry collaboration

The relationship between schools and industry is a complex one, with clear advantages for both sides. It is also a vital issue to get right for the future of STEM in Europe. This roundtable, moderated by Maité Debry, Project Manager at European Schoolnet, had representatives from both sides discussing the issues, illustrated with examples from their own countries. The speakers were Emilie de Vries Schultink of Platform Bèta Techniek in the Netherlands, Tobias Eriksson of Teknikföretagen, Sweden, Jörg Haas from Jakob-Fugger-Gymnasium Augsburg in Germany and Tiina Kähärä of Kytöpuiston koulu, Finland.

The first discovery from the discussion was that, in Sweden at least, school-industry collaboration has been a reality for around 15 years. Tobias Eriksson also suggested that reviewing their current practices was important for future development in that country.

Describing to younger students what certain STEM professionals do and what their working life is like can be very difficult, and this is one of many areas where industry can help schools out, the panel agreed.

The importance of having dedicated organisations to support a healthy, productive relationship between schools and industry was discussed, with both Scientix and inGenious being cited as valuable players.

Science fairs and competitions

Science fairs are a great opportunity for young researchers to present and defend their science project results and compete for best project awards. But do these events actually encourage students to pursue STEM careers?

Tackling this question and more were Susana Chaves of the Fundação da Juventude, Portugal, Marjaana Myllylä from the School of Riihenmäki in Mäntsälä, Finland, Carlos Ribeiro from the Agrupamento de Escolas Marinhas do Sal in Portugal and Ercan Torun of Inespo and Cosmicus, the Netherlands.

The roundtable was moderated by Karen Slavin from the European Commission, who reminded the participants that soon: *“Europe will need another one million scientists”*.

With that in mind, what was the value of science fairs and competition? Giving students tangible – and achievable – goals was one answer. Another was that they act as a multiplier effect for stimulating interest in STEM. When one student enters – and even better – wins, their peers take note.

The discussion also dealt with the valuable role that industry collaboration has in such competitions and the challenges of not having the opportunity to work with specific industries, especially in rural areas. The panel agreed that one challenge for science fairs was to encourage more such participation.

Science education and gender as part of RRI

Responsible Research and Innovation (RRI) has been under discussion for a number of years and means different



things to different people, although it can be summarised as: “doing science and innovation, with society, for society”.

Participation is a key aspect of RRI, which aims to involve everyone affecting and affected by research and innovation.

In this roundtable, moderated by Yves Beernaert of EDUCONSULT, Belgium, experts in research, RRI and gender in education discussed the importance of science education and the promotion of gender equality in education and STEM careers.

The experts in question were: keynote speaker Amber Gell of Lockheed Martin and NASA, from the USA, Tricia Jenkins of the University of Liverpool, United Kingdom, Rosina Malagrida of IrsiCaixa in Spain and Dr Maria Korda from the European Commission, based in Belgium.

Given its commitment to inclusivity, gender equality is a central plank of RRI and it is important that science and innovation are gender neutral, to allow them to reach their full potential, the participants agreed.

Communication, remarked Ms. Jenkins, was a facilitator of inclusion in RRI. She emphasised two gender issues facing STEM teaching and research. First, although girls are increasingly engaging in careers in science and technology, very few progress to the upper levels of management and hierarchy in institutes of higher education and other organisations. Second, on the other hand, fewer boys

were progressing into science and technology subjects in higher education.

Ms. Malagrida made the point that, with the world of science and technology moving so quickly, decision making in science and technology needed to include all aspects of society, not least children, whose futures might be affected.

One of Ms. Gell's key contributions to the discussion was the difference in the perception of boys and girls, men and women, and how these different points of view should be a factor that enriches education, research, industry and other organisations.

During the discussion with the audience, a concern was expressed that by focusing on science careers rather than science literacy, those not entering science and technology professions might miss out on the appreciation and knowledge of STEM. In response, it was emphasised that, while an aim of RRI has been to promote interest in STEM careers, there was now a focus on science knowledge and engagement in society as a whole.



TALKS

The talks, 70 in total, provided the audience with a wealth of presentations, ideas and insights, drawing from projects, initiatives and research, again on a variety of topics about STEM teaching. The main subject areas ranged from curriculum innovations, to school projects, from teacher training to out-of-school learning, from competence learning to role models, from tools and schools to energy, engineering and nanotechnology. Some of the take-home advice and wisdom the participants received touched on the following:

- building excitement around science within schools via hands-on activities (taking measurements in the fields of atmosphere, hydrology and many others, or creating maps and graphs);
- acquiring new knowledge of physics and chemistry, recognising it in the world around and connecting it to other subjects;
- enabling students to understand different approaches to science-related subjects;
- raising awareness on environmental and sustainability topics (with the story of an alga who wanted to be a flower);
- showcasing the practical aspect of STEM education, from mechanical to electrical design (with Karelino – a robot for STEM education);
- using posters as educational materials for science;
- bringing together resources about gender science, technology and innovation;
- opening up minds as to how women can help develop science;
- considering the use of games as a main part of education (with geosciences);
- learning about climate change education (and a teaching approach based on a True-False answer option);
- encouraging energy saving behaviour;
- exploring a new approach for teaching data and statistics;
- looking into the ways space exploration can be used in education (in cooperation with the European Space Agency) and bringing space exploration into classrooms;
- designing a new curriculum in science for students;
- organising individual student-scientist internships;
- using science demonstrations as a tool for Inquiry Based Learning;
- optimising the student knowledge/teacher fatigue ratio;
- participating in effective teacher training.

Curriculum innovations

Sustainability and STEM in FYROM

In her presentation, Natalija Aceska described innovations in her home country of the Former Yugoslav Republic of Macedonia (FYROM), focusing on the relationship between STEM education and sustainability.

GLOBE, she explained, is a major educational project that gives students the opportunity to learn through hands-on activities, such as taking measurements in the fields of atmosphere, hydrology and many others, or in creating maps and graphs. It also has the flexibility to allow teachers to develop new methods of teaching and interacting with their students.

Ms. Aceska went on to explain that integration of environmental education in the educational process and computers for every student were part of the new framework of STEM education in FYROM.

She described the new science curriculum for primary schools in FYROM and the fact that it recognises the importance of enabling children and young individuals to be prepared for life in the 21st century.

Hands-on marine biology in Italy

Claudia Maria Mazzanti holds a PhD in Marine Ecology. She presented her research, which examined the problems facing STEM education in Italy. Its conclusions illustrated the need for more coherence between theory and practice,

and for creating more inclusive, practical experiences for learners.

Ms. Mazzanti then described a pilot scheme designed to overcome these curricula challenges. It involved students aged 11 to 14 studying ecology in depth, through the building of a 100 litre aquarium with tropical fish, plants and invertebrates.

The results have been very encouraging. Students demonstrated greater skill development, teamwork, presentation skills, problem-solving skills and creativity. Moreover, this practical project gives meaningful context to classroom theory that all students can benefit from.

INSTEM – innovation network in STEM

Michela Insegna presented the concept of “Innovation networks in science, technology, engineering and mathematics” through the presentation of a project implemented in the context of the Lifelong Learning Programme called INSTEM.

Based on the idea that different projects in STEM should talk to each other, its priorities are to collate knowledge developed by previous projects in science education, distribute it, and thus promote innovation and best practice in STEM education.

The project is currently developing in national working groups, with the intention of then developing case studies.

Practical biology from the US

Another marine biology-based innovation was presented by Dr. Lauren Birney from

the USA, who discussed the Curriculum and Community Enterprise for the New York Harbour project.

Better known as The Billion Oyster Project, it focuses on project-based learning across a wide range of fields, where children get out in the water, have hands-on experience and are responsible for putting oysters into the harbour and harvesting them.

It currently involves over 150 people learning in both informal and traditional settings, and aims to provide practical learning experiences for public middle school students, as well as proving the efficacy of a genuine STEM-C curriculum.

Dr. Birney emphasised the importance of choosing stakeholders that are interested in really investing time and effort in the project – not just providing financial assistance.

School projects

Creativity in physics class

Sanja Bulat and Ivana Jokić take an unconventional approach to teaching physics. They developed their classroom project – “Hello Newton” – with 20 seventh-grade students. The class was divided into five different groups, each one tasked with explaining a different aspect of Isaac Newton’s life and science – from the laws of motion to the theory of gravity.

Techniques employed by the teachers included flipped classroom, creation of a theatre play and plenty of discussion

between educators and students. Close attention was paid to the students’ emotional states during the process and that had a very positive impact in boosting motivation and, ultimately, the students’ academic results.

Teaching science, in English, in Spain

As well as having to teach Spanish students in English, newly-graduated Alicia Sanz Duran faced the challenges of lack of adequate classroom equipment and teaching experience. She overcame them all through a mixture of determination, classroom innovation and in-depth pre-planning. So successful has she been, that a student who originally did not speak English or Spanish has risen to become top of the class.

Inquiry-based learning for evolution

“The alga who wanted to become a flower” project uses a method of teaching based on Inquiry Based Science Education (IBSE) – where students are not told what protocol to follow – to teach aspects of evolution and plant diversity. Presented by Ana Cristina Tavares, the activity has the advantage of being useable both inside the classroom (exploring the story of the book, with plants or models) or outside (as part of a trip through a garden or park).

Essentially a story about an alga who wanted to be a flower, the activity uses an unconventional, non-formal approach to engage students and has been so successful, it has been translated into 11 languages.

Karelino – a robot for STEM education

A European Commission Lifelong Learning Programme (LLP) funded project, Karelino is an evolving robotic platform that brings together students to practice a wide range of STEM disciplines, from mechanics to IT and electronics. Helping to build the robot as a team provides students with a great deal of motivation – but more importantly, helps illustrate the practical implication of STEM concepts. And because it involves international cooperation, Karelino gives students a great opportunity to practice their English in a STEM context, explained presenter Mihai Agape.

Research and schools

ICRC Academy

The purpose of the Czech-based ICRC is to introduce school-age students to ongoing research activities and encourage their future participation. Presenter Zuzana Povolna explained how the academy has already reached out to 700 participants with lectures and seminars at 14 universities and seven high schools in five different cities across the country.

Posters as educational material for science

Visually impactful, immediate and concise, posters can be a very effective tool in the teaching of science to students with special educational needs, explained presenter Nikolaos Nerantzis – although they are equally valid for non-special teaching. They



can be easily accessed on the Internet and can be extended by adding patches. Designing posters is a great classroom activity, as it uses hands-on, low-cost materials and helps students to organise their knowledge.

Learning science in the 21st century

Taking her starting point as the ever-lower uptake of STEM careers, presenter Tania Pinto designed a research project to demonstrate how Problem Based Learning could help reverse the trend by engaging students. Ms. Pinto and her colleagues Rosa Soares and Fatima Ruas worked with 75 students, 42 girls and 33 boys of 12 to 14 years old.

These students very much enjoyed using different innovative software such as Salsa J, Stellarium, Erupt3, Make-a-Quake or Virtual Quake to explore and bring to life various geological subjects, such as moon craters, volcanic activity and seismology.

Collaborative action on gender and science

GenPORT is a growing, global community of educational practitioners working for gender equality in science, technology and innovation. As presenter Jörg Müller explained, this community uses an online portal to showcase and share the world's best research resources, practical materials, policy briefings, experiences and more. The real value of GenPORT is in being a single point of access to high quality materials that would otherwise be scattered across hundreds of different archives and forums.

Tools and schools

Walking in Galileo's footsteps with digital shoes

Matteo Siccardi demonstrated how one simple app can take the place of a physics lab in bringing three of the most relevant theorems of Galileo's Discourses to life. Using the open-source GeoGebra applet, students can follow in Galileo's footsteps by taking measurements from different experimental scenarios. Best of all, the app is available free under a Creative Commons licence.

Using the GLOBE programme in education

The Global Learning and Observations to Benefit the Environment (GLOBE) Programme is an international environmental education programme that Hungary joined in 1999. Piroska Tóth explained its history and how educators in Hungary had used GLOBE and its network across 112 countries to involve their students in highly engaging science. Students participate in collecting a wide range of data, such as water quality and soil temperature, on a weekly basis. They then use this to make calculations of their implications for the local environment and climate.

PLE – supporting personal STEM learning

Personal Learning Environment (PLE) has proven to be a significant factor in making school an interesting, engaging and challenging place, according to presenter Elisabeth Hall'en. She explained

how her particular PLE project – the first pre-commercial procurement project at EU level – has been designed to ensure content providers in the private sector are aware of the needs of teachers and the aims of the education system in this growing and exciting new area.

Chasing Aurora: Using authentic context for STEM

The Aurora Borealis is one of nature's most impressive phenomena. Richard Hechter explained how he had tapped into the wonder of the Northern Lights to engage students, by developing an authentic astronomy-themed curriculum and associated resources. The Aurora Borealis is visible from Mr. Hechter's school and he took advantage of this to enliven what, in Canada, is a fairly limited science curriculum for Elementary students. His was a multidisciplinary approach, helping to bring engineering, geography, maths and even art into play – as students were keen to video and paint what they saw in the night sky.

The world around us

A serious geosciences game: path in a volcanic area

The aim of this project, as explained by Annalisa Boniello, was to improve the motivation of students for earth science and to develop their scientific competencies, using a game set in a virtual world. This, said Ms. Boniello, reflected the changing patterns of modern teaching, where immersive games have serious and relative lessons to teach. In this case, students

were engaged in discovering more about geosciences, in particularly volcanoes.

Teachers learning about climate change education

John Oversby's research recognises the fact that climate change education is not a specific topic in the curriculum – what's more, teachers are often not confident or knowledgeable enough to teach it. His project is designed to answer the questions about what the features of climate change education that promote engaging teaching and learning are. It used a mixed-method approach, drawing on a variety of written evidence and observations of teacher education sessions.

Projects I

Motivating teacher and student science learning

The session started with a small introduction from Tommy Byskov (the moderator of the session) and continued with the speaker, Eleni Kyza, showing subject-related online resources. She presented details of two projects centred on inquiry learning and aimed at motivating students to engage in evidence-based problem solving of complex, socio-scientific issues, such as genetic modification and climate change CoReflect ran from 2008 to 2011, and the PROFILES project, which started in 2010 and is still running, have both shown positive signs of success. Their essential elements are: relying on teachers being active participants in creating learning materials, the availability of customisable

and re-configurable tools for teachers, and authentic learning environments.

Towards a ubiquitous good NST education

Moshe Talesnik from Israel explained the various ways nanoscience and nanotechnology (NST) can be used in science and technology education in secondary school systems across Europe, specifically in relation to the learning of science and technology. Mr. Talesnik also gave a fascinating and insightful overview of a range of current NST educational projects.

Quantum Spin-off

Laura Tamassia explained how the Quantum Spin-Off project seeks to inspire a new generation of STEM professionals by bringing secondary-school science teachers and their pupils into direct contact with research and entrepreneurship in the high-tech nano sector. As part of the project, teams of pupils, guided by teachers, are challenged to create a responsible and socially relevant application from a scientific paper, in collaboration with actual researchers and entrepreneurs. She also explained that resources produced for the project can be found in the Scientix portal and called for more teachers to get involved in the Quantum Spin-Off Summer School and the National Teacher Training programme, both taking place in 2015.

Responsible Research and Innovation, a new paradigm in Horizon 2020

Rosina Malagrida discussed the concept of Responsible Research and Innovation (RRI). She analysed how the different stakeholders

can reflect, deliberate and act together to steer science and innovation towards a more socially desirable and sustainable goal. Ms. Malagrida presented the RRI Tools project (www.rri-tools.eu), an initiative that aims to provide tools to the various stakeholders concerned by Research and Innovation to make their practices more responsible. Whilst warning that the project was still very much in its early stages she emphasised the utility of RRI Tools, as well as the need for multidisciplinary approaches and collaboration to confront the complex challenges RRI presents.

Projects II

Opening science to school students – 10 years on

The Open Science project allows active teachers to contact scientists directly and learn about the latest advances in science. As presenter Anna Barton explained, the initiative also arranges summer camps to raise awareness about science careers. But the project's principle activity is to organise individual student-scientist internships.

Unfortunately, due to high demand, it is not possible to offer an internship to every student interested. But after 10 years of existence, the programme has already generated more than 500 internship opportunities and currently involves 21 STEM professionals.

Bringing space exploration to a classroom near you

Val Caldwell and Alex Blackwood detailed how their organisation, the International Education Business Partnership Network (IPN), brought eight European teachers to Huston, Texas in order to aid the development of an online resource and help build a community of practice for science teachers around the world. They pointed out that, although there is a good selection of inspiring space-based materials in existence, dissemination of them has been problematic. During their talk, they promoted the STEMspace.eu website, which hopes to help remedy this.

Implementing strategies in science teaching

The CREAT-IT project has developed a pedagogical framework that integrates the arts with science teaching. In their

presentation, Menelaos Sotiriou explained that the project plans to involve more than 600 STEM teachers, across six countries. Its objectives are to provide teachers with ideas to teach STEM topics in a more creative way, as well as to inspire women to pursue STEM related careers. Activities to date include the Science Theatre and Junior Science Cafes Scenarios projects. An international conference is planned for October 2015, to present the main accomplishments and learnings from the project.

PARRISE: integrating society in science education

The Promoting Attainment of Responsible Research and Innovation in Science Education (PARRISE) project aims to foster Socio Scientific Inquiry-Based Learning (SSIBL) in schools, explained presenter Ralph Levinson. One of the key objectives



of the project is to demonstrate to students the practical application and presence of science lessons in their day-to-day lives. PARRISE tries to combine four dimensions: responsible research and innovation, citizenship education, practical principles beyond science and operationalisation of concepts. In order to achieve this, teachers need to work as facilitators in order to trigger the right questions from their students, keeping them motivated, as well as providing engaging, concrete examples that work in the real world.

From early ages to long distances

Enabling creativity and inquiry in early years

This project, presented by Fani Stylianidou, seeks to document and compare current policies and practices in science and mathematics education in preschool and the first years of primary school in the nine European partner countries. It does so using a variety of methods from desk research to a survey and classroom-focused fieldwork. The conclusions it draws can then be applied to teaching, learning and assessment in STEM for younger students, for the benefit of all.

Teaching statistics in primary school

The value of understanding statistics cannot be underestimated in STEM subjects. Introducing stats to any student, particularly younger learners, can be a challenge, so the Italian National Institute of Statistics (Istat) has developed a range of learning tools to be used in primary

school classrooms. Silvia da Valle of Istat presented the tools and described how they were developed. She also pointed out how the interactivity, ease of management and use by teachers, friendly language, feedback and multiple formats benefit the teaching of statistics in the classroom.

Inspiring STEM in pre-service primary teachers

Asuncion Menargues Marcilla addressed the problem of pre-service primary teachers who do not have a minimum scientific education and who have negative attitudes to science learning and teaching. Focused primarily on Alicante in Spain, her novel approach is based on the idea that students could change their attitudes through in-depth learning of a given scientific topic. The topic chosen was diurnal astronomy, which was taught as a standalone course at the Alicante University. Ms. Menargues Marcilla reported that the approach was highly successful and that teachers overcame the feeling of inability to learn science that they had had at the beginning of the course.

The Future Project: a new cooperation

The Future Project promotes activities that increase the involvement of young people in science and engineering in Australia. Its main focus is to motivate and engage the next generation of scientists and engineers, by providing students with the opportunity to collaborate with working scientists and engineers, to solve real-world problems and to communicate this innovation to the broader public. It does so, explained project co-ordinator Roger Kennett, by

'embedding' whole research teams from business or academia in schools, where they conduct their research. As a result of this arrangement, the students actively participate in the research and have first-hand experience of doing it in a real-world context – without having to leave the campus. Meanwhile, STEM teachers have the opportunity to rub shoulders with and learn from scientists on a day-to-day basis.

Energy, engineering and nanotechnology

STEM intertwined – learning by analogy

The integrated study of STEM subjects, rather than studying each subject separately, offers a significant pedagogical advantage, according to Yair Ben-Horin. During his presentation, he also placed great emphasis on the value of analogy – where students explore the similarity between two concepts. Integrating STEM subjects allows students to enjoy diverse, multi-disciplinary classes that enable a broader and better perspective.

The Green Agents Mission

This programme, presented by Anna Christodoulou, seeks to help students aged 9 to 12 to appreciate the links between everyday life – such as electricity usage and carbon footprint – with global environmental issues, like the greenhouse effect and climate change.

Focusing on energy consumption, the programme helps students understand the science behind current environmental issues, encouraging them to help reduce electricity use in their schools and to spread the word in their community.

From NanoYou to secondary school nano studies

Surveys show that Europeans have a poor understanding of nanotechnology (NT) and its potential risks. To counter this, NanoYou (Nano for Youth) was aimed at increasing young people's basic understanding of the issues and at engaging them in dialogue. Presenter Nira Shimoni-Ayal showcased the highlights of the NanoYou portal, including its award-winning video featuring popular UK comedian and broadcaster Stephen Fry.

System thinking with Aquaponics

System thinking is seen as a central skill in education for sustainability. This project, presented by Ranka Junge, is an educational concept developed in the FP6 Science and Society project WasteWaterResearch. It aims to train students in system thinking by using a connected fish and plant culture system. "System thinking with Aquaponics" provides an interactive, practical way of involving multiple teaching goals and has a unique approach to involving more students in the classroom, and to making them more interested in science related matters.

National projects

Didactic method helping to obtain comprehension

The Goerudio Project, described by Uldis Heidingers, aims at excellence in teaching STEM subjects. It was designed to be a learning method, based on direct user involvement in the learning process, while encouraging user understanding of complex formulas, laws of physics and other concepts. These concepts are presented by teachers through simple examples. Attendees at the presentation received a first-hand view of the process during a practical activity, where participants were asked to create their own individual models and to present them.

IBL for raising students' attraction to science

ACARISS is a project aimed at increasing knowledge about the environment and the risks of pollution. It involves schools taking part in experimental activities and has involved 37 schools, 70 teachers and a total of 1950 students to date. As well as presenting the details of the project, Francesca Ugolini presented a practical activity derived from it, featuring a game based on the CO₂ cycle.

U-Talent Academy

Promoting excellence in STEM education was the title of Andrea van Bruggen's presentation on the U-Talent Academy run by the Junior College of Utrecht. Ms. van Bruggen made the points that talented STEM students are willing to go

beyond the regular curriculum, that they are easily bored and are at risk of losing their motivation – but are able to positively influence classmates. With this in mind, the curriculum developed by U-Talent has been designed to be tailor-made for these students, who have the opportunity to participate in research areas and business-based projects. In all cases, the emphasis of this excellence-orientated programme is on encouraging creativity and lateral thinking – and challenging exceptional students.

The Cell EXPLORERS programme

Billed as “hands-on molecular and cellular biology,” this presentation on The Cell EXPLORERS programme by Muriel Grenon dealt with a science and public engagement programme based in the School of Natural Sciences (SNS) at NUI Galway, Republic of Ireland, which aims to inform, inspire and involve the general public in science, technology and research. It does so by connecting primary, secondary, third and fourth level students, lecturers, researchers and the general public. The programme's practices consist of school visits, science festivals, holiday camps and “Saturday morning in the lab” activities, which are both student-led and research inspired. To date, it has enjoyed a great deal of success, expanding from 10 to 100 classrooms and reaching out to almost 2900 students.

Role models and good examples

Meet the Scientist

Launched in 2010, this United States programme has the goal of promoting engineering and natural sciences along with education among high school students. At every meeting, a former Fulbright scholar volunteers to give a 30-minute presentation about their current research, scientific activity and past Fulbright experiences. Lectures are recorded and uploaded online for future viewing, too, explained presenter László Antos.

It is my choice – women in STEM studies

Responding to the challenge of gender imbalance in STEM professionals, this project, presented by Doris Elster, assessed attitudes of male and female students in Germany and Austria via a survey.

Amongst a number of interesting results, it found that school choice plays an essential role in determining if a woman chooses to enter a STEM profession or not.

How to use participatory action research to foster inquiry-based learning in science education

This was a presentation on the benefits of Participatory Action Research (PAR) in a collaborative project. It involved the science education research and development team of the Hungarian Institute for Educational Research and Development (OFI) and eight primary and lower secondary schools in Hungary. Anna Majer described how teachers at small primary school in Hungary had changed their mind about using IBSE with primary school pupils, who they had previously thought too young to benefit from it.



Fostering innovation in STEM education

Maite Debyr presented the Reach Out Toolkit in this session. The toolkit was the major result of the Disseminating Educational Science, Innovation and Research in Europe (DESIRE) project, and is mainly concerned with ensuring that new knowledge and practices in STEM education reach the appropriate practitioners. Ms. Derby and her colleagues are concerned with the obstacles that prevent educators from picking up on all the resources that could benefit them and their students. Suggestions for improved communications included better use of social media, plus attending conferences, seminars and workshops.

IBME

Science demonstrations as a tool for inquiry-based learning

This presentation showed how science demonstrations can be used to improve the efficacy of IBSE. Presenters Paul Nugent and David Keenahan described how they realised different experiments, related to elementary physics and concerning gravity, atmospheric pressure and other topics. All were showcased online, to give other teachers the opportunity to improve on them and use them. They had been designed using everyday materials, to make them as easy to reproduce as possible.

Inquiry-based learning in physics and maths classes

Patrick Bronner made the case for using inquiry-based learning to address physics

and maths classes of mixed abilities. IBL has a great advantage, as it allows students to pose their own questions, design their own hypothesis, plan their own experiments, interpret the gathered data, as well as present and evaluate the overall result – but it is often difficult for educators to find suitable tasks to use. In order to help remedy this, Mr. Bronner provided his own tried and tested “examples from the classroom”.

Update on Fibonacci in Spain

The University of Alicante’s IBSE group has been working on the expansion of inquiry-based methodology since the 1980s. It was engaged in the Fibonacci Project from 2010 to 2013 and continues to train pre-teachers and in-service teachers in that inquiry-based methodology. In this presentation, Antonia Trompeta focused on the project’s successes in planning and executing a massive dissemination activity – part of which involved three conferences, two seminars, two field visits and two science festivals.

Projects III

COMBLAB

The COMBLAB (COmpetency-MBL-LABoratory) focuses on the acquisition of science competencies through ICT real-time experiments. Presenter Montserrat Tortosa described its five goals as:

- Obtain research-based teaching materials as a way of enhancing the acquisition of science competencies through ICT real-time experiments;

- Develop more teacher training materials that relate to ICT real-time experiments;
- Disseminate the results of the project on a web portal, as well as in conferences and related events;
- Create a community of teachers and researchers to share relevant, project-related good practices;
- Create synergies with the interested parties, in order to align their approaches to the results and recommendations of the project.

ASTEP and professional development

Initiated by the foundation “La main à la pâte,” this initiative supports STEM in primary schools through inquiry-based learning involving scientists in schools, explained presenter Evelyne Touchard.

Overall, the project has had a major effect on the implementation of investigative research, as well as moderately affecting the scientific knowledge of students in primary education. With perspectives centered on a more comprehensive e-learning resource, there should be more emphasis on teamwork, as well as a better understanding of practical effects, concludes Ms. Touchard.

DynaLearn

Bert Bredeweg presented the project – an intelligent learning environment that allows learners to acquire conceptual knowledge by constructing and simulating qualitative models of how systems behave. Aimed at secondary students, DynaLearn helps students to become good at modelling, motivating them to get hands-on experience of the subjects they are dealing with.



School in the cloud: lessons from Digital Earth

Creating online groups of like-minded individuals dedicated to innovation in education is a key strategy in STEM promotion, according to Karl Donert. His presentation showcased ways of networking to achieve this aim, through the medium of cloud computing. He also pointed out that the spread of mobile devices, combined with augmented reality software, opens up a variety of new educational possibilities.

Teacher training, continuous learning and assessment

Promotion of science vertically

At what age should students become involved in STEM? Natalija Bohinc Zaveljcina, a secondary school teacher from Slovenia, described the success of workshops for children still in kindergarten, which were also attended by children of various ages, up to secondary school level. Content for these vertically integrated workshops was specially developed for chemistry, physics and biology, as well as physical education.

Teacher education by science centre pedagogy

Hannu Salmi from the Heureka Science Centre in Helsinki, Finland, focused on how teachers and teacher trainers can take inspiration from informal learning approaches employed by science centres. As part of the presentation, he detailed the highly successful course developed

by the university in cooperation with the Department of Teacher Education at the University of Helsinki and the Heureka Science Centre. The course has been running for twenty years for all trainee teachers in Helsinki.

Strategies for assessment of inquiry-based learning in science

The Strategies for Assessment of Inquiry-based Learning in Science (SAILS) project supports teachers in adopting inquiry-based science education at secondary level. Eilish McLoughlin, Director of the Centre for the Advancement of Science and Mathematics Teaching and Learning (CASTeL) at Dublin City University, Ireland, described how SAILS answered the perennial problem of how to assess learning outcomes in IBSE. She presented the three stages of the research and implementation of new assessment methods fully embedded in school curricula: review and mapping, assessment frameworks and instruments, and piloting and evaluation.

ASSIST-ME: assess inquiry in science, technology and mathematics education

ASSIT-ME's aim is to provide reliable research on the uptake of IBSE in different contexts across Europe. Jens Dolin's presentation outlined the assessment methods and competences selected by the project and showcased several specific examples of using these methods to assess the selected competences.

Science and social inclusion

Listening to and empowering children

Involving children between the ages of 7 and 14 in the social, cultural, political, educational and scientific decision-making processes that will affect their future is the ambitious goal of the SiS Catalyst project, as described by Vanessa Mignan in her presentation. It ran a series of experiments and workshops whose outcome so far has been to establish best practices for institutions that wish to take child empowerment seriously – by listening carefully to them.

Targeting activities for under-represented groups

Educational institutions as well as teachers and lecturers are confronted with a growing diversity of students while, at the same time, certain groups are still under-represented. This presentation, by Pravini Baboeram-Mahes, explored opportunities for under-represented groups to be targeted and a teaching and learning environment to be designed which is able to serve a diversified group of learners.

Ethics of working with children and students

Guidelines for working with children have been developed within the SiS Catalyst. Mari-Liisa Parder's presentation took a look at these guidelines and examined how they could be implemented in practice.

Implications of delivering science and social inclusion

Living in a time of great transformation, and recognising and acting on the changing needs of children was at the centre of Tricia Jenkins' presentation. Children often do not know why they are at school and what, if any, is the ultimate goal of their studies. But teachers have the influence – and the responsibility – to make a difference. Ms. Jenkins took the audience through how that might be achieved.

Coding in education

Computer programming and coding skills in national, regional or school curricula

What are government plans for computer programming and coding skills? Katja Engelhardt shared the results of a survey launched last summer by European Schoolnet, where 20 Ministries of Education gave an overview of their current initiatives in national, regional or school curricula.

Programming creative games in Estonia

The weather starts to get wet and rainy in Estonia in October. When the outdoor activities become more limited, what better time to introduce students to creative computer games? Tauno Palts showcased three student-made, weather-inspired games that were produced at her school last year by enthusiastic, inspired students as young as 10.

Out of school learning

Science camps in Europe

A joint presentation from Susana Chaves of the Fundacao de Juventude in Portugal and Professor Martin Linder of Martin-Luther University in Halle-Wittenberg, Germany. They discussed science camps in Europe and presented the SciCamp project – a network for these camps, which connects organisers of science camps across the continent. Participants from 6 to 20 have taken part, with very positive results in supporting and strengthening their interest in and knowledge of STEM. The project's final conference will take place from 7-9 October 2015 in Berlin, Germany.

Science on European School Radio

A new media platform called European School Radio (ESR) has been created, where students from every cultural and national background broadcast on internet radio, share their opinions and conduct debates on specific topics and news stories. Eftychia Toulou, a secondary teacher from Greece, explained that ESR is an initiative of teachers in Greek schools and is an online streaming service operated by a network of these schools. She also examined one of their recent projects – the 'Eat, buy and sell sustainable fish' campaign – in detail.

Mobiles and games

Mobile learning: go for it!

Despite the widespread adoption of smartphones and tablets in everyday life, their use in education is in an early adoption phase. In the future, the "anytime, anywhere" feature of mobile learning may have a considerable impact on how learning takes place in many disciplines and educational contexts. Stavros Nikou argued persuasively that mobile technology could play an important role in education, with a special focus on inquiry-based learning. Mr. Nikou also took time to look at the perceived challenges that these technologies bring with them, such as distraction, battery life and security issues.

STEM for all: developmental and game-based approach

Tuula Nousiainen introduced the audience to two projects: the European UPDATE (Understanding and Providing a Developmental Approach to Technology Education) project, and the FUN (Finland-U.S. Network for Engagement and STEM Learning in Games) project. Both are game-based approaches to covering a wide range of subjects.

Competence learning and motivation

A crossed approach for competence-based learning

The Italian KEYS project, explained Michela Tramonti, has been designed by her university in order to build on the successes of five previous projects: SUSTAIN, AQUEDUCT, KeyTTT, READIT and IDial – all of them focused on the development of the eight key competences for lifelong learning. In practical terms, KEYS uses a distance learning technological platform that integrates communication tools, such as e-learning, video-conference and mobile technology, with in-class programmes including workshops and seminars. Students take exams in eight Marconi centres. In this way, KEYS supports educators in the implementation of competence-based education.

Towards the improvement of students' motivation in learning physics

How do you tackle the low popularity of physics in schools? This was the question posed by Marina Poposka, who advocated renewed efforts into finding ways of boosting motivation and interest for learning this subject. Key to doing this are what Ms. Poposka described as the Four Cs – control, challenge, curiosity and contextualisation. She then added useful, practical details for enthusing students about physics – by making the subject relevant and by being prepared to be flexible in the way lessons are presented and results assessed.



Remote and digital

Remote experiments about bioclimatic architecture

Education for Sustainable Development (ESD) has become a very important issue recently. It encourages students to understand and assess their own values and those of the society in which they live, in a sustainable context, emphasised Anthoula Maidou. As an example, she explained the project “Zero energy house”. Involving four upper secondary high-school classes from Greece, the project had the goal of increasing the understanding of pupils, regarding the waste of energy that occurs inside a modern house – and how this resource waste could be curved towards zero. Essentially, the project took advantage of various remote technologies.

It proved to be extremely popular with both teachers and students and, as a result, will be continuing.

Science learning: the analogue versus the digital

Dr. Sai Pathmanathan’s presentation focused on the fact that only a small percentage of the knowledge we have regarding science, is learned in school. Television documentaries, computer games or mobile applications often have a bigger impact on STEM learning than school. As a result, Dr. Pathmanathan advocated judiciously combining the traditional approach with the possibilities offered by the new ubiquitous technology, providing examples of how this might be done.





THE STANDS

25 projects joined the conference with a short presentation on their activities combined with a stand during the whole conference where participants could learn about their activities in more detail and collect materials. These projects were:

Project	Project website	Project in the Scientix portal
	http://www.mascil-project.eu	http://goo.gl/Nq8ylZ
	http://geoschools.geol.uoa.gr/	http://goo.gl/xc5vhv
	http://www.metafora-project.org	http://goo.gl/dq7d3d
	http://ictforist.oeiizk.waw.pl	http://goo.gl/Avbj6H
	http://www.engineer-project.eu	http://goo.gl/yxsQAK
	http://www.nanodiode.eu/	http://goo.gl/MQj2qC
	http://www.nanopinion.eu	http://goo.gl/Y9ZRME
	http://www.openplaces.eu	http://goo.gl/x9pBkt

Project

Project website

Project in the Scientix portal



<http://www.teachingmysteries.eu/>

<http://goo.gl/Arf5Sa>



<https://www.cybermentor.de/>

<http://bit.ly/1t0UQoO>



<http://www.inspiringscience.eu>

<http://goo.gl/GiOS3M>



<http://www.science-on-stage.eu/>

<http://goo.gl/3i4Gor>



<http://www.etwinning.net>

<http://goo.gl/dqjcc8>



<http://www.sails-project.eu>

<http://goo.gl/wYFjqR>



<http://assistme.ku.dk/>

<http://goo.gl/wYFjqR>



<http://research.ncl.ac.uk/fasmed/>

<http://goo.gl/QjJwz7>



<http://www.go-lab-project.eu>

<http://goo.gl/D3WKSv>

Project	Project website	Project in the Scientix portal
	http://www.e-bug.eu	http://goo.gl/bejVOK
	http://www.profiles-project.eu/	http://goo.gl/HV3kb1
	http://www.fp7-restarts.eu	http://goo.gl/aq08aR
	http://www.sustain-europe.eu	http://goo.gl/8zxi5
	http://www.xplorehealth.eu	http://www.xplorehealth.eu
	http://www.ingenious-science.eu	http://goo.gl/kb0kBG
	http://www.scientix.eu	http://www.scientix.eu
	http://science-girl-thing.eu/en/splash	http://goo.gl/2wG232
	http://ec.europa.eu/research/swafs	

The 3' presentation format has now been picked up at other events!



RESOURCES AWARDS

The 2nd Scientix Conference was an occasion for awarding the outstanding work of teachers who have developed their own resources and posters and there was also a Twitter-based competition. Below are details of the winning projects and individuals. Well done to all!

Additional information can be found here: <http://www.scientix.eu/web/guest/scientixawards/resources-competition-1>

Category 1: STEM teaching materials addressed to teachers

The winner was “Super Sucker: Designing a contraption that sucks up litter”, an enquiry-oriented activity for 9 to 12 year-olds, which consists of a guide, lesson plan and tool. It was authored by Maria Adlerborn.

Category 2: STEM teaching materials addressed to students

There were joint winners in this category. The first was “Star in a Box: High School”, an astrophysics and space exploration enquiry-oriented activity and lesson plan created by Edward Gomez from the astroEDU and designed for 10 to 19 year-olds. “Learning Station II: What Is Light?” was the second joint winner. A result of the Quantum Spin-Off project, it is an engineering and physics-based package that includes a course, enquiry-oriented activity, experiment, lesson plan, project, reference, simulation and more, for students 16 years of age and over. The authors were Renaat Frans and Laura Tamassia.

Category 3: STEM reports “PRIMAS Guide of supporting actions for teachers in promoting IBL”

Sona Ceretkova authored this winning guide which introduces key issues in implementing supporting actions and presents a wide range of case studies that have been successfully carried out in the PRIMAS project.

2014 Scientix Twitter Competition

The winning participants – who tweeted the most about Scientix during the Brussels conference were: Zane Pilsniece @ZanePilsniece and Nikolaos Nerantzis @nerantzis.

Scientix conference poster competition

The competitors who produced the most compelling posters in the opinion of the judges were Eugenia Kyriotis and Angelos Lazoudis with “Following Eratosthenes’ steps”, and Anabela David and Manuela Costa who submitted “GPS & meteorological science in forest protection”.

The winning posters can be seen in all their glory here: <http://www.scientix.eu/web/guest/conference/poster-session>

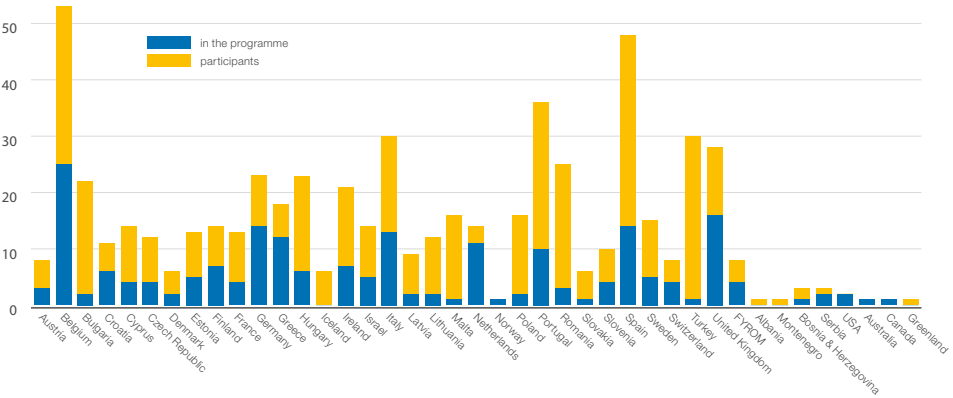


PARTICIPANTS' STATISTICS

The 2nd Scientix Conference was a huge success in terms of attendance, participation, networking and knowledge sharing opportunities. Here are few statistics to illustrate the impressive variety of countries represented.

- 596 participants, 207 in the programme (ie presenting, moderating a session, leading a workshop or author of a poster). The graph shows the country distribution.
- 41 countries.
- The Belgian case: The most represented country was Belgium (53 participants, 25 in the programme). This is due to:
 - 1) Many “Belgian” participants are expats.
 - 2) Many projects sent colleagues based in Brussels to represent them.
- Participants coming from the closest location: DG Research colleagues, who have an office just besides the venue.
- Participants coming from furthest away: Australia.

Country distribution



- Why so many Spanish, Italian, Portuguese and UK participants? Thanks to the dissemination from the Ambassadors and National Contact Points from those countries!
- Participants coming from furthest away: Australia.
- European countries without participants, which we were surprised by: Luxembourg and Moldova.
- How far did the hashtag #scientixconf travel during the conference? Here is the #scientixconf reach-out report:

1,978 tweets	16.46% Original tweets (328)	51.83% Retweets (1,033)
	2.06% Replies (41)	29.65% Links & pics (591)
A	R	S
7,671,817 Impacts	1,750 Followers per contributor	4.92 Tweets per contributor
703,604 Reach	402 Contributors	591 Links & pictures





RESOURCES

All about the conference:

<http://www.scientix.eu/web/guest/conference>

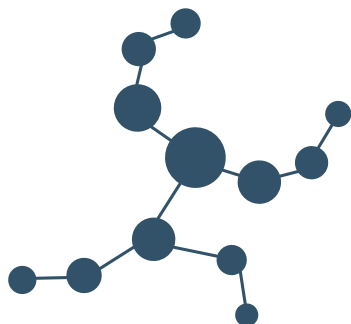
• Find all the presentations: <http://www.scientix.eu/web/guest/conference/presentations>

• Watch the video of the conference: <http://bit.ly/1DLBTLI>

• View all the pictures: <https://flic.kr/s/aHsk2aVJH4>

• The conference on Twitter: https://storify.com/scientix_eu/2nd-scientix-conference-24-26-october-brussels

• Read the first Scientix publication: "Scientix the community for science education in Europe": <http://www.scientix.eu/web/guest/publication>





CONCLUSIONS

Over the course of three days, from 24 to 26 October 2014, 596 participants, 207 of whom were directly involved in the programme of events came together in Brussels to share ideas, network and re-affirm their commitment to STEM education.

Their presence, and the fact that the 2nd Scientix Conference “sold out” in a matter of days, plus the fact that so many events were fully subscribed must mean that the event catered for a genuine need in the educational community.

The conference was much better attended than the first, clearly indicating that need is growing, as the realisation that STEM

education should be a policy priority spreads.

And the fact that participants came from all over Europe – and from as far afield as Australia – means that need is far reaching, too.

Meanwhile, Europe has a long way to go before it can be confident it has enough scientists, technologists, engineers and mathematicians, and a generation of young people who value STEM and see it as a potential career choice.

The educators and others involved with Scientix have done a great job to date, but there is still much to be accomplished.

For more information on the best way to get involved – or increase your involvement – with Scientix, please get in touch:

-  www.scientix.eu
-  newsletters: www.scientix.eu/web/guest/newsletter
-  @scientix_eu
-  groups/ScienceTeachersEurope



SCIENTIX

The community for science
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