



ACADEMIA-INDUSTRY ALLIANCE

JOINT EFFORTS IN SCIENCE EDUCATION

**Report of a joint meeting of the Royal Irish Academy
and
the ALLEA Working Group on Science Education**

**Organised by
Odile Macchi and Peter Mitchell**

**Held on 20-21 November 2013
at the Royal Irish Academy, Dublin**

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PREFACE

It is a generally shared observation that the current European science education system is not completely satisfactory. In particular, it does not suitably prepare the scientifically literate workforce that the continent needs for its future.

The responsibility of the academies of science and humanities is to offer fora and possibilities where young people are shown how exciting it is to acquire new knowledge, to apply new knowledge and to communicate about new knowledge. It is important that a joint strategy is developed in order to support the education of our young people, especially in those fields where the societal need is currently not fulfilled: mathematics, informatics, natural sciences and engineering. There are two main paths that together can help to solve this problem.

The first approach utilises a strong and sustainable cooperation between the academic and the business worlds. Science curricula and skills taught to pupils should be defined in a coherent manner with the needs of industry in mind. The second channel requires political advocacy by academies of science and humanities and by their international networks. Their voices are indeed listened to by society and politicians, both at the local and the European levels.

These two routes towards rectifying the flaws in European science education were the subject of reflection at a two-fold European event that took place in November 2013 in Dublin, Ireland and was jointly organized by the Royal Irish Academy and ALLEA, the European Federation of Academies of Science and Humanities.

On 19 November 2013, under the title 'Academia-Industry Alliance: Joint Efforts in Science Education', a selected Forum considered how we can knit a stronger cooperation between the education and the corporate worlds. The speakers are all highly regarded international figures from the political, economic, and academic sectors. A report of this Forum comprises Part 1 of the present booklet.

On 20 November 2013, an international meeting of academicians belonging to the ALLEA Working Group on Science Education (which is also the European council of the science education programme of InterAcademy Panel, the global network of science academies) reflected upon the second question of how national science academies can influence science education reform. Each participant reported about the present state of science education in his particular country and the actions of his or her academy to improve it. Of course, each situation is highly dependent on the respective country, but overarching patterns can certainly be drawn from these reflections. With a selection of these national reports, Part II of this booklet offers a panorama of how European science academies act in this context.

In the end, this report seeks to draw some general conclusions about the present state and future perspectives of science education in Europe and the ways we can improve this situation while also considering the assistance and support that the business world can offer to help achieve much-needed reforms in the European science education system.

We wish the reader enjoyable and informative reading and hope that this report provides comprehensive and illuminating insights into this complex challenge facing Europe today.



Professor Günter Stock
President of ALLEA



Professor Eugene Kennedy
Science Secretary
Royal Irish Academy



Professor Odile Macchi
Chair of the ALLEA Working
Group on Science Education

Part 1:

Report of the Royal Irish Academy and All European Academies Forum

‘Academia - Industry Alliance - Joint efforts in Science Education’

Wednesday, 20 November 2013

1.1. Introduction

Odile Macchi, Member of the French Académie des Sciences and Chair of the ALLEA Working Group on Science Education

Peter Mitchell, Member of the Royal Irish Academy

Part 1 of this booklet focuses on the discussions that comprised the Forum ‘Academia-Industry Alliance: Joint Efforts in Science Education’. The following four key elements make up the framework to synthesise these discussions.

The societal context: This twenty-first century, as we face the various challenges and threats to our environment and civilization, the pace of scientific advancement and technological development has never been greater. To maintain sustainable national economies, there is a wide European consensus that countries need a scientifically literate workforce and new entrants possessing the requisite skills and training in mathematics, science, and technology. Moreover, the demands of a rapidly evolving marketplace and the well-being of an increasingly complex society require a flexible workforce with career-long upskilling and re-training. Such a workforce can only be maintained if supplied on a continuous basis by new entrants who are innovative, enterprising and proactive at problem solving.

The side of academia: New pedagogical approaches of science education aim to prepare the young with the scientific skills and innovative qualities required by the business world. A reversal of school science teaching pedagogy from mainly deductive methods to investigative ones that appeal to the students’ creativity generates an increased interest by pupils and better teacher satisfaction. The

inquiry-based science education (IBSE) pedagogy fulfils this challenge. It was promoted first in the USA in the early nineties by the Nobel prize winner Leon Lederman. In 1996 in France, another Nobel prize winner, Georges Charpak, and the *Académie des Sciences* launched the *La main à la pâte* action at primary level. Then, IBSE programmes were implemented in a number of European countries at primary school level, and sometimes lower secondary level, with encouraging results to date. Many national academies of science that were worried about a shortage of high-level scientists became very supportive of this method. In fact, the improvement of science education has become a challenge in most European countries. This is why the ALLEA network of academies launched a group, which involved representatives of 25 European academies, in 2006 to reflect upon the question.

The side of industries: Twenty years ago, companies felt that science education was not their business, but in the past two decades that mindset has changed owing to the shortage of science-educated employees. Major corporations and industries have realized they should influence education and specifically science education. While criticizing the inadequacy of purely theoretical science education and rote learning in secondary schools, they ask for a more project-based learning and hands-on experience of science in everyday life. They know that desirable qualities of the workforce are nurtured within early and middle school and critically depend on the pedagogical approach. Certain companies became increasingly engaged over the years in the promotion and renewal of science education at school level, investing time, bright ideas and money in local high schools. Their interventions in schools are at the same time a short-term help for teachers and a long-term beneficial investment for them: they promote youngsters’ knowledge about working life, for a higher quality of future employees. Although primary school is not often considered, there are very interesting exceptions with some big corporations, which understand that the shortage of adequate skills is a very long-term risk.

At the national level, several corporations join their efforts with Ministries of Education and the teaching profession. Interesting examples of Irish, French and other similar international initiatives are presented in Part I of this booklet. In Ireland’s case, the corporate sector’s engagement is perhaps

best illustrated by its support for the annual exhibition 'British Telecom Young Scientist and Technologist of the Year' for the past 50 years. At European level, there is the project InGenious. This strategic partnership between major industries and the European Ministries of Education, supported by the European Commission, aims to reinforce young Europeans' interest for education and careers in science, technology, engineering, and mathematics (STEM) and thus addresses anticipated future skills gaps within the European Union. In 2013, InGenious performed an in-depth survey of the already existing links in Europe between schools and industries.

The academia-industry alliance: In most countries the issue of education is a critical one for the government for a number of reasons. Moreover, educational systems in general, and science education in particular, are long-term (over 15 years) social matters, much longer than political mandates. As a result, although many educators all over Europe are convinced of the necessity to renew school science education, the sole will of politicians is not enough. We believe that an in-depth renewal of science education can best be achieved in the context of the closest cooperation between the key stakeholders involved, namely academia in its broadest sense (schools, universities and academies), ministries for education, and the corporate/industrial sector - the future employers of the great majority of young graduates. Industry's representatives have to work with expert groups of the national department of education. The academia-industry alliance is a win-win process for both business and educators. This is the reason why the Royal Irish Academy and ALLEA organized this Dublin Forum: although modest, it is one more stepping stone to promote a scientifically and technologically literate society in possession of an entrepreneurial and innovation workforce.

1.2. Opening of the Forum

[Professor Eugene Kennedy](#), Science Secretary, RIA, welcomed participants to the forum, noting the attendance from many academies across Europe to address the important challenge of developing joint academic/industry science programmes for the benefit of both the economy and society.

He thanked Professors Macchi and Mitchell

for devising the forum's theme and driving its organisation at the RIA.

He also welcomed the newly established Irish STEM Education Review Group, which was setting in motion its work under the chairmanship of [Professor Brian MacCraith](#), who also served as Chair of the RIA/ALLEA Forum. He noted Professor MacCraith's strong record in innovation, in the interface between academia and industry and in STEM.

Professor Kennedy referenced the key role of teachers in the area of science education, noting that attitudes were formed in school students at an early age.

With regard to the Irish STEM initiative, he believed that the science community should support the Irish government agenda to embed STEM through growing the numbers of students taking science subjects and increasing resources, citing positive Irish initiatives to date such as the Young Scientist competition, reforms in teacher training and in the junior secondary-level curriculum.

Professor Kennedy looked forward to the briefing document to emerge from the RIA/ALLEA forum as a significant contribution to the ongoing drive for a joint academia-industry interface to grow science literacy and skills.

Concluding his introductory remarks, he thanked Sinéad Riordan and Paul Lynam of the RIA for their work in organising the forum, its programme and logistics.

Professor Kennedy pointed out how appropriate it was that the forum was meeting under the gaze of William Rowan Hamilton, the distinguished mathematician and physicist, and commended to the forum the motto on the medal received from the Hungarian Academy of Sciences on the occasion of its one hundred and fiftieth anniversary, which placed science at the heart of learning. That motto reads 'The real power of a nation lies in the number of its scientifically educated heads'.

Responding, Professor MacCraith welcomed the fact that Irish domestic deliberations on STEM were being enhanced by the ALLEA participants' contributions. He noted that investment in and development of science learning and application were vital for all economies and the forum provided

scope for shared experience and convergent thinking, in particular with regard to IBSE.

[Mr Seán Sherlock, T.D.](#), Minister for Research and Innovation, Ireland, gave the forum's opening address, noting the current Irish STEM initiatives in train, such as the Research Prioritisation Strategy and the rollout of Project Maths at junior secondary level with its adoption of the Inquiry Based Science Education (IBSE) approach.

He affirmed the perspective of the Irish government that we need to triangulate academia, industry and government policy in order to align academic and industry strengths to secure smart jobs. He noted that the government focus was also on sustaining investment in smart people to create a quality framework around PhDs to deliver the best impact for society. The minister referenced the STEM Education Review Group he had announced earlier that day (20 November 2013) with its focus on the optimal teaching of STEM and expressed his appreciation to ALLEA as their contributions would help to inform the STEM review as well as benefit his own knowledge.

1.3. International perspectives on science education

1.3.1. Industry–school–academy alliance for science education and research: the example of Saint-Gobain with a focus on diversity

[Professor Didier Roux](#), R&D Innovation Vice-President, [Saint-Gobain](#), addressed the forum on the topic 'Industry-school-academy alliance for science education and research: the example of Saint-Gobain with a focus on diversity'.

Professor Roux noted the shared challenges facing companies and economies. Saint-Gobain (SG) was founded in 1665 by Louis XIV and Jean-Baptiste Colbert to make glass and had made the mirrors for the palace of Versailles.

In recent years, SG has opened to the world. Now it is a global company, one of the world's top 100 industrial corporations, with operations in 64 countries, with glass accounting for only 10% of sales. The span of its activities comprehends four sectors: innovative materials, construction products, building distribution and packaging.

SG has adopted a deliberate strategy to become more innovative and competitive. It has become much more open to supporting start-ups and engaging with academics. Now it is engaged in more than 50 start-ups and is in Thomson Reuters Top 100 Global Innovators.

SG sees research and development (R&D) as an agent of innovation and has focused its strategy on growing seven strong research centres to prepare for the future and to prepare the future. These seven main R&D centres have a deployment towards Asia, the dynamic growth centre of the world. Each centre develops specific skills for the SG group, with a focus on shared platforms where activities interact, as this encourages the emergence of common projects.

Collaboration and coordination with suppliers and customers is essential in both marketing and R&D. This is achieved through the following means:

- A market and technological team devoted to emerging markets—TMTTechnoMarketingTeam
- A special organisation to deal with start-ups—NOVA External Venturing
- An international Academic Network—Saint-Gobain University Network (SUN)

The purpose of SUN is to identify the latest scientific advances in the academic world; to secure access to top-level skills and to build research partnerships in emerging countries.

The main purpose of R&D in industry is to support innovation in order to maintain a leadership position and to open new markets. But R&D is also a reservoir of talent. Research is also a first step to production, marketing and management. Research is a good way to educate top-level managers not only to manage an industrial company but also generally to encourage greater adaptation and evolution.

In the experience of Saint-Gobain, the success benchmarks of innovation are:

- To make compatible the incompatible—like-minded people produce like-minded results
- To align creativity and delivery

- To learn how to waste time to save time

In building its talent pool, SG looks for diversity and academic excellence via increasing recruitment of candidates with PhDs. Diversity includes both genders, different ethnic and social origins, and different personal journeys.

Within the Saint-Gobain group, R&D is an intrinsically more diverse community as science and technology have a long tradition of internationalism. This is reflected in the SG research centres, which have staff drawn from 45 different nationalities.

The experience of SG identifies the importance of encouraging scientific studies for young scholars coming from diverse backgrounds. Consistent with that outlook, SG is a strong supporter of the *La main à la pâte* IBSE programme in French primary schools in order to sustain and encourage participation in science.

1.3.2. inGenious, a European programme for a better connection between schools and industry

Dr Agueda Gras-Velázquez, Science Programme Manager, European Schoolnet, Brussels, spoke on the theme *inGenious*, a European programme for a better connection between schools and industry.

Dr Gras-Velázquez outlined the purpose and activities of *inGenious* to the forum. *inGenious* is the European Coordinating Body for Science, Technology, Engineering and Mathematics Education. It is a joint initiative launched by European Schoolnet and the European Roundtable of Industrialists (ERT) aiming to reinforce interest of young Europeans in science education and careers and thus address anticipated future skills gaps within the European Union.

Through a strategic partnership between major industries and ministries of education, *inGenious* aims to increase the links between science education and careers by involving up to 1,000 classrooms throughout Europe.

With a grant of €8 million from the European Commission's 7th Framework Programme over a three-year period, and the support of 42 partners from 20 countries, including seven major

industries, *inGenious* is one of the largest and most strategic projects in science education undertaken in Europe. The *inGenious* initiative aims to increase the interest of young Europeans in STEM education and careers, addressing two challenges: the lack of interest in these subjects and future skill gaps.

Under the programme, there is engagement by schools throughout Europe and beyond with companies at the local level. An observatory of good practice is being developed on industry engagement with schools drawing inter alia from the experience of European Schoolnet's network of 1,000+ teachers and from STEM initiatives at the national level. To date, 152 examples of best practice have been compiled from Europe and beyond. There are four categories of good practice:

- Providing resources to schools to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
- Establishing personal contact between STEM professionals and students
- Making company premises accessible to schools
- Engaging STEM professionals with students' work

In this context there are also four factors that influence young people in their choice of career:

- Student engagement in the study of STEM
- Information about careers and jobs in industry
- Awareness of whether the students' characteristics and interests fit with those required for STEM careers
- Social perception of work related to STEM careers

As a consequence, school–industry collaborations are especially addressed to students' engagement in the study of STEM and also to career information. There is a need to appeal to the personal characteristics and interests of the student.

Most of the data collected to date explain the evaluation procedure used but few actually evaluate

if the goals of the initiative have been attained. This underscores the necessity for longitudinal material to be compiled in order to correlate and codify the data with a view to establishing robust evidential material on the efficacy of STEM initiatives.

1.3.3. Questions from the audience

In the ensuing debate, the following issues were raised:

- It is very important to have the contribution of industry in designing STEM programmes as that is likely to produce effective programmes with effective engagement by industry.
- The possibility was raised for teachers to do sabbatical work in industry. There seemed to be a view that such initiatives could be productive but might need to be of at least three to four months' duration. Also, there is the issue of organisational fit. Industry is not used to academics and there would have to be good planning and preparation for industry to absorb a person with no company-specific skill. Clarity of the expectations on both parts would be essential.
- From the perspective of industry the question was raised as to how to demonstrate a return on industry investment in STEM, e.g. via volunteer hours school initiatives. The evidence is not there as yet to support the efficacy of such investment, so are there any supports for companies to develop the appropriate metrics? The forum concurred that the metrics issue was a serious challenge to be addressed.
- Operationally, it can be difficult for a STEM school/teacher to identify the appropriate company contact person. Would something like a central register of such persons at the national level help?
- There is also a need to make the variety of careers and prospects, which result from study of STEM more visible to young people and parents.
- There is much to be gained by researchers working in industry. It is not only what you learn, but also how you learn it. Developing a project in a big company entails working both independently and as part of a team, and learning the positive attributes of both. Many researchers go on to have careers that utilise an array of skills augmenting their skills as researchers.
- A generation of young people who are experienced users of social media and YouTube look to vox pops and short movies for their sources of information and influence. Interested in the new and in innovative products, they are not bothered by lack of finesse in such clips and definitely prefer 'raw but recent' videos to older videos with high production values.
- There was some discussion on how early to start with the engagement of children in STEM through IBSE. Most current STEM initiatives start around age ten, but there is also a body of thought that proposes 'the earlier the better' approach, noting that a question such as 'Why is the sky blue?' is legitimate to pose at any age.
- There is a need to expand finance for IBSE and underpinning measures such as continuous professional development (CPD) for teachers but also to develop quantitative data to back up the qualitative view of the value attained from IBSE.
- There is also a case against making IBSE too prescriptive and an obligation on teachers. In France, for example, IBSE is optional for teachers. Now, more than 30% of teachers at primary level carry out science lessons. This is good for diversity.
- In concluding the debate, Professor MacCraith referenced the interactive modes of learning being employed by Professor Eric Mazur at Harvard and the spread of peer instruction across universities in the USA, which suggests that some quantitative as well as qualitative evidence on IBSE might also emerge from the third level.



Photo by Paul Weaver

1.4. Current challenges and opportunities facing science education

1.4.1. Building minds for the future—how can business help?

Mr Tony Donohoe, Head of Education, Social and Innovation Policy, Irish Business and Employers' Confederation (Ibec), gave the keynote presentation to the forum for its second session. He addressed the forum theme 'Academia—Industry Alliance—Joint efforts in science education' from the perspective of industry and welcomed the opportunity provided by the Academy and ALLEA to engage on this important issue.

He also welcomed the constructive engagement of academia and industry, along with government, in developing and using alliances and partnerships to promote STEM and IBSE.

Mr Donohoe found the practical experiences set out in the presentations on Saint-Gobain and inGenious illuminating. He believed the challenge in embedding academic—industry alliances in order to deliver STEM by IBSE was considerable. While he believed that alliance and partnership is critical for the delivery of STEM, he noted that tension can arise between education and business and there is a need for a deeper mutual understanding. Notably, there may be a disconnection among the partners regarding timescales. Education is trying to shape minds for the future and works to a much longer time frame than industry whose timescales are set by the demands of competitiveness.

In any event, it would be necessary to be careful in outreach to promote STEM and not to patronise any sector of the target audience, e.g. girls. It was instead necessary to identify what motivates young people and to frame the message appropriately. His own view was that the pitch to engage with young people should take account of their altruism, and appeal to their potential to make a difference in addressing a challenge.

He set out five thematic areas where business can make its engagement with academia more systematic. These are:

1. Influencing policy

This is the single most important building block of constructive engagement. Ibec values its input into curriculum and training reviews, and supports the case for more progressive reforms intended to build the skills of investigation and problem-solving. Ibec also reserves the right to hold the education system to account—for example over the inadequacy of the time devoted to science in the primary-school curriculum and the low national participation rates in physics and chemistry in the final school examination.

2. Influencing curriculum

Ibec is not an expert on pedagogy but can comment on the skills of young people emerging from education and the relevance of those skills to employment opportunities. Ibec supports curriculum reform, particularly the introduction of IBSE via Project Maths and the junior secondary-level science curriculum.

3. Supporting teaching

Project Maths, the IBSE-focused change to the mathematics curriculum in Ireland is showing some very encouraging results. Ibec recognises that IBSE poses big challenges to teachers, and requires a huge amount of continuous professional development. Ibec values its membership of the Teaching Council, the teachers' professional body in Ireland, in helping to embed this important change.

4. Building partnerships

Ibec believes there is no better way of contributing to teachers' informal learning than through partnerships. Industry encourages employees to become STEM ambassadors, provides support to schools and colleges for career activities, and provides workplace visits and work experience opportunities to teachers and young people. The challenge is to make the most of this activity through coordination, sharing the learned experiences and leveraging local enthusiasm.

5. Capturing hearts and minds

The economic arguments for STEM are very powerful in Ireland, given the significant presence

of global companies. Science is a basic literacy with many natural links to other subjects. But there are also powerful societal arguments for STEM. Young people aspire to making a positive difference in the course of their lives; that vision can be realised by tackling grand challenges such as climate change, energy security, and the provision of clean food and water. Through STEM and IBSE we can tap into young people's sense of wonder for the common good.

1.5. Panel discussion: 'Current challenges and opportunities facing science education'

This stage of the forum programme featured four speakers whose contributions set the context for a wider discussion by the forum's participants. The speakers included:

- [Professor Odile Macchi](#), ALLEA Working Group on Science Education
- [Dr Cliona Murphy](#), St Patrick's College of Education, Dublin, Ireland
- [Dr Anne Looney](#), National Council for Curriculum and Assessment, Ireland
- [Mr Bill Kearney](#), IBM Ireland Lab

1.5.1. Professor Odile Macchi, ALLEA

Professor Macchi, who chairs the [ALLEA Working Group on Science Education](#), advised the forum; she spoke of the importance of STEM and the application of IBSE from the perspective not only of a scientist but also 'as a woman, mother and grandmother'. She agreed with Mr Donohoe that science should be exciting for children and engage with their feelings.

She noted that the 2012 ALLEA report '[A renewal of science education in Europe—Views and actions of national academies](#)', which details the views and actions taken by European national academies to advance the renewal of science education and maintain the passion for science and technology among the young, had been presented to President José Manuel Barroso and its findings were available to national ministries and other policymakers. It was written in response to a request by the European Commission seeking to establish the

national impacts across Europe of the Framework Programme pilot projects in the pursuit of better science education. It was further written, conscious of the ten million manufacturing jobs, 200,000 of these in Germany alone, which went unfilled due to lack of a science-educated workforce.

IBSE is seen as the positive way to disseminate knowledge of and enthusiasm for science among young people. It reverses school science-teaching pedagogy from mainly deductive to inquiry/investigative-methods leading to a more interesting treatment of issues and subjects by children and greater job satisfaction on the part of teachers.

One of the national programmes covered in the above-mentioned ALLEA report is France's *La main à la pâte*. *La main à la pâte* is centred on living sciences and technology, is taught in an experimental way and is experienced by the pupils as 'young researchers'.

La main à la pâte is a voluntary programme, i.e. individual teachers decide whether or not to participate, but it is growing across France with 35% of primary teachers now participating and the projections for its continued spread are positive.

It is a national example supported by the three pillars of education: government, academia and industry, with the training of teachers performed at university level. It is important to recognise that a curiosity-based approach towards problem-solving transcends national boundaries.

The European projects [SciencEduc](#), [Pollen](#) and [Fibonacci](#) have disseminated innovative pedagogical practices in science and maths and help national authorities to renew curricula and institutional structures.

The present challenge in order to embed IBSE is to devise and provide in-service training for one million teachers in the primary sector across Europe.



Photo by Tracy Lee Carroll

1.5.2. Dr Clíona Murphy, St Patrick's College of Education, Dublin, Ireland

Dr Clíona Murphy spoke on the topic 'Science education in Ireland: Current challenges and opportunities'. The summary of her findings are as follows:

The good news:

Teaching science

- Student and practising teachers hold positive attitudes towards teaching science
- Student primary teachers are more confident about teaching science after initial teacher education courses
- Teachers are affording students opportunities to engage with hands-on science

Learning science

- Positive attitudes towards learning science
- Opportunities to engage with hands-on science
- Opportunities to work collaboratively
- Performing above average on international assessment tests

(Murphy et al. 2013; Smith 2013; Waldron et al. 2009; Varley et al, 2008)

The not so good news:

Teaching science

- Tendency to adopt more traditional approaches rather than IBSE when teaching science
- Inadequate time being devoted to science and IBSE
- Teachers' lack of competence and confidence in using IBSE methodologies
- Insufficient provision of hands-on pedagogical courses at both pre-service and in-service levels for teachers

Learning science

- Infrequent engagement with IBSE
- Development of scientific skills
- Scientific content not particularly relevant to students
- Attainment in science

(Eivers & Clerkin 2013; Murphy 2013; DES 2008, 2012; Varley et al. 2008; Cheevers, Eivers & Sheil 2006; ICSTI 2000)

Ireland's comparative international rankings in science skills and science literacy are more or less static and the anecdotal evidence is that the amount of science taught in primary schools has fallen. There is a need for a sustained national programme of CPD with innovative models, active participation, feedback and continuity. The introduction of the four-year B.Ed. degree incorporating a science option is a positive development.

The post-primary curriculum also needs to be relevant. More time for science is necessary and more use should be made of the academia-industry partnership method.

What to do?

Dr Murphy's findings from the analysis above on the steps Ireland should take are as follows:

1. Teacher education

Continuing professional development:

- Sustained national CPD programmes
- Novel approaches to CPD

Initial teacher education:

- Specialisms in science education (primary)
- Science pedagogy courses (post primary)

2. Science curricula

- Review content
- Assessment more in keeping with IBSE

3. More time to be allocated to science within the curriculum

4. Partnerships—develop and optimise partnerships with industry.

1.5.3. Dr Anne Looney, National Council for Curriculum and Assessment, Ireland

Dr Anne Looney, CEO, National Council for Curriculum and Assessment, Ireland, spoke to the forum on the curriculum within the context of the social imaginary i.e. the set of values, institutions, laws and symbols common to a particular society. The curriculum embodies continuity, i.e. the set of stories one generation tells to the next, but it also exists to bring about and broker necessary reform.

This is difficult to achieve, particularly in an era of uncertainty.

There are certainly challenges with regard to STEM. The Trends in International Mathematics and Science Study (TIMSS) data indicate that motivational interest in science present at age eight drops between the ages of eleven and fifteen, which would suggest that in Ireland we focus far too much attention on fourteen to eighteen year olds.

Now we have 97% of three year olds in pre-school, we should be looking at introducing and applying IBSE in the early years of the primary curriculum.

Referring back to the social imaginary, we have to take account of the fact that the focus on IBSE and learning through play is challenging not only for teachers but also for parents. In older children there may also be resistance to the concept, because they feel it is the job of the teacher to deliver that, not them and their peers.

The implementation of change in introducing IBSE will come about not only via improved metrics, valuable and essential as they are, it also has to be a public hearts and minds project because it is not just policymakers who have to be won over. It is also the public and the public representatives that they elect.

That said, important new modalities of learning are under way in Ireland, for example through Project Maths and in the junior secondary-level science

syllabus, where a consultation is currently taking prior to review.

Immediate challenges for Ireland include:

- Correcting model divergence between the science syllabus at primary and lower-secondary level.
- Applying standard testing for maths and science competence at age fourteen.
- Fostering systematised engagement between industry and academia and possibly branding this under a common name and developing a common metric for assessing these initiatives.
- Opportunity to focus on the youngest children for the application of STEM via IBSE.

1.5.4. Mr Bill Kearney, IBM Ireland Lab

Mr Bill Kearney, Director, IBM Ireland Lab, spoke from the industry perspective on promoting STEM in education and supporting ICT initiatives to increase the supply of the necessary industrial skills.

He referenced, for example, IBM support and mentoring for CoderDojo, the open source, volunteer-led movement running free coding clubs and regular sessions for young people. At Dojos, young people between five and seventeen learn how to code, develop websites, apps, programs and games.

Industry very much shares the view that if you become a scientist you can change the world, and will work cooperatively with academia to re-enforce that perspective. The issue is how the industry-academia alliance can have the greatest impact. Industry supports a common branding as that will help to develop awareness of STEM. It should also be possible to use social media as a means to connect with young people. Industry strongly supports the IBSE approach to learning and the necessary underpinning to give effect to this through CPD for teachers going forward.

Questions from the audience

In the ensuing question-and-answer session with

the audience, the following issues were raised:

- In Ireland, a disproportionate amount of time is spent on teaching religion as compared with science. Could these allocations be reversed?
- Given its highly centralised nature, the weekly subject teaching requirements of primary teachers in Ireland are much less flexible than elsewhere in Europe, e.g. France. Most European countries do not have a weekly timetable. Ireland is also anomalous in having the same timetable for seven to eleven year-old children. This suggests a priority should be to move to more flexibility in the timetable and to differentiated timing frameworks appropriate for each age.
- At primary level in Ireland, science is categorised under the rubric of geography, history and science (total provision of three hours a week). There are too many teaching objectives at primary level. More time should be spent on literacy proper and giving children time for IBSE.
- As compared with Ireland, primary school teachers in France have considerable scope to organise timetable hours and apply IBSE.
- New modalities of learning are happening at the upper end of primary education. The TIMSS and other corroborative data, e.g. a longitudinal study in the USA, show a drop in interest in science at the time of transition to secondary level. There is greater disengagement in mathematics science and technology than other subjects, with a consequent impact on stated career choice, a stance unlikely to change for the remainder of secondary-level education.
- The decrease in the science interest of pupils as they move from one part of the education system to another is a big problem. This also coincides with the shift from inquiry-based to knowledge-based learning. Teachers themselves trained in the knowledge-based system can find it very difficult to change to IBSE, which creates a very significant CPD challenge.
- The partners in education need to engage with stakeholders to persuade stakeholders of the value of change.
- The heart of the school curriculum should be the

idea of child engagement with each subject as an inquirer—scientific inquirer, history inquirer, etc.

1.5. Concluding Remarks

In his final remarks [Professor Peter Mitchell](#) firstly expressed his thanks to Professor Macchi for her idea to hold the forum. He thanked the speakers for their contributions and noted that a briefing report would be the output of the forum and contribute to the ongoing debate on academia–industry partnership in science education and to ongoing engagement on the further integration of IBSE in the education system. He summarised:

- the case for IBSE-focused learning is overwhelming
- there is a need for sustained investment in teacher CPD and retraining
- there is a need for metrics and compelling data to establish the case for IBSE
- the positive contribution that a diversity of talents and roles across the spectrum can bring to research and innovation
- the role industry plays in influencing policy, supporting teaching, and capturing hearts and minds.

Professor Mitchell also cited the editorial in the April 2013 edition of *Science* on scientific pedagogy, which urged the harnessing of the wisdom of teachers, corporate involvement and the catalysing of major developments in third-level teacher education. Professor Mitchell also thanked the RIA officials for organising the forum and wished [Professor MacCraith](#), Chair of the Forum, well with his objective of producing the report of Ireland’s STEM Education Review within the six-month time frame.

In closing, [Professor Macchi](#), Chair of ALLEA working group on science education, thanked the Academy for hosting the forum. She noted that science is the way to peace, whichever cultural route is taken, and that we share with developing countries ‘the future of our kids and grandkids’.

Part 2:

Country Case Studies of Industry Academy Alliance

2.1. Introduction

Odile Macchi, Chair of the ALLEA Working Group on Science Education and Member of the Académie des Sciences

The first part of this booklet has described the way industry and big companies try to overcome the shortage of science-educated workforce by working hand in hand with schools.

This second part displays typical examples of how national academies try to encourage the passion for science and technology among the young and adults. It describes their actions to renew science education and raise awareness of the various stake-holders in this field.

Although implementation of education remains under the sole responsibility of the member States, the renewal of science education is a research question that the European Union has to consider. This is why national science academies have not tackled the question in an isolated manner, but in connection with other European academies: scientists are used to international actions and European programmes. In effect, science transcends the usual divides and national boundaries. Academicians compare the situation of science education in their own country to other European countries, hence the importance of European networks and programmes.



Photo by Ohio Sea Grant and Stone Laboratory



Photo by Brad Flickinger

One pioneering programme to improve science education was launched by the French *Académie des Sciences*: the *La main à la pâte* programme was initiated in 1996 by three academicians, G. Charpak, P. Léna and Y. Quéré. It is basically an IBSE pedagogy centred on living sciences and technology, taught in an experimental way and experienced by students as ‘young researchers’. It received strong support from the French Ministry of Education, initiated a true change in the science classes of primary schools and acquired a wide international recognition in the past decade.

In 2007, the European Commission issued the ‘Rocard’s report’ entitled ‘Science education NOW: A Renewed Pedagogy for the Future of Europe’. This gave a strong impulse to the renewal of science education throughout Europe. Successive European pilot programmes on investigation-based science education (IBSE), especially in primary and lower secondary schools, have since been implemented successfully: Scienceduc, Pollen and then Fibonacci (which terminated in 2012) have disseminated innovative pedagogical practices in science and math.

In 2006, a structure to coordinate European academies was launched by Pierre Léna on the question of science education, under the umbrella of the science education programme of IAP (the InterAcademy Panel). It became the working group of ALLEA now chaired by Odile Macchi. It is actively promoting local IBSE initiatives and expanding them throughout Europe as well as farther afield in Africa. Its in-depth survey about the efforts of European science academies entitled ‘*A Renewal of SE in Europe-Views and Actions of National Academies*’ was edited in June 2012. It describes 25 national science education contexts. The examples gathered in Part II below are among those detailed in this 2012 ALLEA report.

2.2. ALLEA Working Group on Science Education – Country Case Studies

2.2.1. Jan Zima, 'A report on the current activities of the Academy of Sciences of the Czech Republic in the field of Science Education'

The Academy of Sciences of the Czech Republic (ASCR) is extensively involved in activities related to the field of science education. There have been various projects implemented by the ASCR aimed at improving natural science education, financed by the European Social Fund and the national budget. These projects have been aimed towards practical training and courses tailored-made for high school science teachers to improve their professional skills and the quality of high school education. The educational project Open Science II is intended for students of secondary schools. The project has endeavoured to arouse the interest of secondary school students in natural science and technical fields and has opened access for students to scientific and research workplaces. Multidisciplinary seminars were organized to create links between the different branches of science.

From September 20 – 24, 2013 the Academy of Sciences of the Czech Republic, in close cooperation with the Ministry of Education, Youth and Sports, hosted a prestigious science contest for talented young students – [European Union Contest for Young Scientists \(EUCYS\)](#). The EUCYS is an initiative of the European Commission that was set up with the goal of promoting cooperation and interchange between young scientists and guiding them towards a future career in science and technology. A show of prestigious projects by young talented scientists was held in the Czech Republic for the first time. The exhibition took place at the Exhibition Grounds in Prague, where 124 participants from 37 countries arrived and a total of 83 projects in nine award categories competed: biology, chemistry, computer science, engineering, environment, mathematics, medicine, physics, and humanities.

The Week of Science and Technology is the most extensive science festival in the Czech Republic and takes place every year in November. The thirteenth annual festival took place from 1 – 15 November 2013 in all the major cities of the Czech Republic and offered more than 500 events. The lectures and

excursions were aimed particularly at secondary school students who had the opportunity to attend lectures, exhibitions, excursions, science cafés, documentary films, and look into scientific workplaces, laboratories, and libraries to learn how science is conducted. On the whole, the event was attended by tens of thousands of visitors.

2.2.2. Odile Macchi, 'Progress in science education and alliance with industry in France'

A) The *La main à la pâte*¹ programme stands at the origin for primary schools.

It was founded in 1996 by the academics Georges Charpak (Nobel Prize), Pierre Léna and Yves Quéré. The programme was managed by the *Académie des Sciences* and received financial support from the ministries of education and of higher education and research. It led to the establishment in 2000 of the National Plan for the renewal of science and technology teaching in schools, which was followed in 2002 by new science curricula in primary schools. A network of pilot centres is established at about twenty sites spread out through France so that local innovative systems have come into being, which bring together very different partners on district, town or departmental level. They involve almost 3,000 classes and form special areas of widespread dissemination of the *La main à la pâte* approach. A hands-on programme for junior high school is also implemented in a few hundreds of schools.

B) The common base of knowledge and skills was defined in 2006-2007.

For the first time, the government defined what a pupil should have acquired at the end of his/her compulsory school years. The Minister of Education released a decree outlining the skill set all pupils should master by the age of 15. It involves seven items:

- 1) Mastering the French language
- 2) Speaking a modern foreign language
- 3) Acquiring basic knowledge in mathematics and a scientific understanding
- 4) Developing a humanist understanding

¹ *La main à la pâte* in French means collaborative hands-on work.

5) Mastering common information and communication technologies (ICTs)

6) Acquiring social and civil skills

7) Developing initiative and autonomy

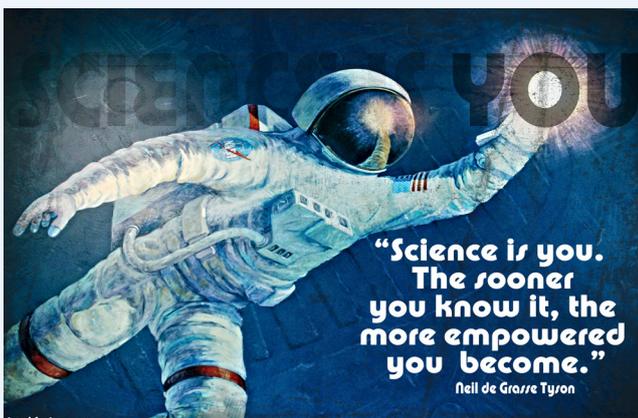
In the decree, each item is declined as -knowledge, -abilities, -attitudes. But, in practice, there is not yet a national usable tool to check that these goals have been reached.

C) The foundation *La main à la pâte*

The programme became a foundation in October 2011, with support from both ministries of education and from several major companies. The aim is to renew and expand science teaching in primary education in France and contribute to this in a large number of countries. For this purpose it is recommended that teachers implement an inquiry process combining exploration of the world, scientific learning, experimentation, mastery of language and argumentation. The staff involves approximately thirty people.

D) A report of the education commission of the National Assembly

In October 2013 an important political report has recommended the renewal of science education in basic schools and the promotion of training for science teachers.



2.2.3. Benő Csapó, 'Progress in Science Education in Hungary'

Participation in international projects

Hungary participated in two FP7 supported Inquiry-Based Science-Education Projects.

1) The **PRIMAS** (Promoting Inquiry in Mathematics and Science across Europe) project

PRIMAS aimed to promote inquiry-based methods in mathematics and sciences by supporting teachers to develop new teaching and learning methods. The project was carried out between 2010 and 2013. Hungary was represented by faculty members of the Institute of Education, University of Szeged. Although the project ended, the dissemination of the results continues.

2) The **SAILS** (Strategies for Assessment of Inquiry Learning in Science) project

The SAILS project is being carried out between 2012 and 2015 with the participation of 12 countries. Its main aim is to develop assessment strategies related to Inquiry-Based Science Education. Researchers from the University of Szeged are responsible for leading the activities of a work-package which aims to identify the goals and expected outcomes of inquiry-based learning, develop assessment frameworks and propose assessment activities.

National activities

1) Developing an online assessment system for the first six grades of primary schools

The '**Developing Diagnostic Assessments**' project (2009-2014) aims to establish a computerized platform which can accommodate an item bank with tens of thousands of items for three main domains, including science. The first phase of the project focused on the theoretical foundations, including reviewing former research on learning science at a young age, and the impact of scientific activities on cognitive development. Several thousands of teachers have been receiving in-service training within the framework of the project. The next phase of the work will concentrate on interventions and differentiated developmental activities for students with developmental disorders.

2) Student laboratories

A **network of student laboratories** has been established with the participation of high schools in the major towns of Hungary. These laboratories may be used for demonstrating

science experiments, disseminating results of IBSE projects and training teachers to use inquiry-based teaching methods. The first such laboratory was opened by József Pálincas, the president of the Hungarian Academy of Sciences in the practicing school of the University of Szeged.

3) Involving science in the regular assessments

In Hungary, within the framework of the national educational assessment system, every student in Grades 6, 8 and 10 is assessed in reading comprehension and mathematics at the end of every school year. Science has been proposed by several stakeholder groups as a third domain of assessment. Inclusion of science in the regular assessments would provide school leaders and decision makers with feedback on the state of the student achievement. Framework development and feasibility studies for such an assessment are in progress.

4) Science as a mandatory subject of the matura examination

The ministry responsible for public education prepares a reform of the Hungarian school leaving examination, the matura. The Presidential Commission on Public Education of the Hungarian Academy of Sciences reviewed the proposals and recommended science to be one of the mandatory subjects of the matura.



Photo by Monkey Business Images

2.2.4. Peter Mitchell, 'Progress in science education and the promotion of science in alliance with industry in Ireland'

Actions by State Ministries, Councils and Review Groups

(A summary of recent actions and initiatives in science education at national level by Ministries and other State Bodies)

- The Irish National Literacy and Numeracy Strategy, published in 2011 by the Irish Department of Education & Skills, has increased the amount of time devoted to literacy and numeracy in the classroom. There has also been significant investment in Continuing Professional Development (CPD) of teachers in order to fully implement the Literacy and Numeracy Strategy.

- The Project Maths Development Team set up by the Department of Education & Skills has, over the last five years, carried out the challenging task of implementing Project Maths at post-primary level. While the Chief Inspector's Report 2010-12 points to the many challenges that still exist for teachers if Project Maths is to be successfully implemented, the report also highlighted the evident commitment of teachers to developing a Project Maths approach.

- New Exploration Station: National Interactive Science Centre announced by the Office of Public Works, 1 November 2013. Essentially a new science museum specifically geared to fit with primary and secondary school curricula, with a view to engage students in science, technology and innovation and thereby increase the numbers of graduates in those fields to meet future employment needs in the technology sectors.

- The launch of the Science Technology Engineering Mathematics (STEM) Education Review Group on the 20th November 2013 by the Minister of State at the Department of Education & Skills in conjunction with the RIA-ALLEA Open Session on an Academia-Industry Alliance. The terms of reference of the Review Group include: preparation of teachers (at First and Second Level) for STEM education in Ireland; the use of inquiry-based and problem-based learning approaches and the impact of different assessment modalities for STEM subjects in the context of, but not limited to, the developing

Junior Cycle reforms; the use of technology to enhance learning (especially on-line approaches) and the way in which the private sector could provide support for increasing engagement in and the understanding of STEM subjects by students.

- The [National Council for Curriculum and Assessment \(NCCA\)](#) is reported by the Department of Education & Skills to be making impressive progress in the advancement of STEM Education.

- The reform of the [Irish Junior Cycle](#) will see the introduction of short courses in Programming and Coding, and in Digital Literacy. The Royal Irish Academy (RIA) has recently (January 2014) made a submission to the NCCA in relation to the reform of the science component of the Junior Cycle.

- The revision of the science syllabi at senior level is ongoing with revision due to be finalized by the NCCA in 2014.

Initiatives and events in alliance with industry and the corporate sector

(A summary of recent initiatives and events related to science education and its promotion by academia and state organs in collaboration with industry and the corporate sector)

- The Smart Futures programme run by Discover Science & Engineering (DSE) through Science Foundation Ireland (SFI) is a national government-industry campaign aimed at second level students in Ireland, which seeks to highlight career opportunities in STEM sectors such as medical devices, information and communications technology (ICT) and energy. The Smart Futures WorkXperience programme, run in conjunction with CareersPortal.ie and supported by the IT sector, is one of a number of initiatives designed to engage with students, parents, teachers, career guidance counsellors, stakeholders and the wider community in order to stimulate an interest in science and technology as a potential career option and to influence subject choice at second and third level. The Smart Futures STEM Careers Week ran on this [website](#) from 29 April – 3 May 2013.

- National Science Week, 11 – 17 November 2013. The aim of Science Week is to promote the relevance of science, technology, engineering and mathematics in our everyday lives and to

demonstrate their importance to the future development of Irish society and the economy. Science Week is a Discover Science & Engineering (DSE) project. DSE initiatives are managed by Science Foundation Ireland on behalf of the Office of Science, Technology and Innovation at the Department of Jobs, Enterprise and Innovation. Numerous events, based around science and technology take place throughout Ireland during this week, every year.

- RIA-ALLEA Open Session on an Academia-Industry Alliance, Dublin, 20 November 2013.

- [BT Young Scientist and Technologist of the Year Exhibition](#), 8 – 11 January 2014. This year saw the exhibition enter its 50th anniversary, making it one of the longest standing exhibitions of its kind in the world. It was also the largest exhibition to date with 2,000 projects (involving 4,418 students) from 379 secondary schools (50% of total in the Republic of Ireland) submitted for consideration. All entries were screened and 550 projects (involving over 1,200 students) were selected to compete in the Royal Dublin Society. The event attracted over 45,000 people. This year's winning project was entitled: Contributions to cyclic graph theory – a mathematical analysis of aspects of graph theory including efforts to solve problems in this important area of mathematical research.

2.2.5. Giancarlo Vecchio, 'Progress in science education in Italy'

The results obtained by Italian students in science and mathematics are below the international standards. Science education in Italian schools, as in many other European and non-European nations, is still mainly offered in a traditional way. This is certainly one of the causes of the low scientific literacy level in Italy.

Following an agreement protocol jointly signed in 2010 by the [Accademia Nazionale dei Lincei](#) (the main science academy in Italy) and the French *Académie des Sciences*, aimed at introducing and adapting the program *La Main à la Pâte* in Italy, which utilizes a typical IBSE methodology, the Accademia dei Lincei has begun a program, supported by the Italian Ministry of Education and in collaboration with the Italian Association of Natural Science Teachers (ANISN), aimed at

introducing the IBSE methodology in Italian primary and secondary schools. The program, which started from the necessity of renewal of science education in schools, a sector which is generally neglected in Italy, has been enlarged in the past two years in order to include two other priorities: that of enforcing the students' capacity of reasoning through a better comprehension of mathematics and through the amelioration of the Italian language teaching. Following the most innovative trends of scientific teaching in other countries, the Accademia dei Lincei is trying to obtain a strong link among the teaching of Sciences, Mathematics and Italian language with an integrated approach.

The program of the Accademia dei Lincei, denominated *I Lincei per una nuova didattica nella Scuola: una rete nazionale* ('The Lincei for a new teaching methodology in School: a national network') has been so far implemented through formal agreements signed together with the Italian Ministry of Education. The program is being carried out by the Accademia dei Lincei, in collaboration with local academies and other scientific institutions. It is at present active in 8 pilot centers (Bari, Bologna, Milan, Naples, Perugia, Pisa, Rome, and Venice). Each pilot center is coordinated by a member of the Accademia dei Lincei, in collaboration with ANISN and with natural sciences, mathematics and Italian language teachers. The coordination of the project is carried out by the Accademia dei Lincei in Rome. The current initiative is based on the success obtained during the academic year 2011-2012 by the program started by the Accademia dei Lincei and denominated SID (Scientiam Inquirendo Discere, 'Teaching Science by Inquiry'), which involved 4 pilot centers, 45 primary and secondary schools, 35 trainers, 150 experimenting teachers and 4500 students. The program was soon enlarged to cover mathematics and Italian language. For these subjects, the program has mainly been aimed at professional training of teachers and has involved 80 mathematics teachers belonging to primary and secondary schools. The Italian language course has been held in Rome, Cagliari, Parma, and Milan and has been given to 450 teachers belonging to more than 250 secondary schools.

The main aims of the program are, on the one hand, to enlarge the initiative in all national territories (new pilot centers are being activated in

Turin, Catania, Brescia, Sassari) and, on the other hand, to communicate at the international level the results obtained so far, as well as to bring the problem of scientific education renewal in schools to the attention of national and international government institutions through a conference held in Rome at the Accademia dei Lincei from 19-20 May 2014, directed at African, European and Mediterranean nations, denominated AEMASE (African, European, Mediterranean Academies for Science Education).



Photo by Public Affaris, USACE Buffalo

2.2.6. Salih Gashi, 'Progress in science education in Kosovo'

The Kosovo education sector is characterized by intensive reform efforts in all its sub-sectors aimed at addressing the key challenges of increasing participation and quality education, at present restricted by a limited level of available resources. During the last decade, many laws and by-laws have been approved, many schools have been built and many new institutions have been established. Significant efforts have been made to improve the curriculum and to develop and provide new textbooks.

Despite considerable improvements through education reforms, there are still many challenges to be met. The implementation of new policies for compulsory pre-education and upper-secondary education will require an additional number of trained teachers. In addition, more high-quality teaching aids and more classrooms are required. All of these are needed in order to meet the actual enrolment increase in secondary education, which currently is 32.3;1 (mainly in

urban areas). Due to demographic movements from villages to the cities, especially during last decade, statistics show that the population is distributed unevenly between primary schools and lower-secondary schools in rural areas and urban areas (urban schools are overcrowded, while rural schools may be half –empty). Many schools in Kosovo work in two or three shifts per day, implying that there are overcrowded classrooms associated with reduced length of classes and time spent at school. Early childhood care continues to experience a great lack of qualified educators during pre-school education. The quality of early childhood care and education is restricted to a small number of qualified educators.

Increasing enrolment, improving the retention rate and addressing fair gender issues in schooling will be highly dependent on improving the quality of education, ensuring the equal allocation of resources and overcoming the causes of drop-out, particularly among children coming from poor and vulnerable groups in society.

Addressing the aforementioned challenges requires a serious and thorough reform of all levels of education curriculum, as well as the creation of appropriate conditions and support for its implementation. The activities of Kosovo Institutions regarding SE projects are going in the right direction. The Ministry of Science and Technology has adopted some basic documents related to the functioning of the education system.

There are some adopted ongoing projects which can be summarised as follows:

Education Strategy 2011-2016
Kosovo's Curricula Framework

In 2001 Kosovo's Curricula Framework was adopted, where science is one of six teaching fields. The new Kosovo Curricula Framework was based on basic competences for three levels of curricula and followed by the development of competences in specific fields and contents:

The curriculum pre-primary and primary education in Kosovo (grades I, II, III, IV, V),

the curriculum for lower secondary education in Kosovo (grades 6, 7, 8, 9) and

the curriculum for upper secondary education in Kosovo (grades 10, 11, 12) are already prepared.

The Ministry of Education, Science and Technology has signed an agreement with the Regional Education Centre (REC) for the sustainable development of the education system.

The five year project 'Education for Sustainable Development in the Western Balkans', in agreement with the goals of the Economic Commission for Europe (UNECE), is based on sustainable development at all education levels. The REC prepared the didactic subject for environmental education known as 'Green Pocket'.

There are also various ongoing projects at the University of Prishtina supported by Tempus:

- Development of Regional Interdisciplinary Mechatronic Studies
- Creation of third cycle studies - Doctoral studies in Metrology
- International joint master degree in Plant Medicine
- Kosovo interdisciplinary Knowledge Triangle Center – PhD-based Education, Research and Training for Medical and Natural Sciences
- KIKT - Kosovo Interdisciplinary Knowledge Triangle - WUS AUSTRIA
- PhD in Food Science & Technology & Creating Capacities for PhD Reform at the University of Prishtina/Kosovo
- Competence at University of Prishtina
- Development of Human Rights Education at the Heart of Higher Education
- Interdisciplinary structure reformation and innovative higher education for new professions
- Empowering Universities to fulfill their Responsibility for Quality Assurance

There was an investment in infrastructure and human resources to improve the quality in the

education system but there has not yet been an effective evaluation of education reforms or the quality of education in Kosovo.

It would be in the interest of our institutions to cooperate closely with EU institutions in the projects related to science and education through the ALLEA Working Group and other institutions which do have precious experience in this field.



Photo by Desirae

2.2.7. Marieke Peeters and Carl Figdor, 'Progress in science education and alliance with industry in the Netherlands'

During the past decade, Science Hubs were initiated at several Dutch universities to create a link between academia and primary education. Young researchers and (upcoming) teachers work together on developing programs for primary schools. Below is an update of the activities during the past few years.

July 2012: Follow-up on Seven Science Hubs (Wetenschapsknooppunten) until 2016

The Royal Netherlands Academy of Arts and Sciences and the National STEM Platform 'Beta Techniek' from the Ministry of Education, Culture & Science together have financed seven Science Hubs for an additional four years. As outlined above, in these Science Hubs, universities work together with primary educational schools and often an expertise centre. The goal is to promote science education in primary schools and to teach children and (in service) teachers how science works. Most Science Hubs use IBSE as a leading pedagogy in their projects. More information can be found [here](#).

May 2013: The Exploratory Committee Science and Technology (Verkenningcommissie Wetenschap en Technologie), has given a set of recommendations for the Ministry of Education, i.e.:

- Develop a curriculum with clear learning lines regarding science
- STEM should be in the curriculum in primary education for at least 10% of the time
- CPD for primary teachers
- The collaboration between industry and school should be more focused on technology education instead of promoting technology, an example in the Netherlands is the JETNET program
- Develop assessment tools for STEM
- Make sure that schools incorporate their science activities in their school plan. Similarly, science education has to be listed in the school reports of pupils in order for the school inspectors to take science education activities into account when judging the performances of schools.

May 2013: Start of the 'DUTCH TECHNOLOGY PACT 2020'

Based on the recommendation of the Exploratory Committee Science and Technology, a Technology Pact was signed between partners in the industry and education.

Summary Dutch Technology Pact 2020

The Netherlands is a world-class player: when it comes to competitiveness, innovation, scientific research and education, we still rank among the front-runners in international comparisons despite the economic downturn. This excellent position is attributable to the high skill levels of our working population. The Netherlands aims to retain its position among the front-runners, but this will require sufficient numbers of smart and highly skilled technical people. Irrespective of whether we consider healthcare, energy supply, construction, industry, ICT, food production, or our main ports, technology is absolutely essential.

Despite all the existing initiatives and plans, the number of technology graduates is not increasing fast enough. Analyses by the Research Centre for Education and the Labour Market show that within the Netherlands alone, we will need to produce 30,000 additional technology graduates every year to meet the growing demand for skilled technologists. This requires additional efforts. Education providers, employers, workers, young people, the top sectors, and regional and central government have therefore agreed to a national Technology Pact. The Technology Pact unites the ambitions of the existing plans and initiatives, but aims to achieve them more quickly (by 2020) and with increased vigour.

To achieve its aims, the Technology Pact will focus on three lines of action lines with a horizon of 2020:

Going for technology: more school pupils choosing to study in the field of technology.

Examples of measures:

- By 2020, all 7,000 primary schools in the Netherlands will have science and technology in their curricula.
- The government will make available a one-off sum of €100 million to bring more science teachers into secondary schools and to allow teacher training programmes to devote more attention to technology. From 2014, technology will be a compulsory subject in teacher training programmes.
- The organised business community will establish an [online technology education portal](#).

Learning in technology: more school pupils and students with a technical qualification progressing to a job in technology.

Examples of measures:

- An investment fund will be created in which the central government, employers, and the regions will each contribute €100 million to invest in public-private education partnerships within the region. Businesses will contribute by releasing staff for guest teaching sessions, by investing in joint study programmes or by

providing vocational schools (VMBO and MBO) and universities of applied sciences (HBO) with technical installations, work placements, laboratories or machines.

- In the future, schools offering senior secondary vocational education will continue to receive higher funding for students following technology programmes.
- Businesses will offer internships or combined work-study places to all students following a technology programme (MBO).
- Businesses in the designated top sectors will make 1,000 scholarships available annually for technology-related study programmes at the universities of applied sciences and research universities with the aim of improving and increasing the enrolment of talented technologists.

Working in technology: retaining technology workers in the technology sector, and finding alternative jobs in technology for people with a technology background whose jobs are under threat or who have been marginalised.

Examples of measures:

- Social partners in the technology sector will produce plans for the sector in the second half of 2013. These plans will be aimed at reducing wastage of (young) workers, accelerated re-entry of qualified technologists who have recently become unemployed, upgrading knowledge, ongoing training, and the coaching of new recruits by experienced staff.
- To boost training and schemes to help redundant workers find alternative work, the government has earmarked €300 million to co-finance the plans for the sector. They will also make it easier for the unemployed to retrain for a job in the technology sector while keeping their unemployment benefits.
- All five regions of the Netherlands have their own Technology Pact.

This is a summary of the Technology Pact. See the full text and information on all measures [here](#).



Photo by Erik Schepers

2.2.8. Stevan Jokic, 'Information about Science Education in Serbia 2012-2013'

The Committee for Education of Serbian Academy of Sciences and Arts organized the regional conference 'Improvements in Subject Didactics and Education of Teachers' that took place from 24 – 25 October 2013.

The reason for this second regional conference was the fact that in many cases, the education of teachers leaves them without a personal grasp of the generating processes through which scientific concepts are gradually synthesized. Thereby, they are left without a deeper understanding of didactical transformation of the subject matter in the discipline they teach. The teachers' education seems to be a strategically critical period during which the improvements in this understanding can be attained. Therefore, the goal of this conference is the increase in quality of courses in subject didactics, focusing on a thorough reconsideration of all main teaching themes and imparting relevant historical facts as well as pedagogical, psychological and technological basics essential for a specific discipline.

Three plenary lectures were delivered by Ferdinando Arzarello, (Dipartimento di Matematica, Università di Torino, Italia, President of the International Commission on Mathematical Instruction), Pierre Léna (Member of the French Academy

of Sciences, Professeur émérite à l'université Paris Diderot, President of the foundation *La main à la pâte*, Paris), and Elena Pasquinelli (foundation *La main à la pâte*). In three sections – Mathematics with Informatics, Science, and Humanities – there were around 40 presentations given by researchers mostly from the southeastern European region.

During our activities on the implementation of IBSME in Serbia in the frame of Fibonacci project, we have developed new resources for teachers and maintained many domestic and international partnerships with the Academy of Sciences and Arts (support via the society, ALLEA, and international workshops), the Serbian Physician Society, the Serbian Ministry of Education, the School Publishing House *Zavod za udžbenike* (we have published the books *Seeds of Sciences* 8, 9), the weekly educational journal *Prosvetni pregled* (we have two appendices of 8 pages with a circulation of 7,000 copies with experiments for the primary schools), the IAP and French Academy of Sciences, the French Embassy in Serbia (two scientific exhibitions), and others.

On the website of the [Serbian Academy of Sciences and Arts](#), we have uploaded the translation into the Serbian language: 'A renewal of science education in Europe: Views and Actions of National Academies. A report of the ALLEA Working Group Science Education'.

On the website of our project 'Ruka u testu' we have uploaded the following translations into the Serbian language:

1. 'Assessment & Inquiry-Based Science Education: Issues in Policy and Practice', Wynne Harlen, 2013, published by the Global Network of Science Academies (IAP) Science Education Programme (SEP)
2. 'Les écrans, le cerveau...et l'enfant', Elena Pasquinelli et al., the Foundation La main à la pâte, France, 2012

We have also created new booklets and experimental boxes which can be viewed [here](#).

The partnership in Serbia between the worlds of education and business is very limited – almost nonexistent – and it is very difficult to expect changes to this situation. The unemployment rate

is very high and businesses, even big international companies, ask for financial support from our government for new investments and opening new posts. The educational sector tries to maintain contact with other countries concerning necessary changes in actual situations and the preparation of students for future jobs.

2.2.9. Andrej Kranjc, 'General development of science education in Slovenia'

During the autumn of 2013, the Slovenian Minister of Education and Science came to visit our [Academy](#). He was comprehensively acquainted with the tasks and achievements of the ALLEA Working Group Science Education and received an invitation to the AEMASE conference in Rome, 19 – 20 May 2014. A further meeting was organized thereafter with him.

With the support of the Ministry of Education and Science, our Academy has organized a series of small meetings under the common title 'Knowledge is value'. The meetings in the previous years were dedicated to the education in the fields of biology and natural sciences; the last meeting in 2013 was dedicated to the education in technical sciences and robotics. The presentations of these meetings have been published as separate booklets wherein the ethical component has been given a preeminent emphasis in each booklet.

Regarding the proposal for the new law on the Slovenian language in higher education, the Academy has been asked to provide its opinion on its contents. The Academy organised a round table with a broad spectrum of participants, including academics, school authorities, and school teachers. We are glad to say that some of the proposals suggested by the participants of the round table have been taken into consideration and eventually even incorporated into the recently passed law.

The House of Experiments, having been active in Slovenia for more than a decade, has achieved a very high level of popularity and this not just among the pupils, but also among their teachers. The Academy has been one of the most consistent and long-time supporters of the majority of the activities of this House.

The Slovenian Science Foundation organizes the Festival of Science every year. Its main aim is to increase the popularity of science in the frame of the primary and secondary education areas. These activities have brought many fruitful results and greatly increased the success of our science education. The Academy's continued support of these actions, with a committed participation of many academics who are tightly involved in these activities, is one of the most important safeguards for the high standards in our science education with possibilities for further improvements in the future.



Photo by Jose Kevo

2.2.10. Stanislav Dovgyi and Maksym Galchenko, 'Progress in science education and alliance with industry in Ukraine'

[The Minor Academy of Sciences \(MACS\) of Ukraine](#) is an educational system that aims at providing the organization and coordination of students' research activities, creating conditions for their intellectual, creative, and spiritual development and vocational self-determination to support the scientific potential growth of the country. MACS is subordinated to the National Academy of Sciences of Ukraine and Ministry of Education and Science of Ukraine. 25,000 secondary school students are annually involved in scientific research in 12 subject areas subdivided into 61 sections and guided by 6,500 pedagogues. CERN, XLAB, Argonne National Laboratory, Fourier, PHYWE, Institute Français are major organizations MACS collaborates with regularly.

Project launch

According to the Ministry of Education, Youth and Sports of Ukraine on April 18, 2012, № 476, 'On a nationwide experiment to implement innovative educational projects in schools of Ukraine' and 'Creating scientific and methodological principles of formation of children educational-research skills', the 'Blossom' research and experimental project was launched in 2012 at 16 educational institutions in Ukraine.

The purpose of the 'Blossom' is the elaboration of the system of development and formation of research skills of the preschool and junior school students in a specially designed environment of educational research activities in the framework of the informational and educational environment of the Minor Academy of Sciences of Ukraine.

Areas of the project implementation:

1. Special course 'Growing as researchers'. The main objectives of the course: the formation of the components of educational and research skills (intellectual, creative, informational, communicative, social, organizational, reflexive), the development of sensory, cognitive, emotional-volitional, and motivational areas.

2. Thematic Project 'Colors of knowledge'. The main objectives of the project: practical training in the use of educational-research skills in the study of the sun, water, air, and the Earth.

3. Distance educational-research activities. The main objectives: training in the use of educational-research skills while performing research tasks using Internet resources.

Regarding the programme of the innovative educational project 'Creating scientific and methodological principles of formation of children educational-research skills' for the years of 2011-2017, the following events have taken place:

in 2012:

1. National Scientific Conference 'Psychological and didactic principles of forming the educational environment of educational-research activities of children' – 350 participants.

2. National scientific pedagogical dialogues (within the 'Blossom' scientific and educational project) - 900 participants.

in 2013:

1. National Scientific Conference 'Educational-research activity of children: specifics of organization, psychological and didactic support, experience and perspectives' - 307 participants.

2. National scientific pedagogical dialogues 'Creating scientific and methodological principles of formation of children educational-research skills'.

3. A number of educational manuals and methodological guidelines editions for the pre-, primary and secondary school students on the topic of nurturing of educational-research skills were published in the frame of scientific methodological support of the 'Blossom' project.

Initiatives and events in alliance with industry and the corporate sector:

International seminar 'Gifted students – the source of perspective ideas for the industry: TheoPrax methodology as an integral element in education, science and entrepreneurship' in collaboration with [Fraunhofer Institute for Chemical Technology \(ICT\)](#) in Pfinztal, Germany.



Photo by NASA/Goddard/Bill Hrybyk

CONCLUSION

*Odile Macchi, Member of the French Académie des Sciences
and Chair of the ALLEA Working Group on Science Education*

In the first part of this report, members of the academic world (academies in particular) and the business world (industries in particular) have emphasized the threatening decrease of scientifically-educated students and declared their will to join their efforts in order to improve science education in schools and prepare a suitable workforce for the future of European industry and economy. Actually, a strong cooperation between these two worlds is already engaged in realising this goal.

In the second part of the report, each academic participant of the meeting of the [ALLEA Working Group on Science Education](#) explained the unsatisfactory present state of science education in his country. They expressed a consensus on the following ideas:

- the possibility to improve science education especially through IBSE;
- the corresponding mission of science academies and of the scientific world;
- the beneficial role of scientific youth events, contests etc.;
- the necessity to raise awareness of politicians and of society about this matter;
- the utility of past European programmes and peer-to-peer international exchanges.

Note that the [2012 ALLEA report](#) has already strongly emphasized these matters.

Obviously, there are diverse approaches and actions among these national academic reports. This reflects the variety of educational systems as well as social, regional, and political structures in European nations. In certain countries efforts focus on primary schools, in particular the inclusion of minorities and girls, while elsewhere there is an emphasis on nurturing talented students. Also, the envisaged impact and form of the activities launched by academies vary considerably, as well as the degree to which they were able to draw the attention of decision-makers and the duration and intensity of participation in the European Union co-funded science education projects.

But in all countries, the present challenge is to disseminate investigation-based methods to all primary teachers (1 million across Europe) by providing them with continuous professional development and in-service training. There is also the challenge of appropriately adapting the IBSE pedagogy from primary school to lower secondary school teaching. It is truly a systemic change. After a decade of successful pilot projects in science education, there are local or national programmes whose results will likely be accepted by communities, employers and employees, and teachers and parents as the basis for such a change. This in turn helps to prompt the necessary administrative or legislative measures, but it is not sufficient. High-level political decision makers must be convinced to use costly means to support the launching of wide national programmes. It will also require their courage for adapting curricula to IBSE approaches. Standard politicians would hesitate to support such reforms in the present severe economic context. But there is no choice if Europe seeks to retain its industrial and economical rank in the world.

Therefore, institutions with long life duration should engage in this battle. Science academies are among those institutions and they should improve their communication in particular with education policy makers. Big industrial corporates are among them too, with their very influential voices as major employers in a nation. A long-term academia-industry alliance with one single voice will empower a strong sense of pro-activity in politicians. Its lobbying efforts should convince educational decisionmakers and hasten the reform. This support is necessary for ministries to adapt local/national curricula and educational structures and secure the indispensable renewal of science education in schools. Such an alliance can also play a critical role at the European level, provided that, under the principle of subsidiarity, the necessary linkage between Europe-wide exchange and the structural impact at local, regional, and national levels is kept in mind.

Appendix 1

Speaker Biographies Forum “Academia-Industry Alliance: Joint Efforts in Science Education”



Mr Seán Sherlock, T.D.

Minister of State for Research and Innovation, Department of Enterprise, Jobs and Innovation and Department of Education and Skills with responsibility for research and innovation

Seán Sherlock was appointed as Minister of State at the Department of Education and Skills, and the Department of Enterprise, Jobs and Innovation with special responsibility for research and innovation in March 2011 by Taoiseach Enda Kenny. He is a T.D. for the Cork East Constituency.

Minister Sherlock is currently:

- A member of the Cabinet Committee on Jobs, Social Protection and Education
- A member of Cabinet Committee on Climate Change and Energy Security
- Chairperson of the Research Prioritisation Action Group

He was:

- First elected to the Dáil in 2007
- Appointed Front Bench Labour Party Spokesperson on Agriculture and Food
- A member of the Joint Committee on Agriculture, Fisheries and Food
- A member of the Joint Committee on Economic Regulatory Affairs



Professor Brian MacCraith

Chair of the Forum
President, Dublin City University (DCU)

Professor MacCraith holds a Personal Chair in Physics at DCU and is renowned internationally for his research on optical chemical sensors and biosensors. He is a member of the Royal Irish Academy (RIA), a Fellow of the Institute of Physics, a Fellow of SPIE (the international society for optics and phototonics), and a Fellow of the Irish Academy of Engineers. Professor MacCraith has had a substantial involvement in science, technology, engineering and mathematics (STEM) education activities through membership of the Institute of Physics Education Subgroup, the RIA National Commission for the Teaching of Physics

and various DCU committees dealing with this topic. Currently, he is a member of the Forfás Advisory Council on Science, Technology & Innovation. He is on the Boards of the Irish Business and Employers' Confederation (Ibec), Social Entrepreneurs Ireland, and the National Chamber Choir. He also chairs the Boards of SciFest and Genio.

In July 2010 he was inaugurated as President of Dublin City University, a position that he will hold for ten years. In September 2012 the first Strategic Plan ('Transforming lives and societies') under Professor MacCraith's leadership was launched by the Minister for Education and Skills, Ruairi Quinn, TD. Among a range of priorities, the plan highlights the president's commitment to issues such as innovation and entrepreneurship, technology-enhanced learning, engagement with enterprise, and a research agenda addressing global grand challenges (e.g. health, ageing, sustainability and digital society).

Guest speakers



Professor Didier Roux

R & D and innovation Vice President of Saint-Gobain
Member of the French Académie des Sciences

Didier Roux was born in 1955, former student of the École normale supérieure ENS de Saint-Cloud, he was a member of the Centre national de la recherche scientifique CNRS from 1980 to 2005. He is recipient of numerous awards and honours. He holds the silver medal of the CNRS. He created two start-up enterprises in 1994 and 1998 and was Deputy Scientific Director of Rhône Poulenc and Rhodia between 1997 and 2005. Since 1 June 2005 he has been R & D and Innovation Vice President of Saint-Gobain. He is a member of the Institut de France (French Académie des Sciences) and member of the National Academy of Technologies of France.



Dr Àgueda Gras-Velázquez

Science Programme Manager, European Schoolnet programme

Dr Àgueda Gras-Velázquez is the Science Programme Manager of European Schoolnet (EUN), a network of 30 ministries of education in Europe and beyond, which provides both ministries and schools with information services relating to education technology, outreach campaigns on specific educational topics and research activities. Agueda is in charge of overseeing and coordinating all the maths and science projects run by EUN. Additionally, she is in charge of the day-to-day management of Scientix (The European Commission's Director General Research's community for science education in Europe, created to facilitate regular dissemination and sharing of know-how and best practices in science education across the European Union, <http://scientix.eu>). She has a PhD in astrophysics from Trinity College Dublin, which she carried out at the Dublin Institute for Advanced Studies.



Mr Tony Donohoe

Head of Education, Social and Innovation Policy, Irish Business and Employers' Confederation (Ibec)

Tony Donohoe is head of education, social and innovation policy in Ibec. He is a member of the National Economic and Social Council, the Expert Group on Future Skills Needs, Business Europe Social Affairs Committee and the Board of the European Centre for the Development of Vocational Training (CEDEFOP). Ibec is the national voice of Irish business and employers, and is the umbrella body for Ireland's leading business sector groups and associations.

Panellists



Professor Odile Macchi

French *Académie des Sciences*
Chair of the ALLEA Working Group on Science Education

Odile Macchi's research field is signal processing. She was a pioneer in digital communications, designing modems with French companies. With 27 doctoral students trained, 230 published papers and several awards, she has made an important contribution to both the French and the international scientific community. She has been the recipient of several prestigious national decorations, is a member of the French Academy of Sciences, and chairs the science education working group of ALLEA.



Dr Anne Looney

Chief Executive of the National Council for Curriculum and Assessment

Anne Looney has led the National Council for Curriculum and Assessment (NCCA) in Dublin for over a decade. Prior to joining the NCCA, Anne worked as a post-primary teacher of religious education and English. She is a graduate of the Mater Dei Institute in Dublin and holds a doctorate in education from the Institute of Education in London. She has published on assessment policy, citizenship education, education and school policy, and school values and ethos. Among other recent work, she delivered Ireland's inaugural World Teachers' Day lecture, and participated in an Organisation for Economic Co-operation and Development external review team.



Dr Cliona Murphy

Lecturer in science education, St Patrick's College, Drumcondra, Dublin

Dr Cliona Murphy was a primary teacher for ten years and has been lecturing in the area of science education at tertiary level for over thirteen years. Currently, her principal work focuses on the research, development and facilitation of innovative pre-service, postgraduate and continuing professional development courses in science education and on the development of educational resources in science. She has conducted and published research in the area of the nature of science and inquiry-based science education. Dr Murphy was the Irish coordinator and principal professional development facilitator for Ireland in the European Fibonacci Project and she is the Irish coordinator for the Comenius project SUSTAIN.



Mr Bill Kearney

Director of the IBM Ireland Lab

Bill Kearney is Director of the IBM Ireland Lab, which develops world class software and services for IBM customers. Over the last decade he has managed significant growth and Intellectual Property creation in the lab and has been active in various university research collaborations, the Irish Research Council and Science Foundation Ireland Advisory Boards. Bill spent two years as the IBEC representative on the Irish University Quality Board and is currently on the Governance Board of the LERO research consortium and the Executive Council of the Irish Software Association. Current interests include promoting STEM in education and supporting ICT initiatives to increase the supply of needed industrial skills.

Prior to IBM, Bill worked for Lotus Development Corporation, Wang Labs and General Electric Corporation.

Bill holds bachelor's and master's degrees from the University of Limerick.

Academy members leading the Forum:



Professor Eugene Kennedy

Science Secretary, Royal Irish Academy

Professor Kennedy is professor emeritus and former Vice-President for Research at Dublin City University. He was elected Fellow of the Institute of Physics in 1987 and member of the Royal Irish Academy in 2004. He brought laser-based research at DCU to international prominence through applications of laser-generated plasmas to problems in atomic physics, laser-plasma source development and plasma diagnostics. He has coordinated major international European Union (EU) research networks and has been an invited researcher at the National Institute for Standards and Technology (Washington, DC), Hamburger Synchrotronstrahlungslabor (HASYLAB) and FLASH (DESY, Hamburg), LURE (Paris) and the Advanced Light Source (University of California at Berkeley).



Professor Peter Mitchell

ALLEA Working Group on Science Education

Peter Mitchell is an emeritus professor of physics at University College Dublin (UCD). He remains active at research level, specialising in the related fields of radiation physics, applied nuclear physics and radioecology, and has published extensively in these fields. He is a member of the editorial boards of several international journals and has previously served as a member of the EC/EURATOM (Article 37) Group of Experts and the International Committee for Radionuclide Metrology (ICRM). He has coordinated major international EU research collaborations, and he is a former Head of the School of Physics at UCD and past Science Secretary of the Royal Irish Academy. He presently serves as his Academy's representative on the All European Academies (ALLEA) Working Group on Science Education.



ALLEA Working Group on Science Education, Dublin, November 2013

Appendix 2: List of Forum Participants

Name	Surname	Organisation
Mari	Cahalane	BT Ireland Limited
Christine	Campbell	IBEC
Tim	Conlon	Higher Education Authority
Benó	Csapó	ALLEA Working Group on Science Education
Claude	Detrez	French Embassy
Tony	Donohoe	IBEC
Stanislav	Dovgyi	ALLEA Working Group on Science Education
Brendan	Doyle	Deloitte
Maksym	Galchenko	ALLEA Working Group on Science Education
Salih	Gashi	ALLEA Working Group on Science Education
Sheila	Gilheany	Institute of Physics in Ireland
Águeda	Gras-Velázquez	European Schoolnet
Sarah	Hayes	Synthesis and Solid State Pharmaceutical Centre
Ingolf	Hertel	ALLEA Working Group on Science Education
Stevan	Jokić	ALLEA Working Group on Science Education
Bill	Kearney	IBM
Daire	Keogh	St Patrick's College
Andrej	Kranjc	ALLEA Working Group on Science Education
Miriam	Liston	University of Limerick
Maeve	Liston	Mary Immaculate College
Anne	Looney	National Council for Curriculum and Assessment
Odile	Macchi	ALLEA Working Group on Science Education
Brian	MacCraith	Dublin City University
Catherine	MacEnri	Forfás
Kevin	McClellan	Department of Education
Charlie	McConalogue	Fianna Fail
Eilish	McLoughlin	Dublin City University
Peter	Mitchell	ALLEA Working Group on Science Education
Mary	Mullaghy	Irish Science Teachers' Association
Cliona	Murphy	St Patrick's College
Pádraig	Ó Murchú	Intel
John	O'Donoghue	University of Limerick
Miriam	O'Keefe	American Chamber of Commerce
Tim	O'Keefe	Department of Education and Skills
Stephanie	O'Neill	Science Foundation Ireland
Marieke	Peeters	ALLEA Working Group on Science Education
George	Porter	Sci Fest
Didier	Roux	French Academy of Sciences
Tony	Scott	University College Dublin
Tom	Sherry	National University of Ireland Galway
Petra	Skiebe-Corrette	Free University of Berlin
Niall	Smith	Cork Institute of Technology
Richard	Timoney	Trinity College Dublin
Frank	Turpin	The Teaching Council
Giancarlo	Vecchio	ALLEA Working Group on Science Education
Fionnuala	Waldron	St Patrick's College
Sean	Ward	MERCK
Jan	Zima	ALLEA Working Group on Science Education



The Royal Irish Academy/Acadamh Ríoga na hÉireann, founded in 1785, is Ireland's academy for the sciences, humanities and social sciences. The Academy provides expert advice, manages research projects, publishes books and journals and sustains a library. A President and a Council of 21 members govern the Academy. The Executive Committee, which comprises the officers of the Academy, the Executive Secretary and a staff representative, oversees the day-to-day business of the Academy on behalf of the Council. Election to membership of the Academy is the highest academic honour in Ireland and the Academy currently has over 470 members. Members of the Academy have included William Rowan Hamilton, Ernest Walton and Erwin Schrodinger. Among its current members are Frances Ruane, Mary Robinson and Luke O'Neill. Situated beside the Mansion House, the Academy regularly hosts lectures, discourses and master classes.

For more information, please visit the Academy's [website](https://www.ria.ie/) (<https://www.ria.ie/>).



ALLEA, the Federation of All European Academies, was founded in 1994 and currently brings together 58 Academies in more than 40 countries from the Council of Europe region. Member Academies operate as learned societies, think tanks and research performing organisations. They are self-governing communities of leaders of scholarly enquiry across all fields of the

natural sciences, the social sciences and the humanities. ALLEA therefore provides access to an unparalleled human resource of intellectual excellence, experience and expertise.

Independent from political, commercial and ideological interests, ALLEA's policy work seeks to contribute to improving the framework conditions under which science and scholarship can excel. Jointly with its Member Academies, ALLEA is in a position to address the full range of structural and policy issues facing Europe in science, research and innovation. In doing so, it is guided by a common understanding of Europe bound together by historical, social and political factors as well as for scientific and economic reasons.

For more information, please visit the ALLEA [website](http://www.allea.org) (www.allea.org).

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Education**

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