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Österreichisches Bundesministerium für Unterricht, Kunst und Kultur
Leibniz-Institut für die Pädagogik der Naturwissenschaften an der Universität Kiel
Project no. **042938**

Project acronym **FORM-IT**

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Instrument: **Specific Support Action**

Thematic Priority: Science and Society

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Bridging the Gap between Research and Science Education-
Cooperation makes Europe competitive in Science
Vienna, 12th to 14th of March 2008
Conference Report

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Leibniz-Institut für die Pädagogik der Naturwissenschaften an der Universität Kiel
Preface

The future global position of the European Union in terms of economic welfare and scientific excellence will depend on the knowledge and the learning skills young people can acquire in today’s schools. The efficiency of national education systems and especially the quality of science education are decisive factors for the performance of tomorrow’s research and economy.

Amongst the key competencies the next generation will need to succeed on the labour market as well as in R&D are self-directed and self-motivated learning strategies, communication skills, the ability to work in teams and above all the ability to differentiate, select, apply and replace information from the daily growing global knowledge base. Science education is therefore confronted with a high pressure to replace outdated teaching approaches by modern didactic concepts and new learning methods.

The Specific Support Action form - it “Take Part in Research” contributes to these innovation efforts by supporting Research Education Cooperation (REC) and networking initiatives of scientists, teachers and pupils who collaborate in joint projects.

The International Conference “Bridging the Gap between Research and Science Education, held in Vienna in March 2008 assembled an international community of very competent experts in Research Education Cooperation: Teachers, Researchers and policy makers from 15 European countries as well as from Australia their experiences and discussed cooperation initiatives of universities and schools, quality criteria for joint projects and new approaches to curricula development for science education.

The atmosphere of the conference was very inspiring and - a clear feedback of the participants - the exchange of cooperation experiences was highly productive.

I want to thank all participants for sharing their knowledge and their motivation with us and I hope, that the results of the conference will be useful for their present and future activities.

Céline Loibl
Project coordinator
Form-it Take Part in Research!
Form – it “Take Part in Research”

Bridging the Gap between Research and Education Coop.
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Form – it “Take Part in Research”

Bridging the Gap between Research and Education Coop.
1. Background

Science Education challenges in Europe
Maria Pilar Jimenez Aleixandre

An overview of the main challenges that Science Education is facing in Europe: 1) research findings from science education don’t find the way to school; 2) there is a decline in students’ interest and enrolment in science; 3) it is necessary to meet the needs of all students, to appeal to both girls and boys, and to contribute to citizenship education. Other European reports (e.g., Nuffield Foundation, 2008) and projects (e.g. ROSE; Mind the Gap) on the same issue, as well as PISA results are discussed.
### Science Education in Europe

- Maria Pilar Jiménez Aleixandre
- Universidade de Santiago de Compostela
- Spain

#### Challenges
- What challenges is SE facing?
- Other European meetings & projects about Science Education challenges
- Conference objectives: how to reach them
- Looking ahead
2. Setting the Frame

2.1. Project description

Form-it “Take part in Research” provides a Specific Support Action for networking experts who work with and on new didactic concepts for science teaching. One of these new concepts is to systematically establish closer links between research institutions and education organisations. Such cooperations are considered to be innovative didactic models for developing the basic skills young people nowadays need for effective, life long learning and for building scientific excellence. In many European countries initiatives have been launched to facilitate partnerships between universities and schools. In some rare Member States such institutional collaboration is already promoted systematically through national programs and additional funding, a strategy for improving science teaching which is already common standard in the United States.

Form-it assembles experienced partners from five universities and research institutions, practising Research Education Cooperation (REC) for many years, two ministries and foundations, supporting modern science teaching through promoting and funding institutional collaboration projects and five research partners specified on innovative didactic models and new learning arrangements, who have particular expertise in analysing impacts of REC (some of them working in both fields: collaboration with schools and research on RECs).

Objectives of the project are to develop a practical guideline for realising such cooperations, to assemble a joint policy paper, addressed to national and European decision makers within the educational system and to compile a concept for preparing joint research on the issue within FP7.

2.1.1. Motivation

The future success of the European Research Area is mainly depending on young people developing skills and competencies to tackle the future challenges. The institutional structures of the educational sector in Europe are very inhomogeneous. The plurality of national school systems, didactic traditions and curricula produces a diversity of knowledge levels and skill profiles. Reformation and harmonisation programs are being pressed since it became obvious that one of the essential factors for the prosperity of the European economy will be, to equip the generations of tomorrow with adequate knowledge resources and learning skills.

The key competencies needed today however, are self motivated and self directed learning strategies, team-working and communication skills and above all the capacity to differentiate, select, apply and replace information from the enormous and daily growing global knowledge base. Science excellence building has a very central function for successfully positioning Europe in international research activities and for assuring economic progress and wealth. In consequence, science teaching in schools is confronted with a high pressure to replace outdated teaching approaches by modern concepts. These modernisation efforts must take into account the findings from state-of-art educational research and must reflect the function of science education within society, university and school system.

One very promising model to test and improve such new learning designs is Research and Education Cooperation (REC). Quite a number of experimental projects and programs are currently being realised in Europe in this field and their experiences seem very relevant in this context of reforming science education. These programs improve teaching quality as well as the didactic and motivational impacts for schools and its pupils. Universities engage in such collaborations and programs because the close co-operation with schools will result in attracting talented and motivated students.

2.1.2. Objectives

The objectives of Form-it are to strengthen the collaboration between education research and science teaching in Europe and to promote young people’s interest in science to enhance a more critical and analytical way of thinking and learning. Form-it has been designed to establish recommendations for the different stakeholders in the field of teaching and training of young people, including policy-makers.

Furthermore, this initiative has been set up towards the creation of a perfect platform for the preparation for FP7 in order to provide best possible starting conditions for building up the knowledge-base in policy-related research, gender research, and research on innovative education systems.
To achieve this overall objectives the following sub-objectives have been set:

- Increasing the efficiency of national and European educational systems by identifying and promoting the success factors of several Research Education Cooperations (REC) in Europe.
- Supporting the collaboration between institutions running such RECs by setting up a European network of experts in science teaching and education research.
- Building up a sustainable network of institutions.
- Increasing the engagement of policy-makers and other decision makers in educational matters by promoting policy recommendations and guidelines on the organisation of RECs.
- Supporting the development of joint EU research projects related to “Science and Society” within the 7th Framework Programme through identifying relevant research topics in this field.

2.1.3. Results

Activities of Form-it aim at developing a practical guideline for realising RECs, assembling a joint policy paper, addressed to national and European decision makers within the educational system and compiling a concept for preparing joint research on the issue within FP7.

A best practice catalogue will summarize and publish the relevant RECs in the consortium member countries. This catalogue will be suitable for use for researchers from other member and non-member states as well as for the European Commission. In this respect, it will also function as a promotion tool increasing visibility and accessibility of RECs. The knowledge assembled will be placed at the disposal of the consortium members and other potential stakeholders and multipliers.
3. Bridging the Gap between Research and Science Education –
   The international conference in Vienna

3.1. Setting the scene

Research and Education Cooperation (REC) is a powerful new approach in science education. It offers very effective learning settings and early inspiring contacts to research in practice.

At the conference the results of the »Report on Research and Education Cooperation in Europe« and a catalogue of Good Practice Examples of REC were provided by the Form-it consortium for discussion. The conference introduced established cooperation models and new and experimental forms of cooperation. Outstanding projects presented their experiences in an interactive exhibition. The objectives of the conference were to:

- discuss REC as a new approach in science education and to compare different cooperation models,
- jointly reflect on quality criteria for different forms of REC,
- outline strategies about how to implement REC into a modern education and science system on a broader basis and to
- discuss recommendations for policy makers and stake holders.

To work along these objectives four workshops have been planned, focussing on different aspects of Research Education Cooperation:

- Workshop 1: What are good practices of Research Education Cooperation?
- Workshop 2: How to realise good cooperation projects?
- Workshop 3: Could a REC be an element of modern science education?
- Workshop 4: How to use a single REC project to move the system?

In addition to that a Call for Posters was launched. All posters were reviewed by the Form-it consortium and the exhibition was embedded into the first day of the conference. To initiate discussions the posters were presented in the foyer, where all coffee breaks were arranged.

3.2. Plenary

3.2.1. Wednesday

Research Education Cooperation and the Austrian framework conditions
SEISER Christian, Federal Ministry of Education, the Arts and Culture, Austria

Science Education in Europe
BERLINGUER Luigi, Interministerial Committee for the Advancement of Scientific Culture, Italy

Science Education in Europe
JIMENEZ ALEIXANDRE Maria Pilar, University of Santiago de Compostela, Spain
(Summary and slides see chapter 4)

3.2.2. Thursday

„Cecil and the penguins“, produced by Climate Change Explorer
PIETIKAINEN Soile, London South Bank University, United Kingdom

The film-makers describe the film project: "Cecil is an 11-year old penguin fanatic. One day, on his way home from the zoo, he sees a newspaper billboard warning about the ice caps melting because of global warming. Cecil is thrown into panic about the plight of the penguins and embarks on a quest to find out how he can save his favourite creatures. This film is the result of teenagers from Dowdales School and Dropzone Cafe working with Shoreline Films to explore ideas around the theme of climate change and to learn about filmmaking process as part of the Climate Change Explorer project. The film elicited so much discussion that a second presentation was arranged on Friday.

Climate Change Explorer brings together young people, artists, educationalists and environmental scientists to develop creative approaches to raising awareness of climate change".
Images of Research and Education Cooperations in Europe
KYBURZ-GRABER Regula, University of Zurich, Switzerland

The images of research and education cooperations (RECs) in Europe are based on a non-representative survey in eight countries. 159 RECs of all scales of projects have been identified, sustainable and short-term initiatives, institutionalized or not. The main pattern is the cooperation between a secondary school and a university research institute. Both partners reported positive impacts, e.g. increasing teachers’ competencies and researchers’ contact with pupils respectively. Difficulties are experienced due to lack of resources, promotion and appreciation. A desirable REC is characterized by: ownership and participation, real life methodologies, impact on teachers’ professional development and links to science education research.
Form – it “Take Part in Research”

Bridging the Gap between Research and Education Coop.

What is a Research and Education Cooperation (REC)?

A REC is a cooperation
• between at least one research partner
  – Public or private science or technology research institutes, educational research on S&T, museums, individual researchers etc.
  – and at least one educational partner
  – Schools, individual teachers, teacher education, individual pupils or students, school authorities

Assumption

• „Researchers coming into the schools, pupils going into the research labs or centres, teachers being trained by researchers; all this has an effect on the quality of teaching and learning sciences“
  (GRID-Network, 2006 “Growing Interest in the Development of Teaching Science“)

Partners involved

• Schools
• Teacher education institutions
• State and private research institutions
• Science museums
• Foundations
• NGO’s
• Private industry
• (educational) authorities

Patterns

Schools
• Universities
• research institutes
• Preparatory support
• evaluation
• Scientific lectures, materials, advice

Actors and Activities

• Students of secondary level and pupils
  • Performing experiments, analyzing data, discussing, presenting results
• Teachers and Researchers
  • Planning, preparing learning materials, choosing the subject, research questions and experimental methods, discussing and presenting results, reflecting on the project and the work process
  • Teachers choose the teaching methods and assess the pupil and student contributions
• Education officers in enterprises

Gender Aspects

• Only few RECs exclusively addressed girls and women
• Only few RECs listed gender issues among their objectives

Science Education Research

• Every fifth REC was accompanied by a project in science education research, e.g. action research

Positive Impacts and Experiences

• On teachers, students and pupils
  • On teachers’ competencies
  • their confidence in science teaching (most frequent answers in 8 countries)
  • raise in pupils’ and students’ interest
  • positively changed attitudes towards S&T (6 countries)
  • influence on students’ choice of university studies (4 countries)
**Form – it “Take Part in Research”**

**Bridging the Gap between Research and Education Coop.**

### Positive Impacts and Experiences
- By the partners involved
  - Positive experiences from cooperating with experts from different fields
  - Successful teamwork resulting in high-quality activities (research by pupils, workshops for teachers)
  - Enthusiasm, inspirational atmosphere
  - Researchers’ contact with pupils
  - Better mutual understanding
  - Role models for the adolescents

### Difficulties
- Most widespread in all countries: Lack of resources (time, money)
- Lack of long-term financial support
- Partners involved do considerable efforts in their spare time
- Little support for promotion and public relations
- Lack of appreciation

### Institutional Background and Links
- RECs linked to obligatory curriculum
- Courses included in curriculum „Science and Society“, „Nature and Technology“, „Nature and Health“
- Out-of-school activities on a regular basis in science classes (e.g., research camps)
- Extra-curricular forms of RECs

### Funding and Promotion
- Innovative science education initiatives often rely on the motivation and the goodwill of a few individuals (European Commission 2007)
- Grants are usually temporary
- Ministries and local authorities are important funding resources
- Implementation of RECs as an element of the regular research and education system
- Promotion, lobbying, patronage, public relation provided most frequently by research institutions
- Foundations and local industry as promoters
- Communication and promotion is rarely included in formal partnerships

### Flashes on national characteristics

**Austria**: Promotion Initiative „Sparkling Science“ over 10 years. Small, individual RECs are most motivating and inspiring.

**Germany**: Regional networks of school labs developing. Integration in curriculum and extracurricular REC offers.

**Italy**: Several successful STS initiatives, but not accepted as „real culture“. RECs starting from the bottom are more innovative than ministerial RECs.

**Lithuania**: Time is needed for a change in existing educational system and thinking. Many projects in lower cost social sciences, all RECs studied use ICT.

**Netherlands**: RECs strongly supported, multidisciplinary, focused on the interface upper secondary – higher education, evaluation revealed increased students’ interest in S&T. High potential is seen in developing innovative teaching strategies and new subjects.

**Slovenia**: RECs partly integrated in the innovative curriculum, e.g., research camps. A coherent national strategy is missing. Integrated science material is needed.

**Switzerland**: Similar initiatives in different (language) regions without knowing from each other. Success of RECs is heavily dependent on personal commitment, institutionalized support is rare.

**UK**: Strong governmental support for education in S&T. Science Learning Centres and STEM Centres can coordinate RECs at local, regional and national level.

### A „typical“ European REC
- Is a cooperation between a university and a school partner
- Its activities are addressed to (upper) secondary level students
- Its primary goal is to promote public understanding for science
- Looks to support career building, in few cases explicitly considering gender specific aspect
- Enhances teaching competences in S&T
- Is self-evaluated
- Documents and disseminates its activities
Research and Education Cooperation on Stage: Tick Patrol - A tiny foe, an underestimated enemy, a school project for your health!

STEINER Konrad, et al, HBLA Ursprung, Austria

Pupils of the HBLA Ursprung for agriculture presented on stage their project/REC "Tick Patrol". This REC is only one of several collaborations with research institutes and universities since 1997.
3.2.3. Friday

Positions and Perspectives of the Austrian Federal Ministry for Education, the Arts and Culture
WIRTITSCH Manfred, Federal Ministry of Education, the Arts and Culture, Austria

Input on national programmes – The Netherlands
ANKONE Henri, National Institute for Curriculum Development, The Netherlands

Nature, Life & Technology
The interactive development of a new interdisciplinary science subject in the Netherlands for 16+

Reasons
Why introduce a new science subject?
Because of:
- low % of students in sciences and mathematics in secondary schools, universities and polytechnics in NL
- very low % of female students

Participation of girls in science in upper sec. in NL

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<th>Pre-polytech 5 years</th>
<th>Pre-univ. 6 years</th>
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<tr>
<td>Girls</td>
<td>53 %</td>
<td>54 %</td>
</tr>
<tr>
<td>Nature &amp; Technology</td>
<td>1,4 %</td>
<td>3,5 %</td>
</tr>
<tr>
<td>Nature &amp; Health</td>
<td>17,2 %</td>
<td>34,5 %</td>
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Causes

- OECD, 2006 -> Student choices are determined by:
  - Image of S&T professions
  - Content of S&T curricula
  - Quality of S&T teaching
- Netherlands:
  - Fairly traditional S&T curricula, lack of interdisciplinarity & team-teaching
  - Contacts of schools with scientists in professional contexts is limited

Netherlands: educational system

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<tr>
<th>First (central exam)</th>
<th>Final (central exam)</th>
<th>Upper secondary Pre-university</th>
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<tr>
<td>Lower vocational</td>
<td>Lower secondary Pre-college</td>
<td>Age: 16-18</td>
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<td>Age: 13-15</td>
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Primary education:
Age: 4-12
### Upper secondary
- Compulsory part: Dutch, English, Civics, Culture, Sports
- Core: 'profile sets':
  - Economics & Society: Ec, Hist, Math
  - Culture & Society: Art/MFL, Hist.
  - Nature & Health: Bio, Chem, Math
- Nature & Technology: Phys, Chem, Math
- 1 or 2 elective subjects: for instance NLT

### Objectives of NLT
- Offer students:
  - A wider & deeper science curriculum
  - Orientation on S&T studies and careers
  - Choice: on basis of interest and ability
- Show students the relevance of interdisciplinarity
- Built bridges between school and university / private enterprise
- Contribute to school and teacher development

### Syllabus pre-university

| A | Skills (in combination with B - C) |
| B | Foundations of science and technology |
| C | Earth and climate |
| D | Molecular information and processes |
| E | Biophysical, biochemistry, bioinformatics |
| F | Biomedical technology and biotechnology |
| G | Sustainable use of resources, energy and environment |
| H | Materials, process- and production technology |
| I | Tools, vehicles and products |

### Development process
- Time frame: short!
  - Preparation 2005
  - Project start 2006
  - First students August 2007
- Cooperative strategy:
  - Teachers ownership
  - Small networks: 2 schools, teachers, college/university, experts, coach

### Developing content
- Units of 40 study hours (modules)
  - Interactive development
  - Quality criteria
  - Development in 4 series (wave model)
- 50 modules developed by 2009

### Curriculum development: prototyping
- 'Cycles' of content development:
  - 4 cycles, 50 modules (required for havo: 10, vwo: 13)
  - Evaluation + adaptation
- Strict cycle-schedule
  - Development of network -> GO by NDC/SC
  - Design of module -> GO by NDC
  - Development of first version -> GO by NDC
  - Testing at 2 schools + evaluation acc. to quality criteria NDC -> test & evaluation report
  - Adjustment -> GO by NDC certified by SC
  - Full use in classroom

### Development of modules
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First modules
- The best egg??
- Dynamic modelling
- Zero-energy house
- Sport performance
- Designing your disco
- Aerosoles in dirty air

More topics for modules
- Medical imaging
- Living soil
- Glue
- Biotechnology
- Technical design in health care
- True or false?
- Farmacology

Implementation
- 30-35% of schools in 2007 (172)
- Team of teachers: min. 3 o/o 5 biology, chemistry, geography, math, physics
  - School & teacher: development
  - Teach the teacher
- Organisation
  - Time table adapted
  - Out-of-school learning
- Regional support centers: universities + colleges involved

Research
- Objective is to evaluate
  - content development process
  - implementation
  - attainment of goals
  - curriculum in relation to aims advice ministry in 2010
- Means
  - data analysis: registration, official data ministry, questionnaires
  - casestudies on development + implementation
  - PhD studies on innovation of science education

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Curriculum levels
- Nano: individual learner
- Micro: classroom
- Meso: school
- Macro: state / country
- Supra: EU

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Curriculum levels
- Nano: individual learner
- Micro: classroom
- Meso: school
- Macro: state / country
- Supra: EU
Input on national programmes – United Kingdom
MEADOWS John, London Southbank University, United Kingdom

A perspective from England

- Next Steps strategy
- Change in lower secondary science
- A Scottish curriculum for Excellence

Some of the steps promoted in this document are:

- Science learning centres established in many regions,
- increase number of women in science by creating a Women’s Resource Centre, in partnership with Business,
- review and amendment of GCSE science curriculum to make it more interesting to young people,

Science learning Centres

- STEMNET’s vision
- A society where young people, regardless of background, recognise the contribution of Science, Technology, Engineering and Maths (STEM) to their lives and more are choosing to pursue STEM qualifications and careers.
  - http://www.stemnet.org.uk/?referred
  - http://www.stemnet.org.uk/?referred

Recent change in Lower Secondary Science

Background

The Key Stage 3 National Strategy (2003) aimed to raise standards by strengthening teaching and learning across the curriculum for all 11–14-year-olds. It was based on four important principles:

1. A perspective from England
2. Some of the steps promoted in this document are:
3. Science learning Centres
4. Recent change in Lower Secondary Science

Bridging the Gap between Research and Education Coop.
Form – it “Take Part in Research”

Bridging the Gap between Research and Education Coop.

Principles
1. expectations: establishing high expectations for all pupils and setting challenging targets for them to achieve.
2. progression: strengthening the transfer from Key Stage 2 to Key Stage 3 and ensuring progression in teaching and learning across Key Stage 3.
3. engagement: promoting approaches to teaching and learning that engage and motivate pupils and demand their active participation;
4. transformation: strengthening teaching and learning through a programme of professional development and practical support.

New science curriculum (September 2008) in KS3 should provide opportunities for pupils to:
1. research, experiment, discuss and develop arguments
2. pursue an area of scientific interest
3. use real-life examples as a basis for finding out about science
4. study science in local, national and global contexts, and appreciate the connections between these

5. experience science outside the school environment, including in the workplace, where possible
6. use in science, and appreciate their importance in enterprise
7. recognise the importance of scientific and technological developments

Scottish “curriculum for excellence” aims
- Challenge and enjoyment – pupils are motivated
- Breadth – range of experiences offered
- Progression – single framework from 3 to 18
- Depth – different types of thinking as they grow
- Personalisation and choice – talents and aptitudes
- Coherence – activities draw together different subjects
- Relevance – why are we doing this?

An example from Scotland
- “I can use my knowledge of the basic needs of humans, and the bodies of our solar system, to put together a reasoned report on whether we can colonise space”
- A mix of physics, chemistry and biology
- Links science with society
- Work cooperatively
- Develop a wide range of skills

An example from the New Curriculum in England
As one boy commented: “I found it enjoyable to learn something new. We all had to work extra hard to complete it because of the amount of work we had to do within the deadline. But I feel it was worth it in the end because I think it was a real achievement and actually quite fun.”

International Conference Vienna, 12th to 14th of March 2008
The function of Research Education Cooperation in sustainable educational systems
DE HAAN Gerhard, Freie Universität Berlin, Germany

The presentation describes the future of natural sciences in the context of the European educational system and the role of RECs in their function between school and scientific-technical research. The PISA studies, their environment and the importance of RECs in this context are addressed as well as the aim of a global sustainable development as a normative basis for RECs and its use as a possibility to increase the surveyed low personal interest of young people in science and technology.

I am very pleased to be allowed to speak to you today. My theme is “The function of Research Education Cooperations in sustainable educational systems”. I have divided my presentation – limited to 20 minutes - into three sections: the future of natural sciences in the context of the European educational system, some remarks about the importance of REC and the aim of a global sustainable development as a normative basis for REC.

1) The future of natural sciences in the European educational system.

If one looks at the attitude of pupils towards natural sciences, the world appears to be in order – at first. Natural sciences are accepted in their importance in very high degrees: 93% of the pupils think that natural sciences are important in order to be able to understand the natural world. This is a good basis for scientific education. One can also say that an aversion against natural sciences or even a technology hostility of young people does not exist because 92% are of the opinion that natural sciences and technology improve our living conditions in general.

The situation becomes more problematic if one doesn’t ask for the general relation to natural sciences, but for the personal relation to natural sciences. Then there are only 57% in the OECD average who think that natural sciences are important for themselves. The values go further down if it is a matter of aspiring to a position in the future connected to natural sciences. Here there are only 37% who can imagine such a profession. And if one looks at who aims for a natural scientific study, there are only 21% which are left.

What we can say is that there is a considerable gap between the importance accredited to natural sciences in general, and the interest to take up an occupation in natural sciences.

I don’t know what it looks like in the other countries participating in our Form-it project, but regarding natural sciences in Germany we do have more bad news.

In Germany after PISA 2004 a subsequent study was carried out measuring the increase in learning of pupils from 9th to 10th grade. One wanted to know how many competencies pupils had gained a year after the PISA test in the 9th grade. Results were frustrating, but in Germany the collective depression about the PISA results had obviously progressed so far that nobody wanted to discuss about the results when these were published in 2006.

Namely the result was: In the natural sciences the pupils and female pupils merely achieve an average competence increase of 21 points. This corresponds to a learning increase as actually expected in half a grade – and not in a whole school year. It is even more serious, that 56% (!) of all pupils achieved no significant competence increase in one year going to school, and that even more than 10% of the pupils in the 10th grade had less scientific knowledge than one year before. One wonders how the teachers managed not to let half of the pupils repeat this grade, as the results were hardly better in mathematics.

This short view at the situation of natural sciences at school shows that something has to be changed if the interest in natural sciences should be strengthened. And a strengthening of the interest is urgently necessary. I would like to clarify this exemplarily in only one problem:

We all know that in Europe we live in a knowledge society. Innovations and economic prosperity as well as social services depend on innovative knowledge.

In this process natural sciences and technology play an extremely significant, even growing role. However, in Germany we nowadays have a situation where more engineers retire from the professional life than engineer students finish universities. This may be good for young engineers looking for a job, but it is bad for economy and society in a whole. No wonder that the RECs take an important function between school and scientific-technical research.
2) If one looks at the RECs more exactly, our project shows a large variety of different attempts which at all are not perceived in a particularly strong way by the state educational policy, and much less supported to such an extent that a wide strengthening of the scientific education can result from the initiatives. At the same time, however, the RECs claim to strengthen the motivation of pupils for scientific lessons – to the point of hope that pupils feel motivated by the initiatives to aim for an occupation in natural sciences.

Concerning their objectives the involved RECs can be arranged into two groups. The first group is aimed, above all, at the motivation to decide for a scientific or technical occupation. From the good-practice examples chosen by the Form-it consortium the following examples belong - among many others – to this group:

- Creative Science Centre – Great Britain
- Climate Change Explorer - Great Britain
- The project “UK-Japan Young Scientists” – Great Britain
- Genetic Research Days – one day stages in labs - Switzerland

As the second group the initiatives can be identified which directly or indirectly look for a relation to scientific education at schools. Then the purpose is to raise the number of scientifically interested young people. Initiatives working in this direction are - among others:

- The project “Future Scapes” – Austria
- The Danial – Duesentrieb Contest – Germany
- Furthermore the project “Penser avec les mains” - Switzerland

Hybrid forms pursue both objectives, while they (as for example the „Ada-Lovelace-Project” – Germany) want to extend, on the one hand, scientific lessons and, on the other hand, inspire specifically girls and women for natural sciences and technology. A special form is also shown by the Austrian project “Future Scapes”, because this one is focussed on the contact of young people with a precise theme – that is “global change”. Here a stronger scientific education is also reached, but is not the primary purpose of the REC.

However, do these initiatives also pay off in the long term? About that we know quite little, because solid long term studies about RECs do not exist. We just don’t know whether the number of students in natural sciences increases on the base of these initiatives or whether school achievements improve in the natural sciences.

Now RECs cannot solve all the problems. Alone the time spent by pupils in the research facilities is too short. One should not expect as well that the RECs could solve the problems going along with scientific education at school. There has to be some compromise from both sides.

Natural science education at school has to admit own activities of pupils in an increasing way and has to begin with everyday problems and -phenomena as well as everyday experiences of pupils. Research facilities, on the other hand, should increasingly search for a connection to the school specific curricula.

Because the cooperation is worthwhile. The RECs seem very well to be able to raise the interest in natural sciences and technology. However, there should not be only a general, but a personal interest which develops in this way. If we are really able to reach this personal motivation by RECs and, besides, if we could prove – by a long-term study – that there is even the effect of an increased occupation in areas of natural sciences and technology because cooperation between research and education has been intensified, then I think it is plausible to put these many initiatives on a solid organizational and financial base. That means: The existence of forms of cooperation between schools and research facilities should be a standard. At least schools with a main focus in a scientific school-specific curriculum should maintain such cooperations as have become visible within our project. In addition the facilities then also have to be budgeted by the educational administration. Because a maintenance and expansion of these initiatives is only possible if the state provides material and personnel resources.

How these cooperations develop, however, must be left to the cooperation partners because, otherwise, there is the danger that these wonderful initiatives become very school-like so that the problem of natural sciences at school will only be extended into the labs and research facilities.
3) Sustainable Development as a Normative Basis for RECs

In my first part I have emphasized the difference between the general interest in natural sciences and the personal interest of pupils in natural sciences as an important aspect. I would like to take up this point once again. If one wants to raise the number of those who have a personal interest in natural sciences, however, this can not be strengthened by RECs alone. These are – as mentioned in part 2 – of a high importance as a methodical instrument in order to strengthen the personal interest and to develop pleasure in natural sciences. But the strengthening of the importance of natural sciences by RECs will – that is what I suppose - not be adequate to develop and maintain a long term interest in this field.

Therefore I would like to suggest to - in the future - take into account the general interests and fears of young people regarding social and global development stronger than before.

As we know from international studies like the Civic Education Studies of the International Association for the Evaluation of Educational Achievement (IEA), young people like to get involved in areas where more equity in the world can be reached, and in areas which deal with environmental protection. This interest in the commitment in social and ecological matters goes along with a high-grade pessimism regarding the development of the environment. In the OECD countries an average of 21% of the pupils state that they do not count on an improvement of the environmental situation for the coming 20 years. That the energy shortage will continue is believed by almost 80%, the continuation of water shortage, air pollution, the extinction of animal and botanical species is believed by an average of 85% of all interviewees / people surveyed. If one brings together these data about pessimism regarding the change of the environmental situation on the one hand with the interest of young people in social and ecological commitment and, on the other hand, takes into account that 92% of the young people have the opinion about natural sciences and technology generally improving our living conditions then something would have to be gained for the personal interest in activities connected to natural sciences.

From there my suggestion is that the scientific curriculum in the schools and also cooperations between schools and research labs etc. increasingly refer to the problems of a non-sustainable and the perspectives of a sustainable development. For “sustainable development” means to bring together ecological criteria like reduction of resource consumption and environmental protection on the one hand with an international social change, minimizing social injustice and, on the other hand, to strengthen a socially and environmentally sustainable economy.

That an orientation towards a sustainable development is not only an idea preferred by myself can be seen by the guidelines of the educational strategy of the OECD. A few years ago the OECD installed an international workgroup – the DeSeCo group. DeSeCo stands for „Definition and Selection of Competencies“. The workgroup had the task to identify key-competencies „for a good life in a well functioning society“. The key-competencies identified by the DeSeCo group do not matter in our context for a start, however, the higher educational aims matter from which the key-competencies were compiled. Common values are the anchor for the key-competencies.

The DeSeCo group formulates as following, I quote:

“...insofar as competencies are needed to help accomplish collective goals, the selection of key competencies needs to some extent to be informed by an understanding of shared values. The competency framework is thus anchored in such values at a general level. All OECD societies agree on the importance of democratic values and achieving sustainable development. These values imply both that individuals should be able to achieve their potential and that they should respect others and contribute to producing an equitable society. This complementarity of individual and collective goals needs to be reflected in a framework of competencies that acknowledges both individuals’ autonomous development and their interaction with others..."

At another point they say:

“...Thus basic principles of human rights, democratic value systems and postulated objectives of sustainable development (i.e. integrating environmental protection, economic well-being and social equity) can serve as a normative anchoring point for the discourse on key competencies, their selection, and development in an international context...” (DeSeCo / OECD 2002, § 26)

If one considers that the OECD sets these general educational purposes as the basis for future studies in the educational area and for lifelong learning one is well advised to follow questions and
problems of sustainable development if looking for a connection between natural scientific matters at school and extracurricular research institutes.

Here also the results of Form-it offer some good advice. For example the projects “Climate Change Explorer” from Great Britain and “Future Scapes” from Austria which primarily deal with global change offer all criteria for the focusing on subjects of sustainability. We should arrange the connection between schools and research institutes in such a way that subjects of sustainability have a priority. Not only because most likely a theme is taken up that interests children and young people personally, but also because the United Nations have proclaimed a world decade of education for sustainable development from 2005 till 2014. The years to come we should also use with this global initiative to support and strengthen our concern.

The Function of Research Education Cooperations in Sustainable Educational Systems
Prof. Dr. Gerhard de Haan
Freie Universität Berlin – Institut Futur

Aspects of this presentation
1. The future of natural sciences in the context of the European educational system
2. About the importance and goals of RECs
3. Sustainable development as a normative basis for RECs

1 The future of natural sciences in the context of the European educational system
From good news ...
• 90% of the pupils of the OECD-countries think that natural sciences are important
• 92% say that natural sciences and technology improve our living conditions in general

…to bad news
• only 57% think that natural sciences are important for themselves
• only 37% can imagine to work in a field that has to do with natural sciences
• only 21% can imagine to study natural sciences

More bad news, especially from Germany:
• In the natural sciences the pupils merely achieve an average competence increase of 21 points from 9th to 10th grade
• 56% (!) of all pupils achieved no significant competence increase in one school year
• More than 10% of the pupils in the 10th school year had less scientific knowledge than one year before
• More engineers retire from the professional life than finish universities

2 The importance and goals of RECs
Two types of RECs
a) The aim is to motivate pupils to decide for a scientific or technical occupation and/or
b) to look for a relation to scientific education at schools
Thank you for your time and patience
and thanks to Jana Huck and Robert Lorenz.
3.3. Workshops

The overall frame for the four workshops held within the conference was the intention to link experiences and visions for Research Education Cooperation.

Choice and relevance of quality criteria depend on the form, the partners and the specific objectives of collaboration projects. The heterogeneity of national school systems and curricula is on one hand a precious source for a productive development of different modernisation concepts and strategies of. On the other hand this diversity is quite a challenge for comparing potentials and restraints of the different approaches. In order to find answers to the question how to improve the interface between school and university - and how to bridge the gap between research and education - research will have to study in depth the preconditions and impacts of Research Education Cooperation.

The participants discussed these main issues of the conference in four Workshops:

**Workshop 1 “Good practices”**
What are good practices of Research Education Cooperation (REC)?

**Workshop 2 “Implementation”**
How to realise good cooperation projects?

**Workshop 3 “Education”**
Could a REC be an element of modern science education?

**Workshop 4 „Curriculum“**
How to use a single REC project to move the system?

3.3.1. Workshop 1: What are good practices of Research Education Cooperation?

reported by Michela Mayer, University of Rome 3 SSIS Lazio, Italy

Workshop1 has as a main aim the discussion on what we mean for a ‘good and effective cooperation’. The main questions to the participants were: What exactly could »good« mean? What exactly could »effective« mean?

The participants – about 30, coming from various European and not European countries and from different disciplines and positions- where all dedicated research educations persons, deeply involved into their own projects in Research Education Cooperation.

The point of departure of the working group was the 'draft catalogue of Good Practices', published by the Form-it Consortium and distributed during the Conference, and the presentation (link to the power point: WS1present) offered by Michela Mayer, with the help of Günther Pfaffenwimmer and Robert Lorenz, on the quality criteria explicitly and implicitly guiding the choice of the Good Practices presented in the Catalogue.

The presentation highlighted the previous work done by the Consortium in order to define and identify the quality characteristics of the REC Good Practices, and the way the catalogue was organised in order to give to the public the information needed to appreciate quality.

The main quality features identified by the Consortium and proposed in the workshops were:

- Ownership and participation'
- Attention to the 'ethical and social aspects of science',
- Educational methodologies where authentic life problems and open ended tasks are used
- Development of critical thinking in a creative and collaborative learning environment.
- Time offered to students for the development of independent thought,
- Opportunity for students to make choices between different points of view, learning materials or activities.
- The ‘mutual gain hypothesis’: what have teachers and researchers learned from the REC and if it has brought about any changes in local curriculum.
• If there were new hypotheses for future REC activities.
• If Science Education Research was consciously accompanying the REC activities.

After the general presentation, two of the ‘Good practices’ described in the catalogue have been presented to the participants by their proponents:
• Dr. Toru OKANO and Dr. Eric ALBONE presented the UK-JAPAN young scientists Good Practice
• Prof. Wolfgang MACKENS presented the Daniel Düsentrieb Prize

The 3 presentations raised questions and issues for the debate:
• What kind of ‘quality’ we are looking for?
• High quality research could be directly measured?
• Do we look for long time effects? How may we foresee the complex effects of education and society?
• What we mean for ‘quality criteria’? The risk is to seek for short term effects, the kind of thing that can be easily used ‘politically’.

The discussion was organised dividing the group in 5 smaller groups, where each one had the possibility to present his/her own experience and to propose his/her own quality features, characteristics of a ‘good practice’.

The groupwork was very fruitful, and at the end each group was able to present and ‘argument’ their own negotiated quality features while sticking them on the paper walls, where different titles – following the quality criteria proposed by the Consortium – have been prepared.

The discussion, and the difficulty in organising the working groups criteria following the proposed scheme, had as a result a reorganisation of the criteria themselves according a different scheme. Quality for the group strongly depends from the point of view we assume for evaluating and judging, this means that we can speak of REC quality from the point of view of:

the image of Science and Technology in Society, looking for ‘authentic science’ not only in research but also in professional applications, enabling creativity and not only providing entertainment, showing uncertainties in science and giving the possibility to say ‘I don’t know’, asking for minds (and not only hands) on the experiments, giving opportunity for different solutions (open ended problems), offering opportunities for ‘frustration’, ….

the scientists involved, offering a possibility to communicate their findings, aims and beliefs to society through pupils and teachers, asking them to reflect on their own assumptions and learn from schools / public, challenging their communication abilities, ….

pupil interest and ownership, fascinating them, linking head and heart, asking to be active, proposing open ended questions, asking for social cooperation and understanding, asking for evidence based autonomous thinking, for products (material or immaterial), giving feelings of competence and ownership, …

the teachers involved, showing the value of science and science learning, recognizing the crucial role of science teachers, showing that RECs are challenging but not frustrating, involving them in team works and offering new points of view on science education, providing enough time for co-evolution (teachers/pupils/researchers), offering possibilities for professional development, school and society recognition, asking for teachers own research (educational action research),…

the school and the image of science and science teaching, asking for a bottom-up approach to scientific issues and for looking for questions and not only for solutions, showing the complexity of science and of science research, that science teaching is based on ‘authentic’ problems (real life, real research, real pupils’ concerns) that can be implemented into the school curriculum, making the invisible visible (offers new eyes to look at the world), asking for interdisciplinarity and team work, providing role models, ….

On the basis of the quality features collected a draft group report was proposed to the debate, deeply discussed and amended, and finally approved (link to Form-it_WS1reportdef).
The following questions were collected and proposed for further debate:

- What is the meaning of ‘authentic science’ at different age levels?
- What is the level of understanding of basic principles we can reach (or we want to reach in a REC)? Is it ‘real science’ or a Trojan horse for teaching ‘school science’?
- How could RECs transfer the acquired knowledge to other RECs? What could be transferred and what is ‘unique’?
- What instruments do we have for evaluating the effects of RECs?
- How to build a long-term benefit into the life of the school?

A common reached agreement was that in RECs, ad for every deep educational innovation and research questions, there is no possibility for shortcuts, and that RECs need time and support for their evolution.
Input statements
What are Good Practices of Research Education Cooperation REC?
Michela Mayer, SSIS, Università di Roma Tre, Italy, Gunther Pfaffenwimmer, Ministry of Education, Austria, Robert Lorenz, Freie Universität of Berlin

What are Good Practices of Research Education Cooperation REC?

Workshop 1
Michela Mayer, SSIS, Università di Roma Tre, Italy
Gunther Pfaffenwimmer, Ministry of Education, Austria
Robert Lorenz, Freie Universität of Berlin

AIMS of the WORKSHOP

• To present the Form-it catalogue of GP
• To compare the experiences of the participants and their ideas for 'good quality' RECs
• To propose and discuss common quality criteria for an effective and successful REC initiative
• To collect ideas and recommendations for future RECs guidelines and quality assessment.

Survey on Research and Education Cooperation

• The results of the survey highlighted the diversity of REC projects: all areas of science and technology are represented, in many cases through a multidisciplinary or interdisciplinary approach, involving various subjects but also issues that are not per se part of the curriculum.
• Based on this survey, partners have been able to define what they consider not only 'successful' but also 'good quality' projects.

Framework for a successful REC in S&T

A Catalogue of Good Practice Examples

• A collection of 26 European Research and Education Cooperation projects (RECs) which emerged from the survey, taking into account the framework and the quality areas discussed above.
• The selection was carried out country by country, and discussed and confronted in the consortium, taking into account the specific contexts.
• The format used try to put in evidence the main quality features, but also the possible weakness of each GP.
Form – it “Take Part in Research”

Bridging the Gap between Research and Education Coop.

Catalogue of Good Practice Examples (DRAFT)

26 GP, each one presented with:
- general aims and arguments for inclusion
- a table offering a brief overview of relevant information,
- contexts and conditions,
- activities and content,
- main methodological features, based on the quality criteria defined
- impact on curriculum,
- mutual benefits: win-win features,
- evaluation and feedback
- limits and possibilities,
- keywords and possible references

Aims
- The project aims to teach children to do meaningful and decent research in their best interest, and to show them what research is and how it can be used in the real world. The project was 
- Argument for inclusion
- a tabular overview of related information, contexts and conditions,
- activities and content,
- main methodological features, based on the quality criteria,
- impact on curriculum,
- mutual benefits: win-win features,
- evaluation and feedback
- limits and possibilities,
- keywords and possible references

Methodology
- The key factors to consider, authenticity, and quality are central to this project. The project aims to engage children and enable them to think independently and contribute to society.
- The project incorporates focused, integrated, and meaningful learning experiences, which enhance cognitive, social, and emotional development.
- Children are encouraged to use their imagination and creative capabilities to learn from real-life situations.
Form – it “Take Part in Research”
Bridging the Gap between Research and Education Coop.

Feedback / mediation / researches:

- Plenary discussion of the results
- Small groups (4 to 5)

**Principles**
**Conceptions**
**Principles**
**Values**

- IMPUT
- IMPUT

**What quality, and in what REC phases?**

- Ownership and participation
- Attention to the ethical and social aspects of science
- Educational methodologies where authentic life problems and open ended tasks are used
- Develop critical thinking in a creative and collaborative learning environment
- Time offered to students (and teachers) for the development of independent learning
- Opportunity for students to make choices between different points of view, learning materials or activities
- What have teachers and researchers learned from the REC; has it brought about any changes in local curriculum; in partners, competences, approaches…
- What have teachers and researchers learned from the REC; has it brought about any changes in local curriculum; in partners, competences, approaches…
- What Science Education Research is consciously accompanying the REC activities?

**How we organise the workshop**

- IMPUT
  - Dr. Eric ALBONE and Dr. Toru OKANO
  - Prof. Wolfgang MACKENS
- Small groups (4 to 5)
  - short presentation of REC experiences/discussion of the GP catalogue
  - definition of good quality features
  - to write on the existing flipchart/ or to new ones to be added
- Plenary discussion of the results

**Conceptions of quality**

- Quality and quantity are not in contrast...
- but quality cannot be reduced to numbers (Aristotele)
- Static Quality, means good performances in defined standards (what we are able to do...)
- Dynamic Quality, means the attempt to do something not done before, where no standards are fixed
- RECs needs both: a ‘stable’ basis is needed to sustain the dynamic of innovation

**Quality Criteria as bridges**

- Values
- Conceptions
- Principles
- criteria
- descriptors
- reality

- Form – it “Take Part in Research”
- Bridging the Gap between Research and Education Coop.
UK Japan Young Scientists
Dr Eric Albone, Clifton Scientific Trust Bristol and Dr Toru Okano, The Rikkyo School England

Dr Toru Okano (okano@tiscali.co.uk) summarised ways in which the UK-Japan Young Scientist Workshops (most recently Kyoto 2007) developed by Clifton Scientific Trust with partners in both countries address key educational concerns in Japan (and also in Britain) particularly the growing disaffection of young people for school science. Dr Eric Albone (eric.albone@clifton-scientific.org) outlined the workshop structure; Senior High School students from both countries live and work together for a week in small UK-Japanese teams with scientists on open-ended projects in cutting edge science and its application. Their thinking is valued and their school knowledge is put to use. At the end of the week, the teams give public presentations of their achievements. In the process, students experience science as a cultural bridge as well as a real life challenge. Preliminary evaluation indicates that the impact of the experience of working between cultures is profound and long lasting, and is valued by students of both sexes. Involvement of teachers and longer term impact on the schools and the scientists were also discussed.
**Japanese Government is fostering future scientists**

Why the Japanese Universities and Research Institutes are developing partnerships with schools

- Open Laboratory Open Campus
- Japanese Government is fostering future scientists
  - Super Science High School Programme (SSH)
  - Science Partnership Programme (SPP)
- Why the UK-Japan Young Scientist Partnership Programme is of value to both countries

**Science Partnership Programme**

**Super Science High School Programme**

**Open Laboratory Open Campus**

**Examples of Science Projects**

- UK-Japan Young Scientist Workshops
  - A Profound Learning Experience
    - Science experienced as a Real Life Challenge
      - where answers are not known
      - where school knowledge is put to use
      - where questioning is valued
      - where they are challenged to be creative and think for themselves
  - UK-Japan Young Scientists
    - Response to the Challenge
      - Japanese Universities and Research Institutes are developing partnerships with schools
      - Open Laboratory Open Campus
      - Japanese Government is fostering future scientists
        - Super Science High School Programme (SSH)
        - Science Partnership Programme (SPP)
      - Why the UK-Japan Young Scientist Partnership Programme is of value to both countries

**UK-Japan Young Scientist Workshops**

- Science as a Cultural Bridge
  - By working together British and Japanese students come to understand and value each other’s culture and form lasting friendship...
  - ...the common language of science

**Science Projects**

- Examples of Science Projects
  - Surrey University, 2006
  - Sleep Research
  - Nanotechnology
  - Monitoring the Earth by Satellite
  - Effects of Global Warming
  - Water resource in developing countries
  - Kyoto University of Education, 2007
  - Stirling Engine construction and performance
  - Immunology
  - Plasma physics
  - Microfauna of streams
  - Chemistry of carbon transport in natural waters

**UK-Japan Young Scientist Workshops**

- Science as a Cultural Bridge
  - By working together British and Japanese students come to understand and value each other’s culture and form lasting friendship...
  - ...the common language of science
Form – it “Take Part in Research”
Bridging the Gap between Research and Education Coop.

UK-Japan Young Scientist Workshops

What Happens
- Post-16 school students from Britain and Japan
- live and work together for a week
- in small UK-Japanese teams
- with scientists on open ended projects
- finally, the teams give public presentations of their achievements

UK-Japan Young Scientist Workshops

Teachers
- Teachers accompany the students to observe but do not take part in projects
- provide pastoral support
- share their own experiences with teachers from the other country (Teachers’ Workshop)
- take the experience back to their schools
# UK-Japan Young Scientist Workshops

## The Scientists

- **working with Clifton ScientificTrust, the scientists taking part**
  - develop projects related to their own work specifically for the Workshop
  - develop their own skills in relating their work in appropriate ways to challenge and motivate young people

## Outcomes

- **Outcomes are measured by**
  - the quality of the team presentations
  - detailed evaluation completed by all participants... changed perceptions of science and of life
  - open ended student responses
  - continued impact reported by the schools following the Workshop

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## Outcomes- Student Views

I cannot thank you enough me and my outlook on life and science. so much in common and can enjoy our differences we all have, yet we all have everything is exciting.. now it has been overcome and communication was a problem, but...to learn from each other science provides the cultural bridge.

Outcomes are measured by continued impact reported by the schools following the Workshop...work in appropriate ways to challenge and motivate young people...development projects related to their own work specifically for the Workshop...foundation courses...and to learn from a real life challenge...work specifically for the Workshop...and motivate young people...and work in appropriate ways to challenge and motivate young people...and to learn from a real life challenge...science provides the cultural bridge.

---

## Outcomes- a Teacher’s view

It was amazing to watch the teams...to learn from each other...science provides the cultural bridge.

Outcomes are measured by...work in appropriate ways to challenge and motivate young people...development projects related to their own work specifically for the Workshop...and to learn from a real life challenge...science provides the cultural bridge.

---

## Outcomes- Teacher’s view

The scientists taking part...work in appropriate ways to challenge and motivate young people...development projects related to their own work specifically for the Workshop...and to learn from a real life challenge...science provides the cultural bridge.

Outcomes are measured by...work in appropriate ways to challenge and motivate young people...development projects related to their own work specifically for the Workshop...and to learn from a real life challenge...science provides the cultural bridge.

Wolfgang Mackens, Hamburg University of Technology

Recently, RECs received questionnaires that asked for structures as well as for qualities. Is politics looking for rules to rule RECs? Is autonomy – one of the key features of RECS – in danger?

REC’s have become – and they should remain – autonomous educational research-laboratories for the development of new school education. “Diversity” is another characteristic of RECs, which would be lost by lumping them together.

Eventually, RECs want to improve research. High quality research can only be measured by its final impact after quite some time. Hence, RECs have to be given enough time, too.

Quality of high quality research can not be measured directly.
High quality research can be measured only by its impact.

Example of high-quality research:

\[ m = F \] (Isaac Newton; 1687)

Quite some RECs want to improve research via improvement of education (by confrontation with research)

Positive effects of RECs might be seen only after rather a long time.

Message to politics:

Give us more time.

&

Give schools more time!

To find out, what’s good.

PROBLEM 1:

Politicians want results hic et nunc.

Actions taken by politicians have to yield fruit early within the actual legislative period to support their desired reelection

Politicians have to initiate actions continuously in order to be in the newspapers every week with Good, good, good evaluations

The resulting chopping and changing at school is certainly one of the very main reasons for the many educational shortcomings.

Problem 2:

Even if there is capacity to set up a hic-et-nunc-quality-detection-process for RECs, I am convinced that it is not useful, in general.

In our School Lab we use to ask visitors whether the visit pleased them, whether they found some enthusiasm for science now....

But that’s not, what we want to know.

Our situation is similar to that of the US immigration authorities.

There you have to fill in questionnaires which ask

- whether you want to kill the American president,
- whether you are a member of some dangerous gang like Al Quaida

or the like.
Form – it “Take Part in Research”
Bridging the Gap between Research and Education Coop.

The Al-Quaida-man knows the answer but won’t tell,

and

the young people would like to tell but they do not yet know.

I further suggest that
• Diversity of RECs will not be given up
• RECs will not be streamlined.
• RECs will not be subject to a set of rules being defined outside the RECs
but that instead
• School-curricula-designers adopt qualities that are found useful in RECs, and are allowed to do so.
• diversity of RECs finds its way into schools.

RECs are and should stay
Research-laboratories for the development of new school education.

Success?

1. Year

Overlooking the years we find some suggestions:
1. Teachers and pupils like building a PRODUCT.
2. The task must be open ended an hard enough.
3. Too many industrial partners will tie up resources.
4. Partnerships between industry and schools need continuous moderation.

I suggest
Not define general quality criteria to judge and assess a REC from outside

But
To look for properties, attributes and features of RECs which are felt to be useful in setting up and running RECs that might help to create NPWs.
Thank you for your attention
What are Good Practices of Research Education Cooperation REC? WS 1 Results
Michela Mayer, SSIS, Università di Roma Tre, Italy, Gunther Pfaffenwimmer, Ministry of Education, Austria, Robert Lorenz, Freie Universität of Berlin

General assumptions
- Diversity is a richness, also in the educational environment: RECs diversity needs to be maintained
- REC quality is related to contexts, society and school needs
- Good cooperation and mutual benefits are the basis of good RECs
- Networks at regional, national, international level seem to be good contexts for improving the quality of RECs

Science experienced as a Real Life Challenge
- where answers are not known
- where school knowledge is put to use
- where questioning is valued
- where they are challenged to be creative and think for themselves
- In international RECs science provides a cultural bridge

High quality research and high quality education cannot be measured directly
Due to Gödel, a logical system can only be understood by a more complex system

Important positive effects of RECs are seen only after a long time

RECs are and should stay
Educational research-laboratories for the development of new school education
Form – it “Take Part in Research”

Bridging the Gap between Research and Education Coop.

**Workshop 1 Report**

**International Conference**

**REC quality from the point of view of the image of Science and Technology in Society**
- 'Authentic science' not only in research but also in professional applications (medicine, robotics, telecom...)
- Enables creativity but not only providing entertainment
- Shows uncertainties of science and gives the possibility to say 'I don't know'
- Asks for minds (and not only hands) on the experiments
- Gives opportunity for different solutions (open ended problems) and foster debate
- Offers the opportunity for 'frustration'

**Questions to be researched**
- What is the level of understanding of basic principles we can reach (or we want to reach in a REC)? Is it 'real science' or a Trojan horse for teaching 'school science'?
- How could RECs transfer the acquired knowledge to other RECs?
- How to build a long-term benefit into the life of the school?
- What is the meaning of 'authentic science' at different age levels?
- Offers possibilities for professional development, school and society recognition
- A challenge for their communication abilities
- Offers a possibility to communicate their findings, aims and beliefs to society through pupils and teachers
- Is inspiring
- Asks scientists to reflect on their own assumptions and learn from schools / public
- Is a challenge for their communication abilities
- Asks for a bottom-up approach
- Shows the complexity of science and of science research
- Is based on 'authentic' problems (real life, real-research, real pupils' concerns)
- Enables creativity but not only providing entertainment
- Shows uncertainties of science and gives the possibility to say 'I don't know'
- Asks for minds (and not only hands) on the experiments
- Gives opportunity for different solutions (open ended problems) and foster debate
- Offers the opportunity for 'frustration'

**Message to policy makers:**

Give RECs more time and support to find out what’s good - there are no short-term solutions

**Questions to be researched**
- What is the meaning of 'authentic science' at different age levels?
- What is the level of understanding of basic principles we can reach (or we want to reach in a REC)? Is it 'real science' or a Trojan horse for teaching 'school science'?
- How could RECs transfer the acquired knowledge to other RECs?
- What could be transferred and what is 'unique'?
- How to build a long-term benefit into the life of the school?

**Message to policy makers:**

Give RECs more time and support to find out what’s good - there are no short-term solutions
3.3.2. Workshop 2: How to realise good cooperation projects?
reported by Atje Drexler and Louise Baker, Robert Bosch Stiftung

Introduction
Workshop 2 posed the question, “what are the deciding factors in making a REC successful and sustainable”? Before trying to answer this question the workshop participants heard good practice examples from two speakers: Yves Quéré, physicist and co-founder of “La main à la pâte”, a programme concerning the renovation of science education in French primary schools, with a large number of international interactions; and Heinz Lingen, Head Teacher of a secondary school in Jülich, near Aachen in Germany, which is very much focussed on the development of cooperation models for schools, science and economy and who has been able to turn a successful REC into a sustainable addition to the school.

In both examples the involvement of regional and national institutions was essential in ensuring that the activities were transformed from projects with a limited timeframe to long term activities with considerable educational impact. The motivation and engagement of the teachers involved was also clearly highlighted.

Approach
The workshop was divided into two groups. Group A concentrated on the criteria needed for setting up and establishing a successful REC, whilst Group B discussed the stabilisation and dissemination of a REC. In their individual groups, participants where asked to name upto three criteria, which they personally considered to be essential for that particular theme. The two groups then discussed these criteria before clustering them together in order find common themes as well as structuring the results. At the end of the workshop the two groups came back together and presented their results to each other. The results were discussed intensely so that a combined summary could be compiled.

Results
The following conclusions were drawn up as a direct result of the workshop discussions:

When setting up a REC, the importance of researching or exploring, which RECs are already available in and around the institution’s area was emphasised. This research is imperative when setting up a new project in order to ensure that a similar project is not already being carried out within the region.

Searching and finding suitable, competent partners was also considered to be key when starting up a REC and the importance of good personal relationships with all partners was not to be underestimated. Determining the benefits and motivation of all partners involved in a REC could be a way of establishing whether a potential partner was suitable or not. This could be done on either an individual basis or on a wider scale, depending on the project. The group believed that it is essential that all partners are clear and honest to each other about why they are involved in the REC and what they aim to get out of it in order to avoid discovering any hidden agendas at a later stage, as well as ensuring that there is a shared vision for all involved.

A formal agreement should be drawn up between project partners so that responsibilities, tasks, project structure, resource input and availability are clearly defined and agreed upon. Partners should also agree on the project culture, respecting the different mindsets of the schools and research institutions. Securing the acceptance of the initiative at an institutional level, for example from the Head Teachers of the schools involved was a further criterion to be met when setting up a REC.

It was agreed that in order to be successful, a REC requires not only organisational development from both sides, but also personal development of those involved. Consequently, those involved may have to accept a different role within the project to the one that they practice in their professional, daily lives and must be open to new ideas and agendas. The structural differences in each institution should also be acknowledged and respected.

The creation of a network, especially between teachers, as well as for recruiting others to help with the setting up and running of the REC was also a further factor for success. Enlisting helpers and alliances ensures that project responsibility is not left to just one person, but delegated to a number of individuals. No only does this have organisation benefits, but it also ensures continuity. It was also decided that there should be a Liaison Officer for each partner institution in order to ease communication between project partners.
When deciding on how a REC could be transferred from a short term project into a long term activity the group was adamant that the REC needed to become part of the institution's mission, once again underpinning the importance of institutional commitment as well as devoted leadership.

The dissemination of the benefits of the REC to all levels, in order to establish institutional ownership, was underlined. The group agreed that for a REC to be developed in the long term there needed to be a stable and reliable framework in place so that activities could be planned and implemented successfully, even if personnel changes occur. This factor was then extended to include a framework policy and the group was convinced that reliable education policies and funding schemes were essential for a REC's sustainability.

The usefulness of feedback loops so that the REC can be modified and optimised throughout the project was highlighted. Evaluation should be part of the project and implemented throughout as opposed to just being carried out at the end of the project.

In order to ensure that the REC had a long term future the next generation of children, students, teacher and researchers should be involved as early as possible, as it is they who will continue to develop the project at later stage.

Finally, financial resources need to be secured and so it was recommended that local and regional stakeholders should become involved.

**Input statements**

The French "Le main à la pate" program as an example for a nationwide REC
Yves Quéré, Académie des Sciences, France

Synergetic Effects and Impediments in the Collaboration between Secondary and Tertiary Educational Sectors – from a High School Perspective
Heinz Lingen, Gymnasium Haus Overbach, Jülich

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**Precisely defined objectives...**
offer a didactic framework and help address target groups,
are a prerequisite of cost effectiveness for all parties involved,
provide protection against unauthorized curricula,
present unfocused aims and improve communication among institutions and their representatives,
help to avoid curricular redundancies and ineffective "educational tourism".

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**A consensual choice of appropriate measures...**
presupposes a knowledge of specific methods,
ensures that the competencies of the involved institutions achieve the intended synergies,
provide target group orientation and increases motivation and focussed learning in the student body,
thus guaranteeing optimal learning outcome.

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**Allocation of responsibilities on the basis of respective resources and competencies**
A differentiated analysis of respective resources and their allocation enhance synergetic effects and help avoid a straining of resources.
Without clear-cut arrangements regarding resources and competencies synergetic effects are bound to be inefficient and to fail expectations.

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**Three prerequisites that ensure long-term sustainability...**
Orientation towards students' prior knowlegde, curricular standards and the respective state of scientific research.

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**A differentiated analysis of respective resources and their allocation enhance synergetic effects and help avoid a straining of resources.**
**Form – it “Take Part in Research”**

Bridging the Gap between Research and Education Coop.

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**Orientation towards students’ prior knowledge yields positive results**

- If students are encouraged to prepare subject lists and questionnaires prior to workshops,
- if resources are provided that bridge the gap between prior knowledge, curricular standards and the respective state of scientific research.

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**Three prerequisites that ensure long-term learning efficiency**

1. **With respect to high school education**:
   - A science-based culture that provides ample opportunity for scientists, students and teachers to interact must be a primary concern.
   - The various forms of collaboration should meet with due appreciation.

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**Three prerequisites that ensure long-term learning efficiency**

2. **With respect to universities and research centres**:
   - Workshops must be oriented towards the cognitive and didactic dynamics at the secondary level.
   - Quality standards concerning collaborative workshops involving the tertiary and secondary levels will have to be defined.
   - "Flashes in the pan" should be avoided and those involved should come down on the side of long-term collaborative strategies.

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**Three prerequisites that ensure long-term learning efficiency**

3. **With respect to the involved government departments**:
   - Collaboration between tertiary / secondary education and scientific research centres should be given a high priority.
   - Innovative and collaborative strategies involving Youth Education Centres should be encouraged.

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**Special thanks go to the following institutions and corporations for their financial and practical support in advancing collaboration between university / scientific research and high school communities**

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**Organisations that collaborate with Gymnasium Haus Overbach, Jülich**
3.3.3. Workshop 3: Could an REC be an element of modern science education?

reported by Dirk Hillebrandt¹, Regula Kyburz-Graber², Christine Gerloff-Gasser², Katharina Kohnse-Höinghaus³, and Edith Oberkofler⁴

¹IPN Leibniz-Institute for the Education of Science, Kiel, Germany
²University of Zurich, Institute for Teacher Education, Switzerland
³University of Bielefeld; teutolab Chemistry (REC at the University of Bielefeld), Germany
⁴HBLA Ursprung; Tick Patrol (REC at HBLA Ursprung), Austria

Can a REC be an element of modern science education? This was the leading question for the authors and the participants of Workshop 3. Everyone knew that there would be no definite answer to this. But the workshop provided the opportunity to come up with an appropriate diagnosis of the current European situation, practical suggestions about current and future needs, and necessary developments: Teachers, teacher trainers, scientists, and educational researchers from eight European countries with different professional background met for the purpose of trying to give at least a provisional answer to this difficult but urging question.

We found the short answer to be: RECs in their various forms of appearance are a necessary element of modern science education. For various reasons, they provide an adequate learning environment for dealing with science. However, and as always in our business (of science education), there is a “but” to this … so the long answer is more complex. But we all agreed on one aspect: the beauty of RECs lies in their diversity. Looking for change on all system levels while keeping this diversity alive is our main motivation.

The longer, more detailed, but nevertheless still fragmentary and incomplete answer after the workshop therefore reads: Science education needs resources particularly with regard to time, demanding a great amount of flexibility, and has to aim at the understanding of basic concepts in context. It is based on the openness and the preparedness of all actors to changes.

Future science education accounting for and incorporating RECs leads to the re-thinking of learning environments, e.g. the classroom setting, materials used, tasks to develop, and experiments to be conducted.

The development and formation of sustainable networks in order to promote professional (teacher) development is one major task for the future, especially among teachers, teacher education institutions, and science. Cooperation, interaction, and systemic support during pre-service and in-service training as well as in further education of teachers are essential for a successful change.

During the workshop quite a lot of different aspects and details to be considered have been mentioned. This short report cannot possibly give every detail on, but the following lists reflect the main topics of our lively discussions.

**Visions of modern Science Education**

In order to change science education the following fields are important:

On the level of society and culture, one of the main challenges is to give science (and science education) a face. One purpose is to help the public to understand science. This comprises the language used to describe important scientific topics as well as showing the necessary links between science, research and every day life. Science is an ongoing (often interdisciplinary) process, which is changing along the course but nevertheless deals with real problems important to all members of a society. In order to make people understand this complex nature of science the scientists therefore themselves have to understand the needs of the public. The goal is to create a culture of science in which all participants respect each other and understand the respective needs. RECs are able to bridge the existing gap because they are bringing science to everyday life in order to improve understanding. Showing the relevance of science to everyday life is a central effect of the work of RECs.

The key effect of RECs is that they offer a whole bunch of different approaches to learning science. This goes from introducing scientific results with the help of simple experiments up to enquiry-based learning approaches which are quite similar to the “real” scientific enterprise. The potential for possible innovation to science education is – apart from the aforementioned diversity – a second key feature of
RECs, which is to be preserved while integrating these approaches to formal schooling. Loosing this focus could mean loosing the potential of bringing about change.

Changing the learning environment by changing the approaches to acquire knowledge is one way by which RECs can change future education of science. The other important way is to change the way science is taught and teachers are trained. Keeping in mind that teachers are able to multiply the positive effects of RECs, this is a rather powerful instrument in order to bring about change. It is our opinion that RECs should play a major and central role in future education and training of science teachers. This includes amongst others the design of flexible work time budgets, systemic support to be able to take advantage of RECs, the implementation and support of networks among teachers themselves and among teachers and scientists (science coaches, tandems), as well as money (grants).

In the beginning, the installation of win-win-networks for all contributors and actors in this field is important. The movement of RECs all over Europe (and in parts being shown at the conference and during our workshop) was a starting point. The inclusion of other important actors in the field of science education will follow. In addition to scientists, teachers, and pupils, administrators and politicians will eventually join in to change the system in a fruitful way.

**Workshop 3 „Education“**

**Introduction**

**Outline**

- First session (Th, 10:30-12:30)
  - Visions of modern science education
- Second Session (Th, 14:30-16:45)
  - Input K. Kohse-Höinghaus
  - Discussion; Identifying the outcome
- Third session (Fr, 11:00-12:00)
  - Identifying the outcome
  - Summarizing results

**Areas of Concern: Education**

- Successful instructional arrangements
- Amount of necessary guidance
- Danger: Busy getting nowhere!
- „Learning Science - Learning about Science - Doing science!“: All within the same learning experience?

**Can a REC be an element of modern science education?**

**Moderator:**
Regula Kyburz-Graber (Zurich)

**Assistance:**
Christine Gerloff-Gasser (Zurich); Dirk Hillebrandt (Kiel)

**Guest Speaker:**
Katharina Kohse-Höinghaus (Bielefeld)

**Rapporteur:**
E. Oberkofler (HBLA Ursprung, Austria)

**Areas of Concern: Education**

- Baseline: Status quo science education?
- Interaction: Top-down educational systems (e.g. schools) and bottom-up educational initiatives (e.g. RECs)
- REC: longer lasting impact or temporary and passing fashion?
- REC: alternative or replacement or accompanying measure or ... initiatives (e.g. RECs)
- Ways and forms of successful collaboration and cooperation (e.g. pragmatic agreements)
- Ways and forms of integration
Can a REC be an element of modern science education?

- RECs as an element of changing science education
- Conditions?
- Ways of exploiting REC’s potentials to bring about necessary changes
- Expectations, recommendations .... and aspirations

Background

Source: Science Education Now: A Renewed Pedagogy for the future of Europe; “Rocard-Paper”

- Observation 1
  - A major threat to the future of Europe: science education is far from attracting crowds and in many countries the trend is worsening.
- Observation 3
  - The origins of this situation can be found, among other causes, in the way science is taught. (‘chalk and talk’)
- Observation 4
  - Many on-going initiatives in Europe actively contribute to the renewal of science education. Nevertheless, they are often small-scale and do not actively take advantage of European support measures for dissemination and integration. The real impact are simply not being exploited.

Areas of Concern: General

- Funding
- Support (e.g. non monetary support)
- Staff
- ....

Input statements

Chemistry? - yes, please! Informal Science Education in the teutolab in Bielefeld University
Katharina Kohse-Höinghaus, University Bielefeld, Germany
3.3.4. Workshop 4: How to use a single REC project to move the system?

reported by John Meadows, London Southbank University, United Kingdom

The working session of Workshop 4 circulated about following main issues:

- Research centres and university researchers should open up to schools
- School autonomy needs to be supported
- Curriculum development should be linked to school development
- Schools need flexible spaces to support a flexible curriculum
- Scientific thinking can exist at many levels – even very young children can be said to be thinking scientifically
- Change in science education can be top down and bottom up
- Science curriculum can be seen as a culture
- RECs need to deal with complexity, not try to simplify it.
- Young researchers and scientific workers should be encouraged to link with RECs, particularly when dealing with children’s own questions.

Input statements

Policy Issues
John Meadows, London Southbank University, United Kingdom

Policy Options in Primary schools

- Learning large chunks of science knowledge?
- Developing curriculum materials?
- Teacher Professional Development
Address the needs of future citizens in a scientific world as well as those of future scientists... Develop... involvement in subject associations, industry... Work with scientific and related industries...

An example: http://www.standardsoff.pdf/engweb04a.pdf

Gender issues

- Girl friendly science?
- Or just science that motivates all learners?
- Environmental or biological sciences for girls?
- The project "Schnuppertage im Labor" (Visit a lab CH)

International Conference Vienna, 12th to 14th of March 2008
Global/ethnic issues
- Studying the history of scientific discoveries may include understanding Muslim contributions to clocks, cosmetics and chemistry.
- Egyptian physics
- Chinese medicine
- Greek Astronomy
- Benin metallurgy

International Science Education
PISA framework, includes competences of pupils to:
- identify scientific questions.
- explain phenomena scientifically
- use scientific evidence.

Some examples from good RECs
1. Pupils identify scientific questions
   - Future.scapes - Austria – pupils’ perceptions and opinions of environmental and social problems
   - UK-Japan young scientists – groups of 6 pupils identify a project

2. Explain phenomena scientifically
   - A Tale of two Valleys (Austria) – students present the project to the public
   - Crossing the Alps – Switzerland – students present part of the exhibition to the public
   - Molecular Biology – Germany – gifted students present their results in a biology conference

3. Use scientific evidence
   - Research and Ethics – Italy - children observe and interpret the behaviour of monkeys
   - UK-Japan young scientists – groups of 6 pupils use science competencies to research a project.

Local contexts and relevance to learners
- Studying rocks pools may be of limited interest to pupils in cities or countryside
- Investigating the chemistry of cosmetics may motivate girls more than boys
- Is it better to make science motivating for all pupils, rather than adapting it for girls or boys?

In our RECs, do the researchers...
- identify the scientific questions and the pupils just carry out pre-determined experiments in order to learn scientific skills?
- explain the scientific ideas and concepts to the pupils, instead of asking the pupils to do the explanations?
- stress the scientific evidence, instead of showing pupils how and why scientific evidence is important in helping them to find answers to their own questions?

English national policy is beginning to encourage...
- Open-ended inquiry-based learning
- Personalised learning and choice for learners
- Assessment for Learning, not just for credits in exams
- Teachers and pupils to link with science researchers in Industry and Universities
Research Education Cooperation as Learning Systems – A Short Illustration of an Austrian Adventure
Franz Radits, Austrian Educational Competence Center Biology – University of Vienna, Austria

- rec & system – a mythologic reflection
- cases & and case study research
- discussion: changing the roles - learning about the science & education system
- résumé: chances for implementation
Form – it “Take Part in Research”

Bridging the Gap between Research and Education Coop.

Case Studies – Interfaces between Science and Education

- Friedrich Palencsar / Isolde Kreis:
  - Doris Elster:
  - Ingeborg Schwarzl:
  - Martin Scheuch / Günther Pass
  - Manfred Durchhalter / Martin Scheuch:
  - Franz Radits / Kurt Allabauer / Christine Eberl / Claudia Mewald:

- Case 1
  - Case 1
  - Case 1
  - Case 1
  - Case 1
  - Case 1
  - Case 1
  - Case 1

Daten collection & analysis

Reporting…

Model of co-operation

- Case 1
  - One research field – two types of questions
  - Scientists and students act separated
  - Ownership: two reports
  - Moderation of the teacher
  - Teachers as meta-scientists

Patterns of communication

- Case 1
  - Private relationship between some researchers and teachers
  - Scientists negotiated research questions with teachers
  - Teachers involved / informed / students
  - Students as local experts – investigating in their home village
  - Scientists and students met first during the presentation of results in the village center…
Résumé

Scientific research

• TE-Students should investigate and learn in the research field of the ecologist (development of landscape and land use) together with teachers and their students

• Goal: transfer of knowledge

• Ecologists created a TE seminar…

causes ….

through a more or less complete research

If pupils, researchers and teachers go

2. Chances: Researchers, knowledge and science

3. Vanishing teacher as “administrater”…

Where is the teacher?

Workshop »Curriculum«
März 2008

• Action research: TE started

• …Teachers reconstructed scientific

• … No transfer of knowledge from the

• Back stage of science

Case 2
Emigration of ecologists into teacher education

• Ecologists created a TE seminar…

• Goal: transfer of knowledge

• TE-Students should investigate and learn in the research field of the ecologist (development of landscape and land use) together with teachers and their students

Case 2
Vanishing ecologists

• … No transfer of knowledge from the science project into TE or school

• …Teachers reconstructed scientific issues offered by ecologists into traditional curriculum content matter

• Action research: TE started systematic reflection → Data based restructured course …

Back stage of science

Case 3
If pupils, researchers and teachers go through a more or less complete research process in co-operation with researchers this causes ….

1. Conflicts: Research questions, Time Accuracy, Accepting open questions & gaps

2. Chances: Researchers, knowledge and science become objects of research and/or reflection. “A general understanding for the necessity and functioning of science evolved”, says the meteorologist.

3. Vanishing teacher as “administrator”…

Discussion: Learning from Heracles or REC as a learning system

Case 3

Educational Reconstruction

Meaningful Learning about science

Experts – Scientific research

Learners

Résumé
Implementation into Curriculum: Scientific Literacy

53
Cooperation as an adventure: Education and Science (e.g.: Universities) are strong cultures...

Collaborative research prevents from incapacitation

We produce through education a majority ruled by knowledge, not served by it – an intellectual, moral and spiritual proletariat characterised by instrumental competencies rather than autonomous power.

(L. Stenhouse, 1978)

Résumé

Implementation into Curriculum: Scientific Literacy

epistemological competences
Learning about Nature of Science
Kriterias for successful rec knowledge action & communication evaluation values

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Résumé

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Collaborative research prevents from incapacitation

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(L. Stenhouse, 1978)
Can a single REC help to change policy?
Alenka Mozer, Gimnazija Vic Ljubljana, Slovenia

Two Slovenian RECs were presented that had positive influence on the recent national science curricula changes: the most important was the project »Lifetime education of natural science teachers« and the other was »Didactic renewal of gymnasium curriculum«. Although both of the RECs were addressed to teachers only and no students were involved, they had an important impact on chemistry, biology and physics curricula changes. Recent Slovenian PISA 2006 results showed very good students’ achievements especially in science literacy (12th place) and were probably strongly influenced by the systematic teacher in-service training in the last 4-6 years, including those two RECs.

No matter what are the policy options in secondary schools, there is always place for students activities in the classroom. Good Slovenian practice examples were given how teaching for the students interest and learning can bring also great results at test and at final external assessment (as less relevant side "product").
Form – it “Take Part in Research”

Changing role of teachers/teaching (PISA)

Do science teachers meet PISA requirements?
Do teachers stimulate/facilitate students to:
- ask open scientific questions
- explain phenomena scientifically
- present scientific evidence (not opinion)

Life-long education of natural science teachers

Context: there was a previous project addressed to chemistry teachers only (primary, secondary and tertiary level)
The aims of that project:
- to identify the most difficult/abstract topics in the existing chemistry curricula through all three levels of education
- to develop a set of effective teaching approaches and didactic strategies for several topics in the chemistry curricula of primary and secondary schools.

Examples of RECs which influenced Slovenian science curricula changes in the last 6 years

- Lifelong education of natural science teachers
- Didactic updating of gymnasium curriculum
  - both of the RECs were addressed to teachers only (no students were directly involved)
  - an important impact on chemistry, biology and physics curricula changes

Outcomes of the previous project:
- full collaboration among all partners involved was established
- several teaching/learning materials were produced (published in a leaflet, also on the Internet)
- unexpected outcomes at faculties of applied sciences
  - awareness of difficult/abstract chemical topics (cognitive levels of students and pupils are different) was evoked
  - recognition of importance of effective teaching approaches

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  - recognition of importance of effective teaching approaches

Lifelong education of natural science teachers

Processes:
- schools were mainly involved
  - in identifying interdisciplinary/abstract/difficult topics to be discussed
  - in evaluation of education models for the teachers of natural science
- coordination and management was done by Faculty of Chemistry and Chemical Technology FKKT, prof. dr. Natasa Bukovec
Lifelong education of natural science teachers

RESULTS

Model of Lifelong Education for Teachers

- researchers and expert teachers as bearers of in-service teacher training, sharing responsibility for the scientific content, all tools developed and educational methodologies used
- developing innovative approaches of teaching difficult and abstract science concepts
- incorporating new scientific achievements into curricula
- innovative approaches priority: real life situations, interdisciplinary approaches, hands-on approaches, and usage of ICT

GROSS PRACTICE EXAMPLE

Science Courses at Gimnazija Vic

GOALS

- to increase students interest in different areas of science and technology and to improve their knowledge through practical experience
- students are bearers of in-class activities, as well as out of classroom activities
- the courses are focused on active teaching methods, interdisciplinary approaches, hands-on activities
- students projects are fully incorporated in school and/or subject curriculum

Didactic updating of gymnasium curriculum

AIMS:

- developing different teaching methods and approaches within existing gymnasium curriculum, subject curricula
- teaching - shift from content knowledge to process knowledge
- to create authentic learning situations, to achieve enduring understanding, lifelong learning
- crosscurricular links were pointed out
- different taxonomic levels approach in teaching and assessing

GOOD PRACTICE EXAMPLE

Science Courses at Gimnazija Vic

TRADITION OF RECs

- science days, research camps (science week)
- open ended investigations of relevance to students: students are (individually/in teams) involved in science projects under the mentorship of teachers and researchers (experts at different research institutions, industry and institutions for popularization of science)
- students’ contributions and presentations are assessed in class according to criteria defined at the beginning of the project/research work

OUTPUT

- "pilot" models for lifelong education of science teachers were developed through the project
- several innovative teaching/learning materials were produced,
  - a leaflet/monography was published, website http://srv10.fkkt.uni-lj.si/moodle/
  - a list of possible bearers of in-service teacher training was formed (networking)
**Form – it “Take Part in Research”**

Bridging the Gap between Research and Education Coop.

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**GOOD PRACTICE EXAMPLE**

**Science Courses at Gimnazija Vic**

**Responsibilities:**
- A team of science teachers is planning activities, deciding on the teaching and learning style.
- Students are involved in identifying interesting topics to be carried out as project/research work.
- Researchers/experts from different institutions are involved according to students’ fields of interests and according to topics in science curricula.

**Outcomes:**
- 100% students pass final exam (matura).
- More students choose chemistry as their optional matura subject.
- Results at final exams significantly above the national average.

**Difficulties/Problems:**
- Teachers and students were established on personal connections mostly, so a network is building up.
- Popularization of science and introducing young people to the important field of research in science and technology has a positive impact.
  - On choosing their studies in this field (Gimnazija Vic students 50% above Slovenian average in science and technology studies).
  - On career building in this field.

**GOOD PRACTICE EXAMPLE**

**Chemistry Course - examples**

Second year students presented properties of the matter at macro and submicro level: human teeth and fillings pictures taken at dentist and from electronic microscope.

**Chemistry Course - results at final exams**

- 100% students pass final exam (matura).
- More students choose chemistry as their optional matura subject.
- Average grades are improving and are always significantly above the national average.

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**GOOD PRACTICE EXAMPLE**

**Science Courses at Gimnazija Vic**

**Outcomes:**
- Efficient individualization and differentiation of lessons.
- Teaching for students interest and learning brings also better knowledge (enabling understanding, higher taxonomical levels).
- Good results at tests and final assessment (as less relevant “side product”).
  - Example – chemistry results.
- Every year more students choose science subjects for their final exam – matura.

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**GOOD PRACTICE EXAMPLE**

**Science Courses at Gimnazija Vic**

**Difficulties/Problems:**
- Cooperations with research institutions and institutions for popularization of science are usually based on informal agreements, on enthusiasm of individuals only.
- System level: moral support?, low/any continuous financial support.
- Problem of longterm activities.

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**GOOD PRACTICE EXAMPLE**

**Science Courses at Gimnazija Vic**

**Outcomes:**
- Efficient individualization and differentiation of lessons.
- Teaching for students interest and learning brings also better knowledge (enabling understanding, higher taxonomical levels).
- Good results at tests and final assessment (as less relevant “side product”).
  - Example – chemistry results.
- Every year more students choose science subjects for their final exam – matura.

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**GOOD PRACTICE EXAMPLE**

**Chemistry Course - examples**

Using simple experiments our first year students analyzed colourings in fruit juices and candies of several producers. The third year students did more complex researches: on colourings and additives in lollipops and on selected organic chemical compounds in tulip.
4. Main conclusions and Recommendations

reported by María Pilar Jiménez-Aleixandre, USC.

A catalogue of good practices

Taken all together the posters, the key note speeches, and the cases summarized in the catalogue and presented in the workshops, offer an impressive wealth of good practices. To cite just one example, the project “Les mains à la pâte” presented by Yves Quéré shows how to involve whole classrooms in inquiry. The challenge that we face is how to disseminate these practices and increase their number and quality.

Braiding the strands, bridging the gaps

In my opinion, there are more than one gap that we need to bridge, because there are at least three strands that we need to braid:

1) D-research, disciplinary research in science.
2) SE-research, research in science education.
3) School science.

The gap between 1 & 3, D-research and school science, has been addressed in the conference. But there is also the gap between SE-research and schools, and between both strands of research. In the last 25 years science education research has been exploring how to get pupils interested in science, aware of the tentative nature of science, how to enculture them in the practices of science, how to get them ready to take ownership of their own learning (Driver et al, 1996). What has been learned is summarized in the constructivist perspective that views students as builders or producers of their own knowledge (Jiménez-Aleixandre & Pereiro, 2002). I perceive this strand as being largely absent from the conference. Taking a metaphor from women’s language and experience, I propose to braid these three strands together.

Outcomes from the workshops

From the many questions formulated in the workshops, I would select some issues that are worth to explore:

WS1) What do we mean by quality? In other words, How can we tell when a REC is a good REC? It was suggested that REC is just one component of the complex processes related to supporting inquiry in classrooms.

WS2) How to implement good cooperation projects? It was emphasized that there is no master recipe for success. One important notion is to make cooperation part of the institutions’ goals. And because we need extension, a conclusion may be: “Don’t let enthusiasm overrun careful planning”.

WS3) How to make REC an element of science education? It was suggested that science education needs time and flexibility, and has to concentrate on the understanding of basic concepts. This calls for a rethinking of the learning environments.

WS4) How to use REC projects to move the system, particularly the curriculum? Three key issues emerged: students’ ownership; curriculum openness (expressed at the nano / micro and macro levels); and the embedment or contextualization of practices and content.

The next steps: some recommendations for integrating Form-it inputs

I see several common issues emerging from the four workshops, and also from the cases presented:

1) Authentic science: by this we mean to give students the opportunity of exploring real life problems (e.g., Are ticks carrying diseases?). But also to get involved in scientific practices, including the discursive practices of science, as the evaluation of evidence (Jiménez-Aleixandre, 2008).

2) Students as protagonists of their own learning, finding answers to their own questions.
About the next step, how to integrate Form-it inputs, I see four main challenges ahead of us:

A) **Double goals**: to involve all students from a science classroom in inquiry as part of their regular science courses. This is much harder than engaging a few interested students in voluntary work, but it has to be our target.

B) **Build on teachers' good practices** in order to transform science teaching, rather than coming into the classroom from “outside”. We need to help teachers to gain confidence and ownership.

C) **Motivation and competencies**: Motivation is important, but we need also the development of competencies as doing inquiry, using evidence to back their claims.

D) **Recruiting science teachers**: Many EU countries have more problems recruiting science teachers than science researchers: we have to learn from Finland, to improve the social image of teachers.

3) Curriculum: Who is afraid of curriculum? We need to transform school curriculum, but I think that we cannot ignore it.

4) Teachers: We need to make teachers part of the picture. I noticed that there were many pictures, photographs of students, but too few of teachers. We need to seduce teachers into inquiry and good practices.

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More than one Gap

Science Education research has been exploring in the last 25 years how to get pupils interested in science / enculturated into the practices of science / aware of the tentative nature of science ready to take ownership of their own learning (Driver, Lederman, Crawford).

What has been learned: constructivism, pupils build their own knowledge.

Outcomes & new questions from Workshops

-1. What do we mean by quality? How can we tell if a REC is a good REC? REC as ONE component of process
-2. Implementation: No master recipe for success. Make cooperation part of the institutions : mission (goals?). Don’t let enthusiasm overrun careful planning
-3. Education: Science Education needs time & flexibility and has to concentrate on the understanding of basic concepts. Rethinking the learning environment
-4. Curriculum: three key issues: students’ ownership; curriculum openness (nano / micro / macro levels); embeddment / contextualization

The next step: integrating Form-it input

The challenges: involving all students from a science classroom in inquiry as part of their regular science courses
This is much harder than engaging a few students, but it has to be our target
2) Building on Teachers’ ideas of good practices to transform science teaching.
Helping teachers to gain confidence & ownership

The next step: integrating Form-it input

The challenges:
3) Motivation is important, but we need also the development of competencies as doing inquiry, or using evidence to back their claims (argumentation, discursive part of science)
4) Many EU countries have more problems recruiting science teachers than researchers: learn from Finland, improve the image of Science Teachers.
5. Appendices

5.1 Abstracts of Posters presented at the Exhibition

A partnership between School and Physics Research
The "Progetto Lauree Scientifiche" at Roma Tre University

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(3) Liceo Scientifico Statale A. Labriola, Via Capo Sperone 50 - 00122 Roma, marcolit@tin.it
(4) Liceo Scientifico Statale F. Enriques’, Via Paolini, 196, 00122, Roma, oriettaproietti@virgilio.it

In the last years, the decrease of the students enrolments in the university courses addressed to the "hard sciences", i.e. Mathematics, Physics and Chemistry, has revealed the need of a close collaboration between schools, universities and research institutions.

For this reason, the Italian Education Ministry and the Sciences Faculties Deans Conference have promoted the National Project "Lauree Scientifiche" which has the aim to improve the scientific vocations.

In this context, starting from year 2005, the Department of Physics of Roma Tre University developed a substantial experience of collaboration between university teachers, schoolteachers, researchers of scientific institutes and pedagogues.

This collaboration has the aim not only to improve the interest of young people for Physics but also to develop new educational approaches in which the laboratory activities and the engagement of students carry a key role.

Our work concerns the study of conceptual nodes and strategies that can support a meaningful learning of Physics and the planning of "learning contexts" addressed both to formal and non-formal education.

The main targets of our activities are the following:

• to find new ways to teach and communicate Physics, also based on daily experience
• to plan and experiment educational and communication modalities based on physics laboratory
• to test the educational use of modern technological devices
• to plan and experiment new didactic approaches addressed to students understanding of the role of models in physics and natural sciences
• to study transversal links between the teaching of Physics and the teaching of Mathematics, Chemistry, Biology and Astrophysics
• to promote the general idea that the school is a place where educational research must be performed

In our project are involved four Scientific Lycea and one Technological Lyceum, which strongly interacted between them and with the University.

We have obtained the following main results:

• a network permanently linking schools and university and devoted to educational research was created
• our activities really improved the interest of students for Physics and Sciences
• interactions and exchanges between students of different school were promoted
• no traditional ways of professional upgrading of teachers were experimented

For these reasons we believe that our approaches can be classified as good practices in the framework of the Research Education Cooperation.

1 In alphabetical order regarding the first author
Reflective Coeducation in MSI\(^1\)-lessons
Ilse Bartosch
Institute of Instructional and School Development /IFF – University of Klagenfurt

Some of the projects supported by the Fonds for Instructional and School Development – this fonds is based on the project IMST (Innovations in Mathematics, Science and Technology Teaching) – focused on motivating female students to choose a carrier in the field of mathematics/science/technology. The qualitative contents analysis shows typical features of “Undoing Gender” in MNI lessons. The analyzed documents deal with three issues: Blended Learning - implementing computers in the classroom, maths and science in context and single-sex lessons in the 8th grade. Self-depending and cooperative working is an essential aspect along with a broad variety of methods. The projects also focused on the ability of communicating science. As content knowledge was considered equally important as being able to communicate this knowledge, girls were promoted in a field where they see themselves competent due to gender stereotypes. This enables the girls to deal successfully with the scientific contents, whereas boys are provided with new experiences. Single-sex classroom activities and concepts are referred to in all of the projects.

IT knowledge is acquired in various contexts in school and job carriers. Technology is considered to be a serving tool rather than a field of science. The analyzed projects set science in contexts which are interesting for students or cause direct concern. The science lessons do not deal with isolated phenomena, materials, objects or processes, but with the relation that science creates with everyday life and social situations. Focusing on these aspects enables the students to reflect their own relation to nature and technology and motivates them to change and enhance it. Meeting “real” scientists is an important requirement in order to break down stereotypes. By observing and encountering people working in the field of scientific research students start to get a more realistic idea of research. Getting to know scientists makes these people and their working conditions visible as well as their personal side. Great attention is paid to female students encountering role models which provide the possibility of identification. In the reports a lot of evidence is found that these classroom activities enhances the experience of competence and therefore helps students to build up a positive self concept related to the subject. In the projects that were realized in the last grades of secondary school (students aged 18), there is some evidence that female students consider choosing study and job careers in the field of science and technology. It is clearly shown that preconditions due to the system play a vital role. The vast majority of schools involved in the projects display their engagement in gender mainstreaming and gender sensitivity on their homepage. Nevertheless it is also revealed that due to the school system which schedules nearly irreversible carrier decisions at the age of 14 a certain asymmetry regarding the choices of study and job fields is predetermined. Choosing educational carriers connotated as masculine interferes with the female gender identity and is hardly ventured in the phase of early adolescence (8th grade).

\(^1\) MSI stands for maths, science and information technology
Sparkling Science, School & Garden (SSS&G)

Evidence based developments of healthy open and green learnscapes

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Background:
Because of urban stressors healthy and restorative spaces in cities gain importance. Open and green spaces at school serve as learnscapes, for exercise and recreation. Activities in the garden bring fun and give joy to all users. The school garden under research has been designed and developed since 2002. About 400 persons participated in the development of the school garden up to now. The school called “HIB”, is exceptionally innovative and got several awards in different categories. More than 1000 pupils from 38 nations and about 150 employees are on-site.

Objectives:
It is the main objective to initiate further evidence based development of the school garden. Thereby all groups of users will be included into the scientific process. In doing so, an extended form of a Post Occupancy Evaluation (POE+) of the garden and relevant spaces will be achieved. Basic research on human-environmental interaction shall be imbedded into applied research in order to use synergistic effects. Additionally, innovative forms of communication and co-operation between researchers, pupils, school staff and the public will be implemented and tested. To have fun and joy while doing research are also important targets.

Methods:
State of health and environmental quality will be assessed with techniques from the natural sciences and medicine. Basic research will focus on psycho-social issues (connectedness to nature, body image, personal resources). A strictly participatory and gender-specific approach is intended. The users express their needs and investigate the research questions with the help of the scientists. The project involves a wide range of disciplines including social sciences, natural sciences, medicine, languages, sports and art. Scientists come from Public Health, Environmental Education, Landscape Planning and Innovative Publishing.

Results:
Findings will extend basic knowledge about human-environmental interactions. Stepwise evidence based improvements of the garden will be implemented. Making young people part of a health-promoting development of an exciting playing and learning environment can stimulate their engagement in positive personal and environmental developments and can serve as a basis for further steps toward a scientific career. Within the project young people (1) are encouraged to create ideas for analysing, planning and designing their environment according to their needs, (2) get used to a variety of scientific research methods, (3) display their findings in traditional as well as innovative forms of scientific communication (4) transform findings from science into art, (5) improve intellectual and physical capacity.

１Excerpt from a project proposal submitted for the First Call of the Austrian Research Programme „Sparkling Science“.
Knowledge transfer and educational practice: How teachers handle new information about Austrian Landscape Research (KLF)

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Austrian Landscape Research (KLF) is an interdisciplinary research programme which wants to contribute to the solution of social problems (see http://www.klf.at). Therefore, written and oral accounts of the Austrian Landscape Research should be made available for the public. This raises the problem of finding ways to make knowledge about landscape research of use for educational practice. A possible solution is to delegate this task to teacher in-service courses because high quality teacher development seems to be involved in the dissemination of new research results (Elster, 2005).

This study reports results of the qualitative evaluation in the KLF-dissemination project. The key players of the project are on the one hand researchers of the University of Vienna and of the Ludwig Boltzmann Institute Vienna and on the other hand 21 teachers of nine different Viennese schools (gymnasium) who took part in an in-service curriculum of interdisciplinary teaching at the Pedagogical Institute Vienna. According to the paradigm of didactical re-construction (Kattmann, 2000) the teachers planned school projects and units in interdisciplinary teams and in discourse with the KLF – researchers. The teachers wrote reflective papers about the planning process and about their classroom experiences. The papers and the processes were evaluated with methods of collaborative action research (Posch & Rauch, 2000).

The focus of the study is on the reflection the question of how teachers handle new information from research and how they transmit new knowledge, mostly available in a form not appropriate for their learners. Moreover, this study discusses the fact that given sufficient time and autonomy in teacher development courses the teachers plan lessons or longer teaching sequences that demonstrate their professionalism. This study also discusses how teachers select topics, it describes their motives, and how they plan and implement tuition (with a domain focus on agriculture and nutrition).

References:


Project group:
Teacher trainers: Doris Elster, Elisabeth Langer, Karl Jost
KLF-Researchers: Thomas Lindenthal, Thomas Maurer, Franz Radits
Teachers: Christa Leopold, Irene Solly, Ulrike Köberl, Christine Rötzer, Christoph Kastinger, Ines Stiedel, Edith Hoffmann, Judith Huemer, Anita Herla, Verena Schreier, Erika Bartl, Bele Pausch, Brigitte Gruber, Rosemarie Robenau, Ernst Plaimauer, Sabine Vlach, Mike Jenner, Karin Nemeth, Brigitte Husa, Ingrid Häusler, Tanja Tajmel.
„IKARUS“ – Pupils and Pre-Service Teachers Work with Scientists to Discover the Physics of Flying

Frantz-Pittner Andrea, Grabner Silvia, Kern Thomas and Bachmann Gerhild
Schulbiologiezentrum "NaturErlebnisPark"

The Science-Education-Centre of Graz/Austria developed a specific type of learning environment, the so-called "learning laboratory". This instructional model which is based on constructivist learning theories can be used as well for the training for pre-service-teachers as for the teaching of pupils. The learners work together with scientists of the technical university and the technical college and do a lot of hands-on activities. Afterwards every single learner can pose own scientific questions and answer them by using techniques of science. The evaluation of this project was done by the pedagogical institute of the University of Graz. The results of this study show a positive impact on the motivation of learners.
The kind of science education pupils get at school has an important share in the discourse about applications, chances, risks and ethical aspects of genetic research. In current science curricula there is a strong emphasis on putting theoretical knowledge in a meaningful context. Additionally the demand on the integration of practical experiments into regular biology classes is getting stronger. Since appropriate equipment and required expertise is missing, teachers are sometimes overtaxed in fulfilling this task. DNA hands-on laboratories provide support.

During the last ten years of its existence, the independent Austrian society dialog<>gentechnik took different approaches to foster the dialogue between science and the public. Beside its main function as a competent information office on life sciences, dialog<>gentechnik organized numerous projects, some of them specifically intended for schools, i.e. teachers and students. The establishment of the Vienna Open Lab – an initiative of dialog<>gentechnik and the Institute of Molecular Biotechnology – is an example for a successful strategy to improve the relationship between science and the public.

Located at the Campus Vienna Biocenter – a Life Science cluster of research institutes and small biotechnology companies – the Vienna Open Lab benefits from its surrounding. Young scientist are recruited as tutors, senior scientist can be enlisted as speakers and new experiments can be developed together with research groups, thus linking the experiments to actual scientific problems.

The Vienna Open Lab offers hands-on laboratory experiments for the public. Pupils are able to manipulate equipment and materials in an environment suitable for them to construct their knowledge of molecular phenomena and scientific concepts. A total number of 4,800 enthusiastic visitors participated in Vienna Open Lab courses so far. Above all high-school classes are attracted by our courses. The proportion of visitors falling into this category comprises more than 60 percent.

In contrast to the United States, where genetic hands-on laboratories have a long tradition, no such institutions existed in Austria so far. After the first two years of operation the Vienna Open Lab has become established as an interface between research and school. Thus the concept will be extended to Styria where the “Offenes Labor Graz” is currently under construction.
NaT-Working is the name of a support program by the Robert Bosch Foundation. Already for many years it supports projects that bring together secondary-school students, teachers and scientists. It supports activities that encourage the curiosity towards science and technology. Practical training, workshops, and summer schools are part of it.

NaT-Working Gläsernes Labor (Transparent Lab) is a project of the German Hygiene Museum (Deutsches Hygiene-Museum), which joins partners from the research and education in the area of Dresden. In numerous events, workshops and meetings, secondary-school students and scientists have an opportunity to discuss, to carry out experiments and to get to know each other. The project continues till 2008.

What is being done?

- Evening lectures, seminars for specially interested secondary-school students, courses on fluorescence microscopy in the Transparent Lab at the German Hygiene Museum
- Summer courses on biological systematics (Botanics/Zoology) of the Zoological Museum and the Institute of Botanics
- Supervision of extended research projects and BeLL (special learning achievements) for secondary-school students
- Talks by the local scientists in participant schools
- Development of the online learning environment for biotechnology designed by the Institute of Food Technology and Bioprocess Engineering
- Advanced teacher training, particularly at the Saxon education association for environmental protection and professions in the chemistry sector
- Workshops on microbiology and cell culture technology at 2 professional schools in Dresden
- Courses and seminars at the Max Planck Institute of Molecular Cell Biology and Genetics

Who is participating?

Max-Planck-Institut für Molekulare Zellbiologie und Genetik (Molecular Cell Biology and Genetics)
TU Dresden, Institut für Werkstoffwissenschaft (Materials Science)
TU Dresden, Institut für Lebensmittel- und Bioverfahrenstechnik (Food Technology and Bioprocess Engineering)
TU Dresden, Institut für Botanik (Botanics)
Museum für Tierkunde Dresden (Zoology)
BSZ für Agrarwirtschaft Dresden-Altroßthal (Agricultural Economy)
BSZ für Gastgewerbe Dresden (Hotel and Restaurant Industry)
BSZ für Technik Pirna (Technology)
BSZ für Wirtschaft Dresden (Economics)
Glückauf-Gymnasium Dippoldiswalde
Romain-Rolland-Gymnasium Dresden
Marie-Curie-Gymnasium Dresden
Martin-Andersen-Nexö-Gymnasium Dresden
Sächsische Bildungsgesellschaft für Umweltschutz und Chemieberufe mbH (Saxon education association for environmental protection and professions in the chemistry sector)
Landesverband Sächsischer Jugendbildungswerke e.V. (Saxon national association for youth education)
Fachhochschule Mittweida (University of Applied Sciences)
Berufliches Schulzentrum Dippoldiswalde (Professional school)
The University of Applied Sciences Burgenland awards a Prize for Applied Research – a Good-Practice Example for Research and Education Cooperation

Ingrid Schwab-Matkovits, Prof.in(FH) Mag.a; Franz Guttmann, Mag.
University of Applied Sciences Burgenland, Campus 1, A-7000 Eisenstadt

By initiating the »Pannonia Research Award« for young researchers in education the University of Applied Sciences Burgenland has created a Good-Practice Example showing that "Research and Education Cooperation (REC)" can have lasting effects on early inspiration in research and (scientific) publications.

This is a possibility for “young researchers” – students still in training – to hand in and publish scientific articles, which are academically reviewed. Furthermore an award is given to the best papers in each category. In addition, the “Researchers Night” at an Award Dinner is an ideal chance to network with renowned researchers and business partners from Europe with focus on Central and Eastern European Countries (CEEC).

We perceive the »Pannonia Research Award« for young researchers in education to be:

• a possibility to communicate to young people in education that their first steps in terms of research are interesting for, and appreciated by, the Scientific Community
• a strategic project encouraging the didactical integration of research in education
• an instrument/means of encouragement for young researchers

Brief description of the »Pannonia Research Award« for young researchers in education

The Pannonia Research Awards are designed to encourage research and publishing activities in the academic areas offered by the programmes of study of the University of Applied Sciences Burgenland. With the creation of these awards, persons who have achieved excellent standards in the research and development areas prioritised by the study programmes, should be supported and gain recognition for their endeavours.

The Pannonia Research Awards are targeted towards both experienced and junior researchers whose work fulfils either the category of “research excellence” or of “applied academic theory transfer”. Entries for the Pannonia Research Awards are welcomed from lecturers (full and part-time), researchers and junior researchers (graduates, students) from the University of Applied Sciences Burgenland, in addition to their contracted partners from central and eastern European universities or higher education institutions. Selection of the applications received is made by an academic jury using a double blind system. Originality, academic quality and applicability are taken into consideration.

Of particular importance is to motivate and initiate junior researchers (also people who are still in education) to publish. All papers that are awarded are published in the „Pannonia Research Report – ausgezeichnete angewandte Forschungsergebnisse des  Awards der Fachhochschulstudiengänge Burgenland“.

The presentation of the works submitted, along with the notification of the prize-winners, take place under the auspices of a “Researchers Night”. In addition to the individual prize money, all the prize-winners have the opportunity to present their research to the wider public. Further, they will be invited to participate in a “Pannonia Research Award Dinner” – a possibility for discussion, exchange and networking with renowned personalities from the fields of research, business and politics with focus on Central and Eastern European Countries (CEEC). Thus junior researchers - also people that are still in education – get the chance for exchange with renowned researchers in a relaxed and appreciative atmosphere.

Further information:

• www.fh-burgenland.at/award
The DLR_School_Lab Oberpfaffenhofen
Attracting young people to science and engineering

Hausamann Dieter, Schüttler Tobias, Haigermoser David, and Kästner Britta
DLR - German Aerospace Center, Wessling, Germany

The DLR_School_Lab Oberpfaffenhofen is an extracurricular science lab, its main objective being to attract secondary school students to science and technology. It has been developed and operated since 2003 by the German Aerospace Center DLR, Germany’s national research centre for aeronautics and space as well as Germany’s space agency.

For this purpose, each of the eight DLR institutes at the Oberpfaffenhofen research site has designed experiments which are, on one hand, based on its respective core research areas and which, on the other hand, are suitable for secondary school students (age 14 to 20). In total, the School_Lab offers 12 experiments in the research areas of

- earth observation sensor technologies
- operation of space-borne and airborne missions
- analysis of earth observation data
- environmental research
- meteorology
- communication and navigation
- robotics and mechatronics

The scientific concept behind each of the experiments includes the involvement of scientific and technical experts, a combination of specialist know-how and high-tech equipment (hardware and software), continuous updating and permanent development of the experiments, and close relation to state-of-the-art research.

The didactic concept for each experiment is based on small experimental groups (four students and one supervising student), emphasising autonomous and haptical work, in a time frame of two hours per experiment. This approach is a straightforward application of the concept of IBSE (inquiry-based science education, as proposed by the European Commission), allowing the level of complexity to be adjusted to each individual group, with the results depending on the students’ ages and capabilities.

In its regular operation the experiments are open to secondary level school classes with up to 30 students. The visiting classes usually stay for one day, allowing each student to perform two different experiments. To date, more than 5,500 students have visited the DLR_School_Lab Oberpfaffenhofen.

The second important activity of the DLR_School_Lab Oberpfaffenhofen is teacher education. Physics and natural science teachers learn about the science lab’s concept by overview lectures, by science lessons about the ongoing research at the institutes, and by actively performing the School_Lab’s experiments. Additionally, teachers are provided with written material about the science and didactics of the experiments. This facilitates to incorporate the experiments into standard curricula and the school education process and, thereby, helps to achieve a sustainable effect of the School_Lab experiments. Nearly 1,000 teachers have already been educated, the respective groups coming from individual secondary schools, or in the frame of teacher education seminars organised by regional school authorities. The highest multiplication effect is achieved by educating seminar teachers (i.e. teachers educating offspring teachers) which has, up to date, been initiated three times by the Bavarian Teacher Education Academy.

Altogether, the concept of the DLR_School_Lab is an excellent paradigm for a Research and Education Cooperation, the corresponding concept is worthwhile being adopted by other similar research organisations in Europe.
**BIT – Biology by Team is the first Austrian biology contest for Upper Secondary Schools**

Holub Peter  
Centre of Science Teaching at the Pedagogical University Carinthia – Viktor – Frankl – University

Students at upper secondary schools, who are especially interested in biology, can deepen their knowledge and broaden their competence in experimental biology within the frame work of this contest.

Each year, a team of teachers choose modules of key themes on which students work in the form of a voluntary exercise. The evaluation focuses in particular on the practical work, and, since the school year 2004/05, also on teamwork.

In April or May, a two-day closing competition takes place, in which groups of six students, each from one of the six participating schools, are given various problems to solve. There is no concurrence between the schools, as the groups are mixed. A jury (persons from the science and corporate communities) evaluate the results and how they are presented.

The concept was developed by a team of teachers in cooperation with the AHS - Department of the Pedagogical Institute in Carinthia. The first contest in the school year 2002/03 took place under the motto: Hell is loose in the Ground Under Us. Other themes included Beautiful But Dangerous, www-world wide water 1 and 2 and expedition forest.  

The closing ceremony of the school year 2006/07 took place on May 31st and June 1st, 2007 at the BG/BRG Villach St. Martin in Carinthia.  

The theme for the year 2007/08 is “Relationship Boxes”. It deals with all different kinds of relations between animals and plants.

Currently, the following schools are participating:

- BG/BRG Mössingerstraße Klagenfurt
- BG/BRG St. Martinerstraße Villach
- BORG Wolfsberg
- BRG Viktring
- Stiftsgymnasium St. Paul
- Österreichisches Gymnasium Prag

BIT was submitted for the German Innovations prize for Sustainable Education and placed among the 13 „best of“ all nominated projects.

This sort of team competition appears to be rare. This is why colleagues from Austria and other countries are again and again surprised to find such a program in the southernmost province of Austria. The base premise is also innovative. To replicate this effort in other regions requires teachers who are prepared to work in teams and school officials who can offer similar financial and organizational conditions.

With these prerequisites the base concept of „Biology By Team“ can be replicated for other science and instructional fields and could provide an important contribution for the improvement of the subject and also team competence of our youth.

Contact:
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Introducing the Competence Centre of Neuroscience - CCN

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Integrative neuroscience addresses not only how individual neurons operate, but how multiple neurons orchestrate with their neighbors to generate the impressive wide spectrum of brain functions which allow humans and animals to operate successfully in their natural environments. The disclosure of these mechanisms is the mission of the newly founded Werner Reichardt Centre for Integrative Neurosciene (CIN) in Tübingen.

Another important goal of the CIN is the enforcement of research oriented training by the Graduate Training Centre for Neuroscience. This training centre will be supplemented by a Competence Centre for Neuroscience - CCN that provides unique training opportunities for high school students and their teachers in order to provide insights into exiting new developments in integrative neuroscience. By doing so, we aim to promote public understanding of neuroscience and encourage talented young high school students to consider careers in this vibrating field.

Classes of students from high schools will be invited to visit the CCN for one day. Approximately 10 different experiments and exhibitions covering various fields of integrative neuroscience will be set-up and can be explored. They include neuroanatomy, electric properties of biological membranes, sensory systems, motor systems and computational neuroscience. It is important to note that the topics of these experiments are substantially influenced by the research topics addressed in the CIN. High school students perform these experiments under the supervision of young research associates, usually doctoral students from the fields. Background information on the experiments will be provided through the CCN-website. Small groups of students perform a single, previously selected experiment and, at the end of the day, report their obtained results to their class mates. This seminar will complete the exciting visit of the CCN. In addition to the above outlined experiments, frequent seminars designed for teachers and grade 12 students intend to inform about the research activities within the CIN. This vocational education will inform high school teachers with state-of-the-art research activities not only in the CIN but in neuroscience in general.

The CCN activities aim to satisfy four major objectives. First, the interest of talented young high school students in neuroscience might be sparked quite early in their education. Talented students are essential to further promote research in neuroscience. Second, the CCN will satisfy the increasing demand for practical courses in biology as envisioned by modern high school concepts. Third, the designed experiments are thought to facilitate the realization of the high school syllabus in biology touching on neuroscience. Fourth, the CNN might help to counteract the resentment of the young generation against basic research, high tech approaches and the use of animals in basic research.

The Competence Centre of Neuroscience – CCN is funded by the Robert-Bosch-Foundation.
Earth System Research in Berlin and Brandenburg - A Network Connecting Schools With Science Institutes

Kirchner Ingo, Tschendel Martin
Freie Universität Berlin

Beginning in summer 2006 the project, as called in the title, is going into its active phase. As a research education cooperation with the focus on Earth Science (funded by the Robert Bosch Foundation in the NaT-Working programme), the aim is to transfer scientific research results to Berlin and Brandenburg high schools. All project activities are related to three scientific topics: climate change, working with earth system data and earth system modelling. The interrelation of different scientific areas will be the play ground for the high school students.

Our project supports three fields of activity:

First the transfer of newest research results to the classes, second the design and development of comprehensive education modules and third the organisation of common activities. Regarding to the first field of activity, we already organised two workshops to open the possibility to present expert knowledge by scientists for teachers.

We are going to realize our next workshop in April this year with the focus on geographical information systems. In addition to the information transfer from science towards schools during these workshops, the participants develop the education modules together, which is our second field of activity. In each module a specific subject or activity is picked up and scientific material will be prepared usable on the high school level.

In order to connect the three scientific topics, we try to develop modules, which can not only be used in a single course, e.g. geography, mathematics, computer sciences, physics, chemistry or biology, but applicable for activities combining different disciplines. Giving an example, one module is dealing with a "Climate Game". This board-game sensitizes the students to problems of the climate change and makes them aware of the relations between economic development interests, environmental protection needs and scientific findings provided by the Intergovernmental Panel on Climate Change. Another module offers portable analyser kits for meteorological and environmental measurements. This module also establishes a network of automated meteorological stations in schools and our research institute. The collected data will be provided on the internet for the schools.

Our third field of activity is the implementation of the module results, obtained by intensive preparatory work in the workshops and education modules. Giving an illustration, our partner schools organise "Climate Game" competition days or they use the analyser kits for field trips, e.g. as in September 2007 during the Berlin Marathon. In the three project years with funding we will publish all our activities and results on our projects web page. This should support our members to interact between the different fields of activities.

But it should also reach not directly involved people to become interested in our work. For the future, it is our objective to equip the project with a certain autonomy. Even after the end of the sponsorship, there should be teachers, students and researchers, who will continue to run the meteorological stations and to keep the "Climate Games" and analyser kits in good condition.
At the beginning of the UN decade for Education for Sustainable Development (2005-2014) a project, aiming to integrate and embed the Education for Sustainable Development in the syllabus and everyday teaching on lower secondary level (grade 7-9), was started in Switzerland. The development, reflection, and evaluation of exemplary curriculum units on this subject takes place in a participatory double loop process: first, pilot schools in the French-, German-, and Italian-speaking parts of Switzerland integrate the Education for Sustainable Development in their school development, considering their particular school situation. These schools document their experiences and reflect upon them in case studies (action research approach). Second, students from eight teacher-training colleges across the country develop and evaluate further curriculum units during their practical periods. Thus, the Education for Sustainable Development will be included in their personal teaching repertory, in their practical schools as well as in teacher-training. The final product of this project will be a curriculum-concept for the Education for Sustainable Development grade 7-9, a collection of useful background material, a broad set of authentic, creative curriculum units and case studies on how to address Education for Sustainable Development at lower secondary level.

From the Swiss project of the Education for Sustainable Development, an example has been taken out and showed on a poster. This, aims to illustrate a sequence of curriculum units on the specific topic named “Mobilità sostenibile – una scelta possibile?” (sustainable mobility – is it feasible?).

This project on the traffic was developed in the Scuola media in Morbio Inferiore in order to sensitize, deepen and work up with the students (grade 9) on this typical and actual problem of the school surroundings as well as of the whole region.

The large curriculum units contain one game on mobility, an extensive inquiry in a shopping centre, four didactical unities, three excursions and several single lessons of Geography, History and Natural Sciences.
Schools and the Technische Universität München (TUM)

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This report can not cover all the activities at TUM. It will only give a few examples and it tries to deal with some important questions.

Since several years TUM (Technische Universität München) is working on programmes to improve school education in science and technology. Already in 1998, TUM started to participate in Global Hands-on Universe (HOU), an international effort to bring research projects in astrophysics to teachers and high-school students. HOU came into being in 1992 as part of the famous “Supernovae Cosmology Project” (Lawrence Berkeley National Laboratory). TUM promoted the introduction of HOU in Germany. Recently, an international group of high-school students succeeded in discovering an asteroid using images of a telescope in Illinois, USA. They were introduced in the field at Deutsches Museum in Munich where we had a HOU workshop for one week in August 2007. Participants came from Austria, Canada, China, South Africa and Bavaria. The internet was used for the asteroid search later on.

Within the TUM ScienceLabs project high-school students gain access to laboratories of the Garching research centre. Real research is done each year in so-called “Facharbeiten” which are small research projects of high-school students. One of the more recent examples is a student who studied the process of mummification of a body displayed at the museum of archaeology in Munich (Archäologische Staatssammlung). Many scientists were involved as well in order to find the origin of the body which is not known in detail.

Each year, TUM organizes a conference in March or April where high-school students present their projects. Students have to talk in front of an audience of more than 100 people. Many of them are students of a lower grade who will hopefully become interested in research through the examples on stage.

Projects between research institutes and school dependent strongly on the persons involved. In order to achieve long-term success it is important to improve the cooperation between universities, research institutes and schools. Recently, TUM started to have contracts with selected schools (“Referenzschulen”) which puts cooperation on a solid basis.

In addition, it was possible to found the first cluster of schools (“TUM Schulcluster Berchtesgadener Land”) in November 2007. Schools fixed by contract their cooperation including their efforts to improve science education. In this special case we approach another problem of partnerships between schools and research institutes. In many cases schools are simply to far away. The cluster guarantees that the efforts of the university reach many students and we can develop new concepts for partnerships and science education. We are already planning summer and winter schools for gifted students which include examinations at the university. A local research centre for school students will probably be founded in the near future in Berchtesgaden. We are also planning to increase the number of clusters in Bavaria.
Form-it Take Part in Research

Meissner Markus, Prauhart Nadia
Österreichisches Ökologie-Institut

Form-it - Take Part in Research! supports networking experts who work with and on new didactic concepts for science teaching. The overall objective of Form-it is to promote the interest of young people in science and to qualify them for a critical and analytical way of thinking and learning. Form-it provides a platform for supporting reform and modernisation of science education in European member states. Through comparing and analysing national activities and programmes a common knowledge based on innovative didactic approaches to teaching of science is continuously upgraded. This should motivate schools and research institutions to establish new research based models of science education. To achieve this overall objective, the following sub-objectives have been set:

- Increasing the efficiency of science education strategies by identifying and promoting the success factors of Research and Education Cooperation Projects (RECs).
- Supporting the collaboration between institutions running RECs by setting up a European network of experts in science education and education research.
- Supporting the development of joint EU research projects by identifying research questions on REC as a new model of science education.
- Building up a sustainable network of institutions that will keep up cooperation and mutual exchange beyond the duration of the project.
- Increasing the engagement of policy-makers and decision makers in educational concerns by promoting policy recommendations and guidelines for RECs.

The essential questions that Form-it deals with are:

- Which general conditions are necessary to provide high quality cooperation?
- How is collaboration organised, which partnership models exist?
- Why are many projects successful - but others not?

Form-it brings together European institutions, researchers, promoters and initiatives in REC-projects with the aim of empowering all involved actors. Three main activities are carried out:

- Analysing selected RECs: A Catalogue of Good Practice Examples of REC of the eight participating EU-countries will be developed. The preliminary GP-list will be discussed on the International Conference »Bridging the Gap between Research and Science Education« from 12th to 14th of March 2008. The analysis generates important benchmarks that are the basis for improving these kinds of programmes and to promote the interest of young people in science.

- Networking in expert working groups, at workshops and at the International Conference. In order to exchange national experiences in science education, to develop a common strategy for REC in Europe and to build up strong partnerships for future cooperation and research in this area.

- Increasing public awareness for excellence in science education: Detailed knowledge on innovative REC-activities in Europe will be disseminated to encourage modern science education.

The Form-it consortium carried out a survey on the situation of REC in their countries and found 159 REC examples in Austria, Germany, Italy, Lithuania, Netherlands, Slovenia, Switzerland, United Kingdom. They show the multifaceted possibilities and difficulties within Science Education, Research and Science Cooperation and innovative didactic concepts. The »Report on Research and Education Cooperation in Europe« was the basis for the development of the Catalogue of Good Practice Examples. Practical guidelines and a proposal of quality criteria for initiating, realising and embedding of REC are developed throughout the project Form-it. A joint policy paper will be addressed to national and European decision makers within the educational system to support the realisation of RECs.
BioValley-College Network (BCN): Trinational Network to Intensify the Teaching of Natural Science at Gymnasia Level.

Kilian Ingo¹, Walter Bernadette², Giardon Sacha³, Hermann Janine⁴
(¹Kant-Gymnasium Weil am Rhein DE, ²Lycée Jean Marmoz St. Louis FR, ³Gymnasium Bäumlihof Basel CH, ⁴Sekretariat BCN Basel CH http://www.biovalley-college.net/

The Bio Valley College Network (BCN) was created in Autumn 2003, namely to improve the cross-linkage of the Gymnasiums / Cantonal Schools located in the regions South Baden, Alsace and Basle on the one hand, and with research and the economy in the field of Life Sciences in the BioValley (Regio Basiliensis) on the other. Therefore, BCN is an example of Public Private Partnership.

Core Objectives of the BCN:
1. Furtherance of engaged and gifted young persons in the field of Life Sciences through the definition and implementation of a «Curriculum Plus»
2. Support for teaching staff imparting the knowledge of Life Sciences (Symposia, School Laboratories)
3. Intensification and enrichment of the teaching of natural science at gymnasia level
4. Minimization of the loss of competence incurred on the critical career-interfaces

Structures and Events:
• School laboratories in CH, DE and FR
• Scholar Congress and Scholar Olympiad
• BioValley College Day with the bestowal of the College Award
• Practical training places at institutes of technology and in industry
• Symposium for teachers, common projects with teachers from CH, DE, FR and the USA (Mini-Grant Projects, as well as the Biotech Symposium, have resulted in an intensive exchange of ideas between the BCN and High Schools in the region of Boston, and were co-ordinated by the Museum of Sciences, MOS Boston)

Future Projects:
• Development of a Corporate Identity, creation of a new logo
• Adaptation and professionalization of the home page
• Expansion of the co-operation with other institutions in the region (Universities, Specialist Colleges, MOS Boston, Life Science Learning Center Zurich, Industry) etc.
• Setting-up of constructive interactions with institutions beyond the BioValley region
• Development of standards, setting of benchmarks
• Intensification and professionalization of the public relations work (visibility in the media, publications by members of the BCN in technical journals)

Partners of the BCN:
• Education Departments of the Cantons Basel-Stadt and Basel-Land (CH)
• Regierungsräsidium Freiburg im Breisgau, Department Schools & Education (DE)
• Académie de Strasbourg, Pole Pédagogique (FR)
• Interpharma, association of research-based Swiss pharmaceutical companies, Basel (CH)

There is a very firm opinion in the BioValley that the competitiveness and prosperity of the region on the Rhine Bend depend greatly on an excellent education and further training in the core disciplines of life sciences and biomedicine.
“Hands-on” Minds-on”
Teaching Science at the XLAB
Neher Eva-Maria
XLAB- Experimental Laboratory for Young People, Justus-von-Liebig-Weg 8, 37077 Goettingen, Germany

XLAB is an educational institution, which wants to bridge the gap between high school and university. XLAB organizes experimental courses in Biology, Chemistry, computer science and Physics for classes and individual students from European countries and from all over the world. The students do intensive experimental work with state-of-the-art-equipment. Theoretical teaching by experienced scientists runs parallel with the experiments.

In nearly all industrialized countries the number of students enrolling in natural science studies at universities has been decreasing dramatically for more than 15 years. On the other hand science and technology provide the key to the problems and challenges that our societies are facing today. Much effort has to be invested to encourage young people to pursue scientific careers. Young people have to get enthusiastic about the great research adventure of today. Students should get to know how to do research: what it means to work in a laboratory, what it means to solve a theoretical problem, and for what purpose a computer is really needed. This means students should get to know the reality! The economical situation of high schools does normally not allow to install highly sophisticated experiments: the equipment is much too expensive and teachers are not trained in supervising experiments on a more or less scientific level. However central laboratories can serve regional schools and may also be accessible nationwide and - as is the case for XLAB – worldwide.

Aims of XLAB
Concurrent with the Bologna Process XLAB is following the general aims of the EU in promoting the attractiveness of the European Higher Education Area and promoting the mobility of the students and encouraging them to take up university studies abroad.

Teaching at the XLAB
XLAB tries to provide an atmosphere of real research laboratories with authentic tools and machines and most important our lecturers are experienced scientists. XLAB offers a variety of practical experiments in biology, chemistry, computer science, mathematics and physics. The experiments are designed and supervised by scientists. Scientists and science schoolteachers work together in a very tight collaboration; the performance of the experimental courses is supported by qualified technical assistance.

Students work in the laboratories for the entire day. They concentrate on one subject; that means there is no interruption by other lessons as it is the case at school. This provides an intensive learning at a level, which can be compared with university teaching.

Target groups are:
1. School classes and 1st year University Students coming from Germany, other European countries and even Asia. Classes and Students stay for one to five days up to three weeks.
2. International students participating in the XLAB Science Camp for nearly four weeks during the summer holidays. The number of students representing one nationality is limited to 2-4 only. The number of participants per camp is limited to 30 students.

XLAB started in August 2000 and in 2008 we already count approximately 61.000 thousand students x days.
**MATHEON**

Kramer Jürg
Humboldt-Universität

**Summery of the Application Area**

The basic motivation for the scientists of MATHEON to engage themselves in educational activities is the need for more qualified young people in the MINT fields (Mathematik, Informatik, Naturwissenschaften, Technik), in particular in mathematics. To achieve this goal, the basic for a positive attitude towards mathematics has to be built already in school. Furthermore, the unbalanced transitions from school to university, and later on to the working life, have to be smoothened out by integrating these phases more strongly into each other, specifically in mathematical education. As a consequence, the mathematical education for teachers and engineers must become more practice- and problem solving-oriented.

The scientists of the Application Area with the support of the members of MATHEON provide various activities in this direction. Based on their application-oriented research and their teaching experience, they develop concepts for teaching in a more application- and problem-driven way. At the same time, through the close cooperations with schools, in particular the four mathematically profiled schools of the Berlin Network, prototypical examples for a smooth transition from school to university have been set up. This, in turn, leads to a fruitful cooperation between teachers, teacher students, and teacher educators at the universities. In addition, the scientists of MATHEON with the support of the teachers of the Network Schools provide crucial contributions to help bridging between mathematicians and the public at large by their extremely successful outreach activities.
PARLAVIS - Participatory Landscape Visualisation
Participatory development of an instrument for demonstration of landscape development scenarios

Elmer Sonya, Steiner Regina
FORUM Umweltbildung

(Interdisciplinary team of researchers: University of Natural Resources and Applied Life Sciences: Prof. Dr. Otto Eckmüller and Dr. Sonja Vospernik (both Institute Waldwachstumsforschung), Dr. Gerhard Weiss (Institut für Wald-, Umwelt- und Ressourcenpolitik), Dr. Tatjana Koukal (Institut für Fernerkundung und Vermessungswesen) and University of Veterinary Medicine Vienna: Dr. Susanne Reimoser (Research Institute of Wildlife Ecology), Team of teachers: Ing. Andreas Sulzer (Land- und Forstwirtschaftliche Fachschule Alt-Grottenhof), DI Martin Kugler (HBLA für Forstwirtschaft, Bruck an der Mur), Ing. Herbert Grulich (Office of the government of Lower Austria - LW. Koordinationsstelle für Bildung und Forschung - "LAKO"; Fachschule Edelhof), DI Herbert Spicar (Forstliche Ausbildungssätze Ort/Gmunden), Interface management: Mag. Sonja Elmer, Mag. Regina Steiner (both FORUM Umweltbildung) und Dr. Gerhard Weiss)

An interdisciplinary team of researchers together with four teachers of different agricultural and forestry schools and training centres design an educational tool for the three-dimensional demonstration of scenarios of landscape development. Goal of this simulation-model predeveloped by the researchers and concretised together with the teachers for its use in schools is to show the problems of sustainable usage of a natural resource, to enable people to understand human-environmental systems and to clarify the possibilities of shaping situations by stakeholders. The area of Rax-Schneeberg is serving as an example where PARLAVIS seeks to investigate which possibilities a presentation style like this is offering for ESD. On the other hand methods of inter- and transdisciplinary cooperation shall be explored in the framework of the project and supporting and inhibiting conditions shall be identified concerning this cooperative way of generating knowledge.

The project is made up of four stages: stage I (development) contained the technical construction of the tool by the technicians in the team of researchers. In the course of this stage the teachers introduced their wishes and needs for the application in school. Their propositions have been implemented as far as possible by the team of technicians. Subsequently the teachers will test the tool by conducting school projects using the tool, make records of the process of these tests and evaluate the lessons using action research methods (stage II: test stage – just in progress). The results of the test stage will be discussed among all participants of the project (stage III: evaluation of the tool) to draw conclusions for further development and adaptation of the tool. The teachers will then get a (slightly) improved version of the tool at the end of the project. The final (= fourth) stage of the project is dedicated to the common reflection and evaluation of the entire cooperation process between researchers and teachers. This evaluation will include the participation of all involved persons (teachers, pupils and researchers) through a mixture of self-evaluation and external evaluation by the interface management team.

The intermediate evaluation following stage I provided first results concerning the understanding of the different roles by the project partners (and the modification of this comprehension), the motivation of the involved project partners, the progression of the learning process and the challenges for the project partners and for the interface management.
From the computer to nature – biodiversity education with simulation models

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Biodiversity is dramatically decreasing as a result of habitat loss, invasion of alien species, overexploitation of resources, pollution, and climate change. However, little of current knowledge is involved in school lessons. Opinion polls show that the majority of 15 to 18 year old pupils want to know more about extinction risks of animal and plant species.

The educational software SINAS deals with the results of the EU research projects ALARM and MacMan. Our approach includes (1) the demonstration of complex biodiversity issues at the example of indicator species, (2) interactive usage of simulation models, (3) explanations of how the models have been developed, and (4) the motivation to practical conservation measures. The indicator species were derived from studies within the EU project ALARM and MACMAN which concluded that both pollinators and amphibians are highly endangered by extinction. The diversity of bees and of the plants they pollinate has declined significantly over the last decades. The existing studies demonstrate the loss of pollination services for some major crops and imply a more general risk for pollination services in the future, in both agricultural and natural ecosystems.

The impact of changing environment on pollinator populations was exemplified at the Red Mason Bee Osmia rufa and the Maculinea butterflies. Amphibian species are represented by the Common toad Bufo bufo and the Tree frog Hyla arborea. Simulation models demonstrate the response of individuals and populations to environmental changes. The user can interactively select “disturbance” or “protection” scenarios and test their impact on the population (total size, number of females, males, and offspring). The extinction risk is displayed in terms of mean population life time. Simulations show population development within a reproductive season on a daily time scale and on a time scale of many successive years. Practical measures for conservation management are described in a separate chapter of the SINAS software and include special offers of public visitor centres in four German states.

Project results show that close collaboration of researchers with partners from schools and the public allow finding new and effective ways in biodiversity education.
SUPPORT
Partnership and Participation for a Sustainable Tomorrow

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The Comenius network “Partnership and Participation for a Sustainable Tomorrow”, SUPPORT, has been established in order to address the need to enhance the quality of educational practices and material in line with the challenges of sustainable development (SD). The overall objective is to promote education for sustainable development (ESD) in European schools. The SUPPORT network consists of 31 partner institutions in 14 European Union and EFTA countries, plus 9 other participants from 7 countries.

The project will bring concepts and issues of SD into the education system by linking schools, research institutions and communities in a web-based network. Learning opportunities will be provided that stimulate and empower individuals to acquire relevant experiences, knowledge, skills, values and understanding and to reflect critically on their role in creating a sustainable tomorrow. In so doing the project will contribute to lifelong learning for an active and responsible citizenry. SUPPORT will generate and spread knowledge about how ESD can be effectively supported through cooperation with actors outside the school using ICT. The project is expected to enhance the status of schools through greater involvement in the local community and participation in democratic processes. Interaction and cooperation among key stakeholders and best practice exchange will be facilitated by thematic conferences, workshops, a Comenius mobility seminar, Comenius school partnership contact seminars, Arion visits, and a web-based campaign on schools' ecological footprints. The activities will be managed and coordinated through annual advisory group and partner meetings.
Our Pupils Research Center offers unique possibilities for research activities in the area of Life Sciences and physics. The abstract and the poster is focused on the Life Science field. Situated in the trinational region near Basel within the Biovalley region, high school students train their own first-hand lab experiences in an university-like environment.

Our team of teachers aid the pupils in defining Life Science projects, designing experiments, contacting experts from universities, participating and presenting results at symposia or contests. Participants of the curriculum have to do an internship at selected companies that individually establish partnerships with the students.

In our region there is an ever growing demand of very well educated, specialized and trained employees in the industries of Life Science. On the other hand a high percentage of university studies or vocational trainings are not completed. We aim to bridge this obvious hurdle between school and higher education in the Life Sciences by encouraging the pursuing of real experiments that train add-on-capabilities like self-responsibility, self-organization and frustration tolerance.

The pupils who are interested in Life Science are led in their research activities by an experienced former researcher.
5.2. Presentations of Cooperations out of the Catalogue of Good Practice Examples

The following Good practice examples were exhibited within the poster session. Detailed information to these Research Education Cooperations can be found in the report Good Practice Catalogue (www.form-it.eu/download or www.ecology.at):

AUSTRIA

Children are Doing Research - A project on Archaeology
prepared by Cech Brigitte, Independent researcher
Report was available (Bericht, Wissenschaftskommunikationspreis des österreichischen Fonds zur Förderung der wissenschaftlichen Forschung, Archäologieprojekt „Kinder forschen“)

Tick Patrol - A tiny foe, an underestimated enemy, a school project for your health!
prepared and presented by Steiner Konrad and students of the HBLA Ursprung, Elixhausen/Salzburg

Urban scapes - future scapes
presenting future.scapes – Global Change from children’s perspective
prepared by Tötzer Tanja et. al, ARC, systems research

GERMANY

Ada Lovelace - Mentoring for Women into Science and Technology
presenting Ada-Lovelace-Project Mentor network for women in techniques and science prepared by Ebach Judith, University of Applied Science Koblenz

Daniel-Duesentrieb-Contest
prepared by Mackens Wolfgang, Technische Universität Hamburg-Harburg

ITALY

Material Science: an interdisciplinary laboratory course
prepared by Binetti Simona, University of Milano - Bicocca

How can young people participate in the scientific debate
presenting Ethics and Polemics. Learning to participate in the scientific debate
prepared by L’Astorina Alba, Istituto per il Rilevamento Elettromagnetico dell’Ambiente (IREA)

To observe, to understand, to respect
presenting Research and Ethics. To observe, to understand, to respect
prepared by Tranchida Flaminia, Institute of Cognitive Science and Technology of the Italian National Research Council

LITHUANIA

Don’t buy their lives
prepared by Lazarevičienė Violetta, Project CITES

Water is the main source of life
prepared by Silanskiene Loretta, Kaunas University of Technology

SLOVENIA

National Education Institute Slovenia
presenting Touching the Research Institute
prepared by Bačnik Andreja, National Education Institute Slovenia

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1 Listed along countries and then in alphabetical order regarding the contact person
SWITZERLAND

Genetic Research Days
presenting Genetic Research Days. Project “Visit a lab”
prepared by Bodenmüller Kurt, Foundation Gen Suisse

Penser avec les mains – Thinking with the hands
prepared by Hulo Sophie, Université de Genève

The Life Science Learning Center
presenting Life Science Zurich – Learning Center
prepared by Jann Peter, University of Zurich and ETH Zurich

Explore-it
prepared by Providoli René, Pädagogische Hochschule Wallis PHVS

THE NETHERLANDS

JETNET - Jongeren en Technologie Network Netherlands
prepared by Boots Beatrice, Landelijk Coördinatiepunt Jet-Net

Bètapartners
prepared by de Beurs, Cor, University of Amsterdam

UNITED KINGDOM

UK-Japan Young Scientists
prepared by Albone Eric and Okano Toru, Clifton Scientific Trust

In addition following initiatives were exhibited via posters:

A bunch of spring flowers
prepared by Ogrin Tomaz, Insitut Jozef Stefan (Slovenia)

NLT Nature, Life & Technology
prepared by Krüger Jenneke, Landelijk Ontwikkelpunt NLT (The Netherlands)

5.3. Bibliography


5.4. List of participants

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HBLA Ursprung  
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Bökehof-Reckelkamm Annette  
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5.5. List of Referents, Moderators and Workshop leaders

ALBONE, Eric (Referent Workshop 1) is Director of Clifton Scientific Trust, a charity dedicated to developing innovative strategies for engaging young people of all ages and backgrounds in experiences of real life science and its application, giving school knowledge meaning and motivation and building skills for life through science. His current work includes the award-winning UK-Japan Young Scientist Partnerships, and in his home city of Bristol in developing effective working partnerships between primary schools and medical students. Dr. Albone holds a first degree and doctorate in chemistry from Oxford and has divided his career between academic research and school teaching. He is also much involved in Britain in “science in society” initiatives nationally and locally.

ANKONÉ, Henri (key note, Leader Workshop 4), is the contact person for the “Geography olympiade” in the National Institute for Curriculum Development in the Netherlands. He accompanied the development of the multimedia teaching tool.

BAKER, Louise (Moderator Workshop 2) joined the Robert Bosch Stiftung in December 2007. As Programme Officer in the area of Science and Research she coordinates the funding Programme “NaT-Working”, which aims to network schools, universities and research institutes by funding projects and initiatives aimed at getting more young people excited about science and technology. After successfully completing her degree in German at the University of Liverpool, UK and a Masters in European Studies at the University of Aachen, Germany, Louise went on to work for the Europe Programme at the British Council in Brussels and ”Culture 2000” at the European Commission, DG Education and Culture.

BAKONYI, Tamas (Referent Plenary) is senior lecturer at the Institute of Virology, Department of Microbiology and Infectious Diseases, Faculty of Veterinary Science, Budapest. Since 2001 he has close and continuous research cooperation with Prof. Norbert Nowotny's group at the Clinical Virology, University of Veterinary Medicine, Vienna. He obtained PhD degree on the molecular investigations of bee viruses. His main scientific interest is the molecular diagnostics of animal and human viruses; in particular the detection and characterization of previously unknown or less intensively investigated agents. Dr. Bakonyi is the co-author of 38 scientific articles in the field of virology and epidemiology.

DE HAAN, Gerhard (Key note) is the director of “Institut Futur”, the Center for Educational Future Science at the Freie Universität Berlin. His research activities are: development of future scenarios – education for sustainable development - analysis of the effects of a knowledge based society - exploring the transfer of knowledge and innovations - research on future and uncertainty. Several of the institute’s research projects are being funded by the EU, the German Federal Ministry of Education and Research and by DBU (German Federal Environmental Foundation). Among others, he is the chairman of the German National Committee of the UN-Decade for Education on Sustainable Development, Member of the Council of the Europäische Akademie GmbH and Member of the Committee on Sciences of the German section of the UNESCO-Commission.

DREXLER, Atje (Leader Workshop 2) is deputy head of the Science department at the Robert Bosch Foundation in Stuttgart, Germany. She supervises the Foundation’s funding programs for cooperative projects between research and educational institutions such as “NaT-Working: students, teachers and scientists network in science and engineering” and “Denkwerk: students, teachers and scholars network in the humanities.” In addition, she is responsible for the research funding of the Foundation’s medical institutes. NaT-Working is the largest funding program for research-education cooperation projects in Germany. Since 2000 more than 130 initiatives have been funded. Atje Drexler joined the Foundation in 2001, after completing her studies in Slavic literature, Economics and English, and a three-year employment in industry.
EBERHARTER, Lukas (Referent Plenary), student at Höhere land- und forstwirtschaftliche Schule Ursprung, projects: "Orchid Tissue Cultures" "pharmacogenetics - students test their own genes" , "Tick Patrol A tiny foe, an underestimated enemy, a school project for your health!", "Stevia: Illegal vs. Healthy? Students bare their teeth at caries"; "bee important - students pit themselves against bee virus diseases"

HILLEBRANDT, Dirk (Leader Workshop 3), Psychologist, since 2004 he has been working in research regarding the effects of leaning science in out-of-school contexts, he is especially interested in the merits of hands-on experiments for learning natural sciences. For him, inquiry-based learning within an open-ended experimental approach is seen as a part of a modern teaching and learning strategy which relies on those effects of solving complex problems which promotes and supports learning.

JIMENEZ ALEIXANDRE, Maria Pilar (General Rapporteur) is science education Professor in the University of Santiago de Compostela (Spain). Previously she was biology high school teacher for 12 years. Her ongoing research program revolves around the development of argumentation and critical thinking in the science classroom, through authentic problems and socio-scientific issues. She has authored about 45 books or book chapters on argumentation, environmental education and biology education, being the last Argumentation in Science Education. Perspectives from Classroom based research, Springer 2007 (co- edited by Sibel Erduran & M.P. Jiménez-Aleixandre). She has also published as many papers in refereed journals, among the last "Contextualizing practices across epistemic levels in the Chemistry laboratory" Science Education, 2006.

KIRCHDORFER, Lisa (Referent Plenary), student at Höhere land- und forstwirtschaftliche Schule Ursprung, projects: "Orchid Tissue Cultures" "pharmacogenetics - students test their own genes" , "Tick Patrol A tiny foe, an underestimated enemy, a school project for your health!", "Stevia: Illegal vs. Healthy? Students bare their teeth at caries".

KOHSE-HÖINGHAUS, Katharina (Referent WS 3), Full professor for Physical Chemistry at Bielefeld University, main area of research: investigation of complex reaction systems. Founder of teutolab-CHEMIE - das Mitmach- und Experimentierlabor für SchülerInnen an der Universität Bielefeld; Furthermore she focuses on working out recommendations for promoting the collaboration and cooperation between schools and Universities, especially in the area of natural sciences; this work is based on the teutolab model. Award of the Public Understanding of Sciences and Humanities Program of the Stifterverband for the chemical education project teutolab-Chemie and teutolab-NETZWERK; Cross of the Order of Merit of the Federal Republic of Germany awarded by Federal President Horst Köhler, for her major contribution to the Program "Bildung für alle" ["Education for all"], especially for the design, implementation, and successful establishment of teutolab-CHEMIE.

KYBURZ-GRABER, Regula (Key note, Moderator Workshop 3); Biologist and biology high school teacher by training, since 1998 she is professor for Secondary School Pedagogy (teacher education) at University of Zurich, Switzerland. Her main research areas are environmental education (approaches in natural and social science), science education, interdisciplinary teaching, new teaching and learning methods, project-based teaching and learning, self-directed learning, reflective teaching, and school development. In 2007, she received the Award of the North American Association for Environmental Education for „Outstanding Contribution to Environmental Education Research“. Since 2007, she is director of the Institute of Secondary and Vocational School Pedagogy (teacher education) at University of Zurich.
LINGEN, Heinz (Referent WS 2) is teacher for physics, pedagogics and psychology and heads the Gymnasium Haus Overbach in Jülich/Aachen since 1989 (focus points: natural sciences, music and assistance to gifted students). The school has contacts to Belgium, The Netherlands, Poland, Ireland, France, Switzerland and the USA. He focuses on development of cooperation models for schools, science and economy. Furthermore he promotes school development and teacher training (focus points: job orientation, assistance to gifted students, school and science, school and economy, team building and quality management).

LOIBL, Céline (Referent Plenary, Moderator Workshop 4) is leader of the Austrian Research Programme Sparkling Science which has been implemented by the Federal Ministry of Science and Research in December 2007 (www.sparklingscience.at). The programme finances exclusively research projects that involve pupils directly in the research process as well as school projects that are realised in cooperation with researchers. The duration of the programme will be 10 years with a yearly budget of 3 Mio €. Projects from all disciplinary fields are funded; all school types and age-classes are involved. Before taking over the responsibility for the programme, Céline Loibl carried out international research projects on inter- and transdisciplinary, on research evaluation and on harmonisation of research and education policies.

MACKENS, Wolfgang (Referent Workshop 1), PhD in Applied Mathematics at the University of Muenster in 1976 after having studied mathematics, computer science and physics at the Universities of Hamburg and Muenster. Assistantship at Ruhr-University Bochum until 1979. From 1979-88 lecturer at RWTH Aachen. Habilitation (Scientific Computing) at Aachen in 1988. From 1989-96 Professor of Mathematics at Hamburg University, then Professor of Mathematics at Hamburg University of Technology (TUHH), Institute of Numerical Simulation. Spokesman of TUHH in school affairs; responsible in VDI (Association of German Engineers, (Hamburg Section) for contact to School Authorities. Initiator and promoter of several activities to increase pupils interests in Mathematics, Computer Science, Natural Sciences and Engineering.

MAYER, Michela (Leader Workshop 1) is an international expert in Science Education, Education for Sustainable Development (ESD) and Evaluation research. With a Ph.D. in Scientific Education and a degree in Physics, Michela, formerly responsible for research at the Italian National Institute for the Evaluation of the Educational System (INVALSI), is a Lecturer in the Teachers Postgraduate School, SSIS Lazio, at the University of Rome3. She is responsible for the Science Area in the Italian participation to the PISA OECD programme and she was a member of the PISA Science Expert Group. As expert in action research and in evaluation she contributed to national and international projects for the definition of Quality Criteria for ESD, and actually she is a member of the Italian UNESCO commission fro ESD, and of the UNECE expert group for the development of ESD indicators.

MEADOWS, John (Key note, Referent Workshop 4) works in the Education Department at London South Bank University, where he is responsible for the science on primary and Early Years courses. He has researched and published in science and ICT education and also teaches Masters in Education for Sustainability and doctoral level students.

MOZER, Alenka (Referent Workshop 4) is a chemistry teacher at Gimnazija Vic Ljubljana and a member of the National Committee for Chemistry Assessment in Slovenia. Students at Gimnazija Vic bear in-class activities in science courses. Due to the collaboration with research institutions, laboratories and faculties students are taught by school teachers and by scientists/experts. From 1994 – 98 Ms. Mozer was a school inspector at the Ministry of Education and Sport. In cooperation with experts from the National Education Institute she is continuously involved in giving workshops within the in-service training programme for chemistry teachers.

OKANO, Toru (Referent Workshop 1) holds a first degree in chemistry from Rikkyo University, Tokyo and a doctorate in education from King’s College London, and now teaches chemistry at the Rikkyo School in England. His particular interest is in comparing methods and achievements in science education in Britain and Japan and in developing exchange projects between the two countries, initially in 1991 with the Japan Society for Science Education, and since 1994 with Clifton Scientific Trust’s UK-Japan Young Scientist programme in which school students from both countries (with teachers) live and work together with professional scientists and give team presentations of their achievements, experiencing science both as a real life challenge and as a cultural bridge.; most recently Kyoto 2007; Univ. Surrey 2006.

PFAFFENWIMMER, Günther (Moderator Workshop 1) is responsible for Environmental Education programme development in the Subdepartment for Environmental Education in the Austrian Federal Ministry Education, the Arts and Culture. Since 2004 he is the President of ENSI-Network (European Network of Consultants for Social Inclusion) and acts as the official Austrian Contact Partner of the GLOBE-Programme (Program for Global Learning and Observations to Benefit the Environment). Furthermore he represents the official Austrian Contact Partner of the OECD/CERI-Network (Organisation for Economic Cooperation and Development & Center for Educational Research and Innovation).

QUÉRÉ, Yves (Referent Workshop 2) is a solid state physicist who has been working mainly on crystal defects in solids, irradiation effects in materials and particle/solid interactions. He is a member of the French Académie des Sciences and of the Pontifical Academy of Sciences. Being the foreign Secretary of the Académie, he was elected co-Chair (2000-2006) of the InterAcademy Panel (IAP), the Assembly of the Science Academies worldwide. He has been the President of the Department of Physics and the Chair of the Senate of Professors at the Ecole polytechnique (Paris). Since 1996, he is deeply involved, together with Nobel laureate Georges Charpak and Astrophysicist Pierre Léna, in La main à la pâte, a programme of renovation of science education in French primary schools, with a large number of international interactions.

STEINBACH-BUCHINGER, Hermine (Moderator), as moderator she guides conferences and other large group interventions such as public participation processes embedding all attendants in the communication processes. As representative project manager she is involved into the local agenda 21 processes in two Viennese districts. Focussing on adult education she is member of the Austrian AGB (Ausbildungsinstitut für Gruppe und Bildung) and of the international Anti Defamation League (ADL). Furthermore she is lecturer at the University Klagenfurt and at the University of Applied Sciences for Applied Knowledge Management. She studied pedagogic and holds a Master degree in Supervision, Coaching and organisational development. As consultant she is specialised in the fields education, non governmental organisations and public administration.

STEINER, Konrad (Referent Plenary) HBLA Ursprung, Austria Biology, Mathematics, Informatics Teacher at Höhere land- und forstwirtschaftliche Schule Ursprung; manager of several interdisciplinary school projects such as "Tick Patrol". http://projekte.ursprung.at

WIRTITSCH, Manfred (Key note), Since 2001 head of Department of Citizenship Education, Environmental Education and Consumer Education in the Austrian Federal Ministry for Education, the Arts and Culture. After his study of History and Mass Communication he started in the Austrian States Archive. Between 1988 and 2000 he worked in the Federal Ministry of Science and Research, Department for Social Sciences (Deputy Head since 1996), focussing on contemporary history, cultural studies, and comprehensive security.
5.6. Conference programme

International Conference
12th - 14th of March 2008
Vienna

Wednesday 12th
From 12:00
Registration
16:30 – 17:00 Opening
Welcome address
Johannes Hahn, Federal Minister of Science and Research, Austria

17:00 – 17:30 Setting of the conference
Form-it – Take Part in Research!
Marie Céline Loibl, Form-it Coordinator, Austria

17:30 – 17:50 Key note
"Science Education in Europe"
Maria Pilar Jimenez Aleixandre, General rapporteur, Spain

17:50 – 18:00 Introduction of Workshops
Workshop 1 »Good practices«
Nieves Meyer, University of Study Rome 3 - Scuola di Specializzazione all’Insegnamento Secondario del Lazio 3, Italy
Workshop 2 »Implementation«
Alia Drexler, Robert Bosch Stiftung, Germany
Workshop 3 »Education«
Dirk Hillebrandt, Leibniz Institute for Science Education at the University of Kiel, Germany
Workshop 4 »Curriculum«
Henri Ankoné, National Institute for Curriculum Development, The Netherlands

18:00 – 19:30 Interactive exhibition
Good practice examples of Research and Education Cooperation
Poster Session
19:30 Dinner
Orangerie, Europahaus

Thursday 13th
9:00 – 10:00 Key note
"Images of Research and Education Cooperations in Europe"
Regula Kyburz-Graber, University of Zürich, Switzerland

10:00 – 10:30 Coffee break

10:30 – 12:30 Workshops in parallel session
Workshop 1 »Good practices«
Workshop 2 »Implementation«
Workshop 3 »Education«
Workshop 4 »Curriculum«

12:30 – 14:00 Lunch
Orangerie, Europahaus

14:00 – 14:30 Research and Education Cooperation on stage
Tick Patrol
Edith Oberkofler, HBLA Uprising, Austria
Konrad Stein, HBLA Uprising, Austria
Tamas Bakonyi, Veterinary University of Vienna, Austria - Hungary
Lisa Kirchdorfer, HBLA Uprising, Austria
Lukas Eberharter, HBLA Uprising, Austria

14:30 – 16:45 Workshops in parallel session
Workshop 1 »Good practices«
Workshop 2 »Implementation«
Workshop 3 »Education«
Workshop 4 »Curriculum«

16:45 – 17:45 First impressions of Workshop sessions
18:30 Beethoven walk and Dinner (optional)
Departure to Pullendorf/Vienna

Friday 14th
9:00 – 10:30 Key notes
"Positions and Perspectives of the Austrian Federal Ministry for Education, the Arts and Culture"
Michael Wittich, Federal Ministry of Education, the Arts and Culture, Austria
"Input on national programmes"
Henri Ankoné, National Institute for Curriculum Development, The Netherlands
"The function of Research Education Cooperation in sustainable educational systems"
Gerard de Haan, Free University Berlin, Germany

10:30 – 11:00 Coffee break

11:00 – 12:00 Workshops in parallel session
Workshop 1 »Good practices«
Workshop 2 »Implementation«
Workshop 3 »Education«
Workshop 4 »Curriculum«

12:00 – 12:45 Outcome of Workshops, questions and outlook
Workshop-leaders
Maria Celine Loibl, Form-it Coordinator, Austria
Discussion

12:45 – 13:15 Conclusion of the conference
Maria Pilar Jimenez Aleixandre, General rapporteur, Spain

13:15 – 13:30 Closing session
Maria Celine Loibl, Form-it coordinator, Austria

13:30 Lunch
Orangerie, Europahaus
14:30 Departure
Form – it “Take Part in Research”

Bridging the Gap between Research and Education Coop.

Workshop 1 »Good practices«
What are good practices of Research Education Cooperation?
Workshop-Lead: Michela Mayer, Università degli Studi di Roma Tre – Scuola di Specializzazione di Ingegneria dei Sistemi, Italy
Input: Toru Okano, Rikkyo School, United Kingdom – Japan
Eric Allman, Citizen Scientific Trust, United Kingdom
Wolfgang Mackens, Technische Universität Hamburg-Harburg, Germany
Moderation: Günther Pfaffenwimmer, Federal Ministry of Education and the Arts, Austria

Workshop 2 »Implementation«
How to realize good cooperation projects?
Workshop-Lead: Alois Dreher, Robert Bosch Stiftung, Germany
Input: Petra Lippert, Gymnasium Nova Overbach, Germany
Yves Quoilin, Académie des Sciences, France
Moderation: Louise Baker, Robert Bosch Stiftung, Germany

Workshop 3 »Education«
Could a REC be an element of modern science education?
Workshop-Lead: Dirk Hillebrandt, Leibniz Institute for Science Education at the University of Kiel, Germany
Input: Katharina Koch-Höinghaus, University Bielefeld, Germany
Moderation: Regula Kyburz-Grabar, University of Zurich, Switzerland

Workshop 4 »Curriculum«
How to use a single REC project to move the system?
Input: Alenka Mizer, Gymnasium Vic, Slovenia
John Meadows, London Southbank University, United Kingdom
Franz Raditl, Austrian Educational Competence Centre Biology, University of Vienna
Moderation: Maria Cikine Łuck, Form-it Coordinator, Austria

Impressum

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Institut "Jožef Stefan"
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