kidsINNscience

Innovation in Science Education – Turning Kids on to Science

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www.kidsinnscience.eu

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Where do potatoes grow? On the potato tree!

Drawing of a Swiss kindergarten pupil at the start of the field trial „Potatoes don't grow on trees"

What I liked most were the experiments with the fire!

Girl, Science in Family, 2012, Austria

I was deeply impressed by the teachers' committment. Each time I visited a teacher and his or her class, their creativity, joy and pride caught me, too.

Christine Gerloff-Gasser, UZH

The most exciting was the work with the students and the discussions about how they liked the innovative practices.

Nadia Prauhart, AIE

kidsINNscience.
Innovation in Science Education – Turning Kids on to Science ...

... is a collaborative research (SICA*) project funded by the European Commission under the Seventh Framework Programme (2007 – 2013).
... involves ten partner countries in Europe and Latin America: Austria, Brazil, England, Germany, Italy, Mexico, the Netherlands, Slovenia, Spain and Switzerland.
... runs from November 2009 to July 2013.

kidsINNscience aims to ...

... facilitate educationalists at different positions in the educational system to operate more creatively within the system.
... help generate changes toward more active learning systems in science and technology (S&T) education.
... improve performance and interest in S&T among young people.

Therefore, kidsINNscience investigated

how to transfer innovation in S&T education from one educational context to another, from one country to another.

To study the transferability of innovative practices, kidsINNscience addressed the following core questions:

1. What strategies for teaching and learning in S&T motivate teachers and learners in the ten participating countries?
2. What similarities and differences are there in the process of adapting innovating S&T teaching and learning in the participating countries?
3. Which strategies innovating S&T teaching and learning would work in the participating countries, taking into account their contexts and characteristics of S&T teaching and learning?

Diversity and inclusiveness, gender aspects and activity based and learner centered approaches are crucial in S&T education and were explicitly addressed in each step of kidsINNscience.

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* Collaborative project for specific cooperation actions dedicated to international cooperation partner countries.

Innovation in Science and Technology Education – Why?

Education in general and S&T education in particular are considered important factors for the success of a country in terms of the level of economy and of democracy. Scientific literacy - together with math and reading literacy - has become a worldwide aim. However, surveys as TIMSS (Trends in International Mathematics and Science Study) or PISA (Programme for International Student Assessment) register a lack of interest and a decrease in competences in S&T of students. Differences are detectable amongst students with different socio-economic background and between girls and boys. A few examples: Students with a more advantaged socio-economic background show more interest in science and identify science as important for their future. Performance and scientific literacy, but above all the self-concept of boys and girls in terms of scientific competences differ – with girls having lower confidence in their scientific abilities.[1] In the face of the ever more complex „knowledge society" and the current and predicted lack of peoples taking up a career in S&T the improvement of scientific competences and scientific literacy of all learners is essential.[2]
Innovative S&T education contributes to support equity amongst all S&T learners and to raise the students' interest in and the motivation towards S&T.

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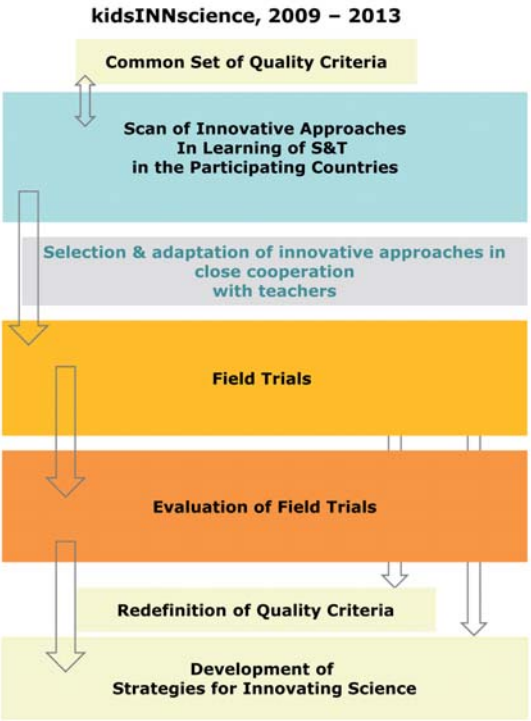
[1] Science Education in Europe: National Policies, Practices and Research, Eurydice, Education, Audiovisual and Culture Executive Agency, 2011.
[2] Further information, see also: Rocard, Science Education now: A Renewed Pedagogy for the Future of Europe, 2007; Osborne & Dillon, Science Education in Europe: Critical Reflections, 2008; results of TIMSS 2011 and PISA 2009.

The steps towards strategies for innovating S&T Education



Public Project Reports

Innovative methods in learning of science and technology
National findings and international comparison (D3.1, July 2010)

National contexts and innovative practices in Science Education.
A Comparative Report. (Annex D3.1, April 2011)

Adaptation of Innovative Methods in Science Education (D4.1, Nov. 2010)

Evaluation of field trials of innovative practices in science education (D5.1, Sept. 2012)

Strategies to facilitate innovative education in Science & Technology (D5.3, Feb. 2013)

All public reports (Deliverables D3.1, Annex D3.1, D4.1, D5.1 and D5.3) are available on the project website: www.kidsinnscience.eu

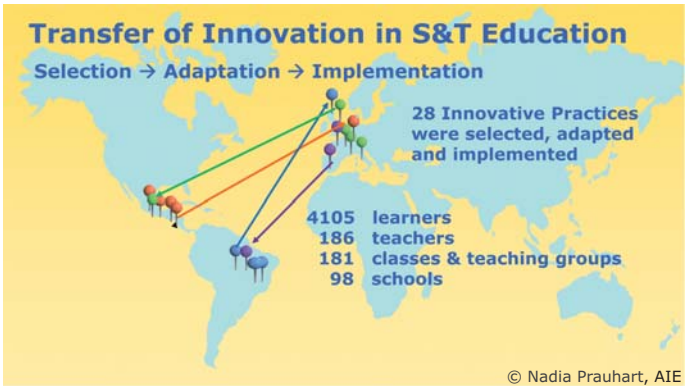
The starting point of kidsINNscience was the **definition of a set of quality criteria** to describe and compare S&T curricula and practices. These criteria constituted the basis for describing and comparing innovative practices (IPs). The IPs were collected in each of the ten participating countries and merged in the **scan of innovative practices (D3.1, RM3)**.[1] It comprises 80 innovative practices from pre-primary to upper secondary school, covering a broad range of subjects and topics.

A **comparative report on national contexts and innovative practices in science education (Annex to D3.1, RM3)** allowed an overview of the main similarities and differences between S&T education policies and practices in the partner countries. In parallel, the **selection and adaptation of IPs (D4.1, USC)** focussed on providing a frame to be considered when transferring an IP from one context to another.

During the school years 2010/2011 and 2011/2012, **field trials** adapting and implementing 28 IPs from other partner countries were performed at schools. This core part focused on three important issues in S&T education - diversity and inclusiveness, gender equity and activity based and learner centred approaches - to contribute to a reduction of the exclusion of disadvantaged groups in S&T education. 186 teachers and 181 classes and teaching groups were involved at 98 schools. A total of 4105 learners of all ages were reached!

A National Evaluation Report of each project partner constituted the basis for the analysis and compilation of the **Evaluation of the field trials (D5.1, UZH)**. Based on the evaluation, the set of quality criteria was redefined. Finally, **strategies for innovating S&T education (D5.3, FUB)** sum up the experiences of kidsINNscience.

[1] Only reports available to the public are mentioned. Several internal reports have been compiled by FUB and IJS.



The field trials

In order to find out about the need and the level of adaptation when transferring innovations successfully, kidsINNscience realised field trials: 28 innovative approaches/practices (IPs) (about a third of the IPs collected and described in D3.1) were transferred from one country to a different partner country and implemented in mainstream schools from pre-primary to upper secondary level. The selection, adaptation and implementation of the IPs and the evaluation of the field trials were realised in close cooperation with the teachers. They are considered as the most important key change agents to implement innovations at class room level in the partner countries.

Some impressions of the field trials:

■ The Austrian IP ***Apple, Apple, Apple*** was brought to Mexico. There it was turned into ***Corn, Corn, Corn*** - a culturally important product in Mexico.

■ ***Cooking with the Sun***, originating from Spain, motivated a large number of students in Austria, Italy and Slovenia to investigate on alternative energy and to design their own solar cookers – and use them!

- Spanish secondary students looked into the scientific reasons for an event communicated by the news, inspired by the Slovenian IP ***The weekly „5 minutes of science news"***. In Brazil, teachers of an in-service education course adapted this IP to the conditions in their schools.
- How to connect ***Physics and Sports***? The Austrian IP made Swiss and Dutch students, run and jump – and measure, calculate and improve both their physical abilities and their abilities in physics.
- The Brazilian IP ***Science Blogs*** showed Spanish and Mexican lower secondary students that dealing with scientific topics, doing research on them and then blogging what they found out, definitely is fun.
- The Swiss IP ***Walk about through the body in 80 pulsations*** made learners and teachers work on the circulatory system in Austria, Brazil and Mexico.

- German students investigated their own questions in the Swiss innovative practice ***The mobiLLab*** by using methods from industry and research – and in this way getting an insight into professions in S&T.

- ***Science in Family*** from Mexico was implemented in Austria, England and Slovenia. The aim was to include the families in science learning. In Austria, students prepared experiments with the parents at home, in England family members came to school.

- The Italian IP ***Potatoes don't grow on trees*** went to Austria, Germany, Spain and Switzerland. In quite different ways, the students learn about where and how potatoes do grow, about their variety and their cultural context.

Transferability of innovation in S&T Education

kidsINNscience investigated the transferability of innovation in S&T education, as innovations that work well in one country do not automatically work well in another one. The adaptive approach of the project involving teachers and taking into account their context and the conditions in the classroom proved to be crucial for a successful transfer of innovative practices. This approach helps to involve all learners in a class. The awareness of gender differences and individualized teaching to include girls and boys equally as well as pupils with various levels of achievement, or with different cultural and socio-economic background, is supported. Learner and activity centred teaching such as Inquiry Based Science Education and hands-on activities and the integration of real-life contexts increase the motivation of both, teachers and learners.

A good innovative practice (IP) helps to increase motivation and to decrease the gap between various students (girls/boys, disadvantaged/advantaged pupils, etc.). It should be clearly described but flexible enough to be adapted. It aims to improve or change the regular context of teaching and learning of S&T. Every innovation is relative to a cultural context and a good innovation should present successful results concerning the problem addressed (Scan of IP, D3.1).

Many of the IPs collected in the Scan (D 3.1) deal with issues of health or environment or with Education for Sustainable Development – themes that work well due to their connection to everyday life and their social relevance as motivating agents for the students. The need to overcome the artificial division among disciplines, is shown in the relevant group of interdisciplinary IPs. The integration between scientific and social competences is considered relevant for giving the students a more correct idea of how scientific knowledge can be used and a sense of authenticity to the learning of the disciplines. Learner and activity centred teaching such as Inquiry Based Science Teaching and Learning (IBTL) and hands-on activities are present in the majority of the IPs.

A successful implementation of an innovation is facilitated by various features: The original IP is attractive and close to the learners' and teachers' real-life. It matches the curriculum or the curriculum is flexible enough to integrate it. The support and acceptance of educational authorities, colleagues and parents is crucial. Furthermore, teachers should be free to adapt the IP according to their context and interests. Teachers' interest in their own professional development allows them to broaden their repertoire of teaching methodologies. Finally the teachers' willingness to reflect on the integration of important issues, such as **diversity and inclusiveness, gender and IBTL** in their own teaching is vital for working towards the aim of a more innovative S&T education which supports equity amongst all learners, raises the students' interest in and the motivation towards S&T and their scientific literacy (Evaluation Report, D5.1).

Main patterns of strategies for a structural change in S&T education were formulated by the team of kidsINNscience (Strategies, D5.3):

- **Teacher education supported by educational research results:** An early discussion of diversity, inclusiveness and gender issues raises the awareness regarding these issues. Hands-on activities and IBTL should also be part in teacher education and in-service training.
- **Teaching material** - a selection of up to date IPs, well documented in the national language - should be available to a variety of teachers, teacher associations and institutions for teacher education and professional development.
- **Everyday contexts/life aspects** increase motivation and interest of learners – therefore this approach should be integrated in teacher education and in teaching material/methods.
- **Flexibility and teaching freedom** as a structural context: Curricula with a limited compulsory core curriculum together with other suggested topics leave the teacher to choose among different contents and methodologies.
- **Existing professional learning communities** (working group of teachers) support the implementation of innovations. Co-operation among educational researchers, teachers and schools supporting each other is crucial. Teachers who implement innovations need a kind of "safety net" provided by the researchers and/or the authors of the original innovation.
- **A network of schools and research institutions** enables schools to increase the use of equipment and the related activities in S&T education, either by purchasing their own new and up-to-date equipment or by sharing resources with others.

The research team of kidsINNscience
Here all research team members are mentioned, some participating for the whole period, some for several months.

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