Welcome to the PROFILES-Newsletter Issue 04/2013

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Editorial

Dear readers,

Half way through – the PROFILES project members met in April 2013 at the Consortium Meeting in Klagenfurt to discuss about already achieved milestones as well as further steps to take.

In this newsletter the project partners from Ireland, Germany, Latvia and Finland give an insight in their Continuous Professional Development (CPD) courses. We include examples and experiences which cover methods like action research, focus groups, curriculum development and evidence-based CPD.
The article on the participation of Berlin teachers in the science on stage festival (Poland) acts as a good example of what comes after CPD – the development of teachers' ownership.

Furthermore, we include a PROFILES module example where the partners of Turkey and ICASE ask the students "Can traffic accidents be eliminated by robots?"

Finally this newsletter gives an overview of (future) conferences and meetings.

Your PROFILES team

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1 Continuous Professional Development (CPD) by PROFILES Partners

1.1 Introduction into CPD

1.1.1 The PROFILES CPD Model – From Generic to Individual Partner Operations

by Jack Holbrook (University of Tartu, Estonia and ICASE, UK)

As the acronym PROFILES is intended to convey, this project promotes 'inquiry-based science education' (IL) as an essential component of PROFILES teaching and also 'education through science' (ES), whereby the project draws attention to the fact that science education (i.e. the science lessons in the school setting) is in fact about promoting students' education and not about engaging students in acquiring isolated science knowledge (Bolte, Holbrook & Rauch 2012). This twin approach to promoting science education (IL plus ES) is enhanced through the use of PROFILES teaching modules – these modules including a socio-scientific and/or everyday life oriented introduction designed to focus science teaching from a familiar, motivating setting; leading to a science education learning section which is required to be inquiry-based teaching; and ending with the need to consolidate the science learning, which in PROFILES is by transference of the science from the inquiry-based learning to the introduction of the setting which was intended to enable students to gain further education (ES) skills in the area of argumentation and reasoning learning to undertake decision making.

Clearly the above differs from standard teaching practices for many teachers and the PROFILES project, as is the case with many new projects, advocates the teachers undergoing a CPD programme. This CPD is based on a broad-based model, put forward as four components – teacher as learner; teacher as teacher; teacher as reflective practitioner; teacher as leader. Each term is defined by the project itself in-line with the support which teachers might need in enacting PROFILES teaching and learning. Thus, by way of an example, the teacher as learner component was included in recognition that many experienced teachers may not have had the opportunity to keep abreast of new developments in the field of science and yet this background is valuable when teaching PROFILES modules.

Regarding the four CPD model components, there is a need to rationalise the PROFILES CPD programme in each participating country. To facilitate this, PROFILES devised and offered partners the opportunity to administer a 'Teacher Needs Questionnaire' primarily focused, not surprisingly, on the 'teacher as teacher' i.e. handling the teaching being advocated by PROFILES. Inevitably, motivational teaching approaches, inquiry-based teaching and learning, education through science aspects such as goals of education, assessment strategies, nature of science and scientific and technological literacy, were all included. Based on such a questionnaire, or otherwise (e.g. through teacher interviews), the emphasis for the programme making up the composite of the actual model enacted by each partner could be developed.

The 'Teacher Needs Questionnaire' approach did not attempt to encompass all aspects of the CPD model, of course. It did not, for example, explicitly solicit 'teacher as learner' components. Equally important it did not include aspects that were obviously new to teachers – the PROFILES philosophy, the model on which the philosophy is based and exposure to actual

PROFILES modules and their design. These are clearly essential components. Equally important, but left to each partner, was the emphasis to be placed on the teacher as a reflective practitioner. Largely this is expected to be based on the interventions in the classroom in which teachers tried out PROFILES modules. Examples below show that in some cases partners place strong emphasis on this area and hence their CPD model saw a high percentage of CPD time devoted to this. The emphasis on the fourth component 'teacher as leader' was also not a feature of the Teacher Need Questionnaire and here partner CPD models can be expected to varied from zero percentage (not included) to inclusion but percentage of time dependent on the focus chosen (where this aspect was included, the overall CDP time tended to well exceed the PROFILES minimum CPD time suggested of 40 hours).

The CPD model chosen by partners was thus envisaged as being based on the PROFILES generic model encompassing the four pillars of – teacher as learner, teacher as teacher, teacher as reflective practitioner and teacher as leader, but the actual model varying depending on the partners. Partners allocated differing percentages of time to each of these areas and to complete the model, also varied the manner (and percentage of time) in which the CPD was enacted (i.e. whole group/small groups, face-to-face/online, teacher focus group/individual teacher operations, evidence of intervention success/oral reporting to other teachers, etc.).

Reference

Bolte, C., Holbrook, J., & Rauch, F. (Eds.) (2012). *Inquiry-based Science Education in Europe: First Examples and Reflections from the PROFILES Project.* Berlin: Freie Universität Berlin. Print: University of Klagenfurt (Austria).

1.1.2 The Nature of CPD in the PROFILES Project

by Avi Hofstein and Rachel Mamlok-Naaman (Weizmann Institute, Israel)

One aspect in the PROFILES project is that teachers are involved in CPD oriented workshops providing them with ample opportunities for reflection on their experiences regarding the adaption, development and implementation of PROFILES modules. Ideally, the workshops provide a platform for reflection by all teachers. The feedback is provided by the other teachers and by the professional development providers (leading teachers).

Loucks-Horsley, Stiles, and Hewson (1996) suggested six key principles for effective and continuous professional development experiences that should be provided for science teachers. It is suggested that the experiences provided:

1. Are driven by a clear, well defined image of effective classroom learning and teaching. Among other factors they emphasis on inquiry-based learning, students' investigations and discovery, and application of knowledge.
2. Provide teachers with opportunities to develop knowledge and skills and broaden their teaching approaches, so that they can create better learning opportunities for students.
3. Use instructional (pedagogical) methods to promote learning for adults to mirror the methods to be used later by their students.
4. Provide condition to learn in a community of practice (promotion of collegiality and collaboration). Also providing support for

each other. In addition, the PD is viewed as a lifelong process that is part of school norms and culture.

5. Prepare and support science teachers to serve (at least some of them) in leadership roles if they are inclined to do so. The meaning of leadership in this context is highly aligned with the claim made by Fullan (1991) regarding: "*The ability of a person to bring about changes among teachers and teaching*".
6. Include evaluation. Professional Development programmes must constantly be evaluated and reviewed regarding engagement, satisfaction, etc.

Clearly, the first three principles are related to the first two stages of the PROFILES CPD Model[1], namely the teacher as a learner and the teachers as a teacher, while the other three are highly related to the teacher as a reflective practitioner, enhancing his/her self-efficacy and ownership. It is suggested that the various CPD models (implemented by the different partners in the PROFILES project), designed according to these principles, have high potential to develop teachers' ownership as a follow-up to the PROFILES CPD programme.

Project partners are using different CPD models and operational approaches to enhance the teachers' professional status. Based on several years of experience with CPD, we came to the conclusion that the most effective models are enhanced by:

1. *Action research:* In which the teachers in the intervention phase, in collaboration with science educators, research their own classes.
2. *The teacher as a curriculum developer:* In which the teacher is intensively involved, to support the intervention phase, in the various curriculum development stages.
3. *Focus groups:* In which the teacher collaborates with other teachers as a community of practice to further enhance the implementation phase.
4. *Evidence-based classroom intervention:* Based on questionnaires, teacher portfolios, and other documents which can be used to demonstrate evidence-based accomplished practice in science teaching, in an effort to achieve more effective teaching.

These are teacher-centered approaches related to the intervention phase of the CPD model in which the teacher is in control regarding content, pedagogy and implementation.

Read more about the implementation of these CPD approaches, enacted within the CPD model developed by the partners, in the following articles by project partners.

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Fullan, M, G. (1991). The meaning of educational change. In M. G. Fullan (Eds.). *The new meaning of educational change* (pp. 30-46). New York: Teachers College Press.

Loucks-Horsley S., Stiles K., & Hewson P. (1996). Principles of Effective Professional development for Mathematics and Science Education: A Synthesis of Standards. National Institute for Science Education (NISE) Brief. Volume 1., No 1. Retrieved December 5 from http://www.wcer.wisc.edu/archive/nise/publications/Briefs/NISE_Brief_Vol_1_No_1.pdf

[1] PROFILES 4-stage CPD Model: 1) teacher as learner; 2) teacher as teacher; 3) teacher as reflective practitioner; 4) teacher as leader.
See also: http://stwww.weizmann.ac.il/g-chem/profiles/docs/PROFILES_D61.pdf)
See also: PROFILES Newsletter 1: http://ius.uni-klu.ac.at/misc/profiles/newsletter/newsletter1 and PROFILES Newsletter 2: http://ius.uni-klu.ac.at/misc/profiles/files/newsletter/PROFILES-Newsletter%2003_2012.pdf

1.2 CPD Model of UCC/ICASE Science Teachers in Ireland

by Declan Kennedy (University College of Cork, Ireland)

The first group of UCC / ICASE teachers to undertake CPD in PROFILES comprised of 30 science teachers. These science teachers were recruited through the branch network of the Irish Science Teachers' Association (ISTA). We are fortunate that the ISTA is a member of ICASE and hence we received full co-operation in advertising the PROFILES project to ISTA members. All of the teachers involved in PROFILES are classroom practitioners. The CPD training began in September 2011 and continued until May 2012 for the first group of teachers. A summary of some of the topics covered during this time period is given in Table 1.

All of the 2011/'12 CPD sessions took place in the Eureka Centre of University College Cork (UCC). The Eureka Centre is one of the world-wide network of ICASE Science and Technology Education Centres. It consists of two modern science education laboratories which are fully equipped to teach the full range of science syllabi (Physics, Chemistry and Biology) to students in Ireland in the 12-18 age range. In addition, seminar rooms, lecture theatres and a Science Education Resource Centre are also available in the Eureka Centre and all of these were used in the CPD training programme. A total of 65 hours were devoted to CPD in the first year. This CPD programme consisted of a mixture of lectures, workshops, discussion groups and laboratory practical activities.

Introduction to PROFILES

- What is PROFILES all about?
- PARSEL type modules – their purpose.
- Focus group discussion on identifying teachers' CPD needs.

Inquiry-based Science Education

- What is Inquiry-based Science Education?
- The constructivist teaching approach.
- The use of datalogging in promoting inquiry-based science education.

PROFILES Intervention Modules

- Writing and designing PROFILES intervention modules.
- Multiple Intelligences Theory – What every teacher should know.
- Teaching difficult ideas in Science Education.
- Teacher self efficacy.
- The 3-stage PROFILES model.

Research Methods in Science Education

- Teacher as curriculum developer.
- Teacher and Action Research.
- The Reflective Practitioner.
- Focus groups.

Developing the PROFILES Intervention Modules

- Peer group presentations on draft intervention modules.
- Focus group discussions.
- Finalising of topics.
- Planning of implementation in January 2012.

Etc.

Table 1. Some of the topics covered in the first CPD programme.

Ten teachers from the group were asked to be the "leader" teachers in developing the UCC/ ICASE modules. The topics for the modules were chosen by the teachers themselves and arose out of their own needs in the classroom. In Ireland there is a "gap" year called Transition Year between Junior Cycle science (12-15 year age group) and Leaving Certificate level (16-18 age group). The PROFILES modules are ideal for implementing with Transition Year

students as teachers have complete flexibility in the curriculum that they teach. Hence, teachers of Transition Year Science are ideal curriculum developers for Transition Year.

In addition to adopting a CPD model of curriculum development, an action research model was also adopted by the teachers. Each of the leader teachers was asked to liaise closely with two of the other teachers in the CPD group and carry out the following:

- Write an account of their work in the classroom in the form of a lesson plan for implementing the PROFILES module that he or she had developed.
- Distribute the MoLE questionnaires (pre and post) to each class group.
- Discuss and highlight the findings obtained from each individual class group. What did the "pre" questionnaires tell you? What did the "post" questionnaires tell you? What differences, if any, do you notice between pre and post questionnaires?
- Discuss and summarise conclusions based on your data, i.e. are the results of some groups different from other groups. Can you pinpoint any reasons for this? Arising out of conclusions, what recommendations for action need to be made?
- What changes will you make in the next cycle?

As a result of completing the action research cycle, various changes were incorporated into the original modules and Teachers' Notes were produced to help teachers implement the modules. All of this information was uploaded to the UCC / ICASE website. At present, additional CPD seminars on the PROFILES modules are being given throughout Ireland. The response to date is extremely positive – teachers obviously love receiving ready-made teaching packages developed by their fellow science teachers and hence PROFILES is very popular in Ireland!

Picture 1: John Lucey demonstrating the use of datalogging in promoting IBSE at a CPD lab workshop for PROFILES teachers. © UCC

Picture 2: A group of teachers in Donegal attending a recent PROFILES workshop on IBSE given by Dr Declan Kennedy. © UCC

1.3 Using Participatory Action Research for Curriculum Design – A Perspective from PROFILES Bremen

by Marc Stuckey, Silvija Markic, Dörte Ostersehlt and Ingo Eilks
(University of Bremen, Germany)

PROFILES in Bremen is operated by the model of Participatory Action Research in science education as it was described more than ten years ago by Ingo Eilks and Bernd Ralle (2002) and as it was just recently reflected again on its long-term effects on teacher professional development by Mamlok-Naaman and Eilks (2012). PAR intends combining the research-based design of new lesson plans, the innovation of concrete science teaching practices, and in-service teacher education based on the action research philosophy. This article gives a few insights into how PROFILES-Bremen is operating.

PROFILES-Bremen formed a network of teachers from different schools in Bremen to help them in the development of their curricula and teaching practices. The work of the teachers is accompanied by science educators from the University of Bremen. The central focus of PROFILES-Bremen is to accompany school reform in the field of science education. In 2010, the State of Bremen (one of the 16 federal states making up Germany) implemented a school reform by the establishment of a new type of secondary comprehensive schools: the Oberschule. In the Oberschule, science in the lower grades of secondary education (grades 5-8, age range 10-14) combines the previously independent subjects Chemistry, Biology and Physics into integrated science courses. However, until now, textbooks and official curriculum materials for teaching integrated science following the new syllabus are still rare. Also, most science teachers are trained in only one of the science domains. The teachers feel they themselves are not particularly educated to teach integrated science, especially in the areas where they did not receive formal training.

Within PROFILES, in Bremen roughly 20 science teachers per year work on developing new lesson plans and teaching materials. In accordance with the philosophy of PROFILES, the curriculum development focuses science teaching by aiming at general educational skills, the implementation of a societal perspective, and the promotion of inquiry-based science education (IBSE). Further teacher groups coordinated by the University of Bremen were launched in the German states of Lower Saxony and Northrhine-Westfalia too.

The strategy behind PROFILES-Bremen is the collaborative curriculum development of lesson plans following the model of Participatory Action Research (PAR) in science education. PAR in science education combines in a systematic way the use of evidence-based knowledge from educational research, practical experience from the classroom, and teachers' intuition and creativity for a cyclical innovation of classroom practices. The research base and the teachers' knowledge are considered to compose the two ends of the knowledge spectrum of teaching and learning, both of which are equally important and have their own strengths. Evidence from educational research and the practical experience of teachers are united through discussion. Within teacher-researcher group discussions, knowledge from the different domains is compared and reflected upon with respect to its relevance for innovating teaching practices. From this starting point, teachers and researchers cooperatively conceive and investi-

gate science teaching practices. The conception and research is based on a cyclical process. Lesson plans are drafted, tested, evaluated, and revised (see figure 1).

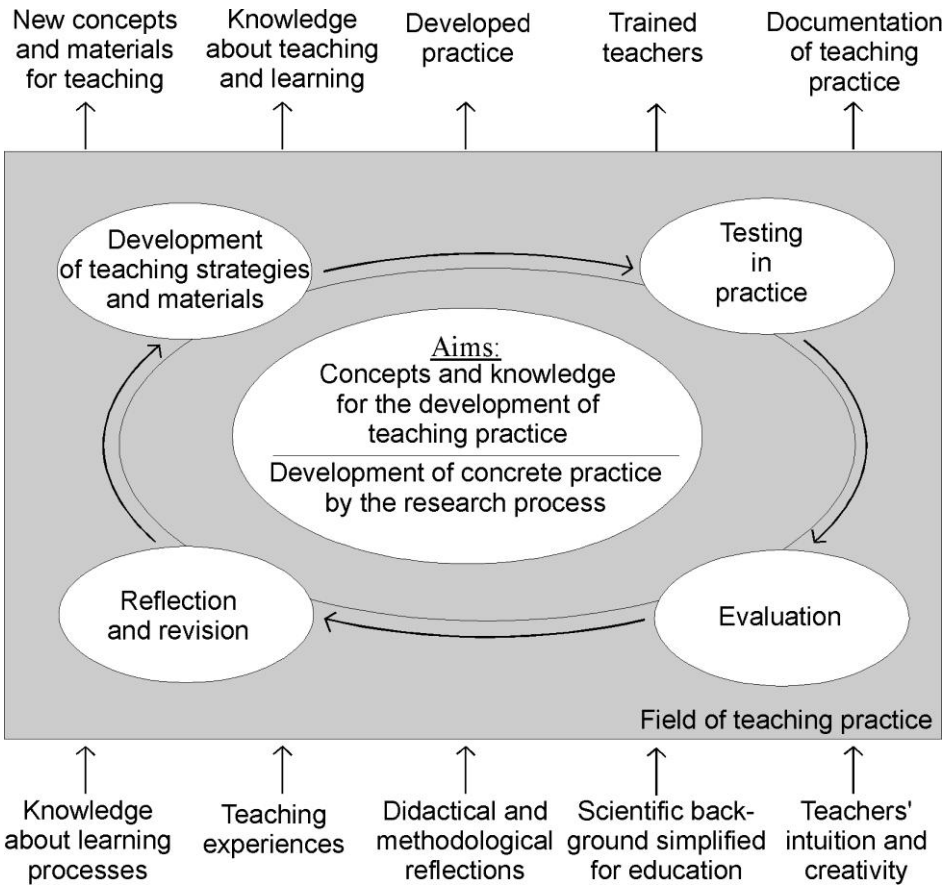

Figure 1: Participatory Action Research in science education

Central foci – as in any kind of Action Research – are the improvement of authentic practice and contribution to the Continuous Professional Development (CPD) of the practitioners. The teachers participating become better trained in developing, implementing, exploring, and reflecting innovative teaching practices. PAR is also aimed at the development of innovative teaching materials as the end-products of this model, as well as evidence regarding their effects in the means of action research case studies being done in parallel by different teachers in a variety of learning groups. The case studies collect evidence, which covers both the effects of changed teaching strategies and teachers' and students' personal perceptions of the new teaching materials and pedagogies.

With regard to the development of materials, the teachers meet regularly once a month in small groups (3 to 6 teachers per group) accompanied by researchers and curriculum experts from the University of Bremen. Five to six lesson plans are conceived, tested and cyclically refined per year. Units that were developed are focusing, e.g., "Energy around the house", "Inspired by nature: bionics", or "Tattoos – chemistry under your skin". The teaching and learning materials are distributed via a local website and in-service teacher education courses that all teachers have the access to. So the materials are available to be implemented by an even broader audience in their classes.

References

Eilks, I. & Ralle, B. (2002). Participatory Action Research in chemical education. In B. Ralle & I. Eilks (Eds.), Research in Chemical Education - What does it mean? (pp. 87-98), Aachen: Shaker.

Mamlok-Naaman, R., & Eilks, I. (2012). Action research to promote chemistry teachers' professional development – Cases and experiences from Israel and Germany. *International Journal of Mathematics and Science Education*, 10 (3), 581-610.

1.4 Action Research – A Powerful Tool to Improve Inquiry Teaching and Reflection Skills. Experience from Latvia

by Dace Namsone (University of Latvia, Latvia)

The background

In recent years, the philosophy of scientific inquiry teaching and learning is a part of teaching and learning process in Latvian schools. The PROFILES project is a great opportunity to continue to develop new forms of teacher professional development to meet teacher needs for implementing scientific inquiry and education though science in every classroom. The evidence for the need for improvement on reflection skills came from the teacher needs questionnaire results, implemented within the PROFILES framework in October 2011. Individual needs to improve experienced teachers teaching skills, like how to teach students pose hypothesis, analysing problem, or making conclusions, etc. were identified by the teachers themselves as problems to improve. Action research was chosen as a tool for classroom implementation component of the PROFILES CPD to support teachers improve their own teaching practice and reflection skills. Action research was designed to bring about change in a personally experienced situation. The aim of the [action] research is to solve a problem or improve a situation. (Taber, 2007)

How to prepare group leaders?

Focused learning groups for action research, as a teacher professional learning tool to improve the individual teaching practice and reflection of science teachers, were organized in Latvia from November 2011 until now as an operational component of the CPD model. For these training for group leaders was an important step which was done in close cooperation with PROFILES partners. The workshop group leaders acted in two roles – as leaders (teacher as leaders) and learners (teachers as teachers) during the CDP. For each workshop, a procedure was developed and updated and group leaders participated as observers during the sessions of other groups. The feedback from participants, observers and group leaders were noted and discussed. The teachers presented their work, took part in the focus group reflective discussions and in a questionnaire during the final conference.

How did the group work?

One group of twelve science subject teachers (6 Biology, 4 Physics and 2 Chemistry) teaching grade 7-12 from different schools in Latvia, adopted a group workplan consisting of five working sessions once a month. The action research took place in the classroom between workshops and the final conference; an opportunity to communicate with the group leader electronically between workshops was offered. Every workshop included a structured procedure: individual reflection, group reflection and discussion about the work done between the workshops; a focused input from the group leader according to the teacher needs; planning of next steps; identification of independent research work. The guidelines under which the group operated were developed together with teachers. Research question were formulated by every participant individually. For example "*If students are given short case studies every two weeks will they acquire skills to formulate a research problem and a hypothesis?*" etc. The worksheets for students and other action research instruments were prepared, regularly discussed and updated.

What were the outcomes?

Ten of these teachers presented their work in the final conference in May 2012 and six of these teachers continued for the second school year.

The teachers mentioned, as individual gains, the sharing with colleagues: *"I feel the support from colleagues on my ideas; it was the first time that I focused on seeking evidence in the classroom with my students on how to make conclusions - and they did it; ... I went step by step, not as a campaign; ... the making of notes disciplined me; students mentioned that the new checklist is really useful; ... there is the tendency that students' achievements increase."* etc.

This form of CPD provided a challenge for workshop leaders and teachers as both were learners at the same time. All group leaders faced the problem to formulate good research questions – which were often too general or too obvious. Unfortunately, Latvian teachers were used to being seen as an empty vessel filled by others and it was a real but exciting challenge for the teachers to formulate their own research question.

Both teachers and group leaders found that the learning group approach was a very powerful tool. The formal outcome on teacher gains showed that all of them had very big gains[2] in the improvement of skills, such as to solve a research problem, to analyse one's own work, to reflect about teaching, to have evidence indicating improvement and to co-operate with colleagues. The teachers pointed out that it was very important that the group leader in the workshops created a positive atmosphere, kept the discussions focused, worked as a coach and supported teachers individually.

The final conference for this school year took place on May 9th.

Picture 1-3: Teachers during a Workshop
© University of Latvia

[2] 4 or 5 in Likert scale (1-5)

1.5 Focus Group Discussions as a Tool for Reflection in the Finnish Teachers' Continuous Professional Development Programme

by Tuula Keinonen (University of Eastern Finland, Finland)

Finland has a long tradition of teachers' in-service training. Twice a year, teachers participate in a one-day VESO educational session, which is based on a collective bargaining contract. These education days are obligatory for those who hold permanent positions as teachers, and the days are normally arranged for teachers from one municipality. In addition, the National Board of Education annually funds several long-term in-service training programmes. These programmes are usually arranged by Teacher Education Departments at Universities, or Further Education Institutes. They last for the whole school year and include both face-to-face meetings and distance learning periods. Teachers have become used to this kind of education and therefore it was decided to use this model for the PROFILES CPD programme. Also, due to the long distances between the domain of the participating teachers and the programme provider, UEF, this model had a further advantage. The model used for the programme was thus seen as blended learning.

Finnish teachers could be said to be familiar with inquiry-based learning because it is included in teacher education; they also have good knowledge of subject content. This being so, the CPD programme could concentrate more on the PROFILES 3-stage teaching model, emphasizing the building up of scenarios and stressing the importance of the decision making stage. Focus group discussions could be used to get information about teachers' ideas concerning the PROFILES 3-stage model. During the first face-to-face meeting, in small groups, teachers could discuss the following themes: What kind of challenges are a) associated with creating a good scenario, and b) with the transfer from the scenario to the inquiry stage?; How could the learning of content be ensured?; And then, after the inquiry stage, how could what has been learned be applied and used in the decision making stage?

The teachers pondered over the question of students being interested in different issues by themselves; would the imagination of teachers be sufficient to create motivating scenarios? The scenario should be a natural starting point that fixed the topic under consideration, avoiding the danger of the scenario being too complicated for the topic in question. The teachers raised the point of teaching discussions to help guide students from the scenario to inquiries, and they also felt some-

Picture 1: Discussion with PROFILES teachers in the 1st and 2nd CPD round including a teacher from America

what doubtful about the students' initiatives. They also felt that this was the case in the transition from inquiry to decision making. Teachers obviously need guidance and encouragement, particularly in the planning of scenarios, the decision-making stages, as well as in trusting their students. Because the first focus group discussions produced valuable information about the challenges in PROFILES teaching, it was decided to collect teachers' ideas through the use of focus group discussions in other face-to-face meetings.

1.6 Investigating an Evidence-based Continuous Professional Development (CPD) Programme for Pre-service Science Teachers at Freie Universität Berlin

by Claus Bolte, Vincent Schneider and Sabine Streller (Freie Universität Berlin, Germany)

Within Work Package 5 (WP5), the PROFILES group at Freie Universität Berlin (FUB) is conducting different programmes of teachers' continuous professional development (CPD) courses for pre-service science teachers which are founded on "*evidence-based approaches*" (PROFILES, 2010; Bolte, Holbrook, Rauch, 2012).

Sources of evidence

One source of evidence we are focusing on comes from the participants themselves, hence the participants give us information about their attitudes and concerns regarding the teaching of inquiry-based science lessons. To get systematic insights to their attitudes and concerns we are using the *"Stages of Concern (SoC) Model"* introduced by Hall and Hord (2011) and a specific SoC questionnaire which was adapted with regard to our research interest (Schneider and Bolte, 2012).

As *an additional source of evidence* regarding 'better science lessons' we chose the pupils' assessments of their *"Motivational Learning Environment (MoLe)"* (Bolte & Streller, 2011; 2012) regarding the time they were taught in an inquiry-based way by the pre-service teachers who participated in this FUB PROFILES CPD programme.

In the context of this PROFILES CPD project at FUB we focus on the question: *How do pre-service science teachers' IBSE-related attitudes and concerns change in this specific CPD treatment course at Freie Universität Berlin (FUB)?*

Furthermore we ask: *Is there evidence that the participants of our CPD course develop their professional skills in the direction of taking ownership for (better) IBSE teaching and is this correlated with the pupils' assessment regarding the motivational learning environment they perceived?*

Framework of the evidence-based CPD programme for teacher students at FUB

The IBSE-related CPD programme of the FUB group is based on the PROFILES "Four Stage CPD Model"[3] (Hofstein et al., 2012; Loucks-Horsley, Stiles, & Hewson, 1996) and divided into three parts:

In the first part the teacher students are introduced to the concept of inquiry-based science education (IBSE) which is mainly based

[3] We – the FUB PROFILES group would recommend to term this model the "PROFILES Four Dimensional CPD Model" because – as will be shown further on – there are no hierarchical stages (or levels) which are reached or not reached one after another by a (pre-service) teacher.

Picture 1: Teacher students as learners © FUB

Picture 2: Teacher-students as teachers © FUB

on contemporary IBSE approaches. They learn how to plan science lessons in general and lessons based on IBSE in particular. In this part the teacher students are acting *'as learners'*. After this introduction they start planning 'their science lessons' by cooperating in groups of two (or three). During this period they are planning their lessons just *'as teachers'* would do it. At the end of this period, the teacher students have to present the lessons' plans they carried out to the other course members in a poster session and they are asked to cooperatively reflect the lessons they planned. In this period the participants are acting *'as reflective practitioners'*

In the second part of this CPD course the teacher students teach a class (grade 7 or 8) in a specific project which takes a whole week (5 days and app. 35 hours per week). Now the pre-service teachers are acting again 'as teachers'. At the end of a project day the groups have to reflect what they did and how they taught. Here, the participants are acting once more 'as reflective practitioners'.

The third part of this CPD programme starts when the project week is over. Now, the participants have to write a report about their experiences while teaching their lessons and while observing the lessons of their course mates. This part ends with a one day seminar (app. 6 hours) at the university. During this seminar the participants are reflecting and discussing the project week as a whole. They share their experiences and impressions regarding their own teaching and the teaching of the others they observed. Once again they are in the role of a 'reflective practitioner'.

Evaluation of this evidence-based CPD programme

To evaluate this CPD programme for pre-service science teachers we adapted an instrument to analyse (pre-service) teachers' profession-related attitudes and concerns about the implementation of IBSE in school practice (Schneider & Bolte, 2012). This instrument is based on the "Concerns-Based Adoption Model" of Hall and Hord (2011) and their work regarding the "Stages of Concern" (SoC). For the evaluation of this CPD programme we chose a pre-post- and a treatment-control group design using the adapted SoC questionnaire. This SoC questionnaire was conducted to the participants before and after the CPD course (N=38), and the CPD course itself serves as the treatment. Students of the BA programme for becoming science teachers who did not participate in this CPD course build the sample of the control group (N=133).

The pre-post analyses of the data – as well as the comparison of the results of the treatment- and control-group – show that according to the SoC profiles of Bitan-Friedlander, Dreyfus and Milgrom (2004) the pre-service teachers of our treatment group developed more 'positive' and more open-minded atttitudes regarding IBSE towards the end of our CPD courses (see Figure 1).

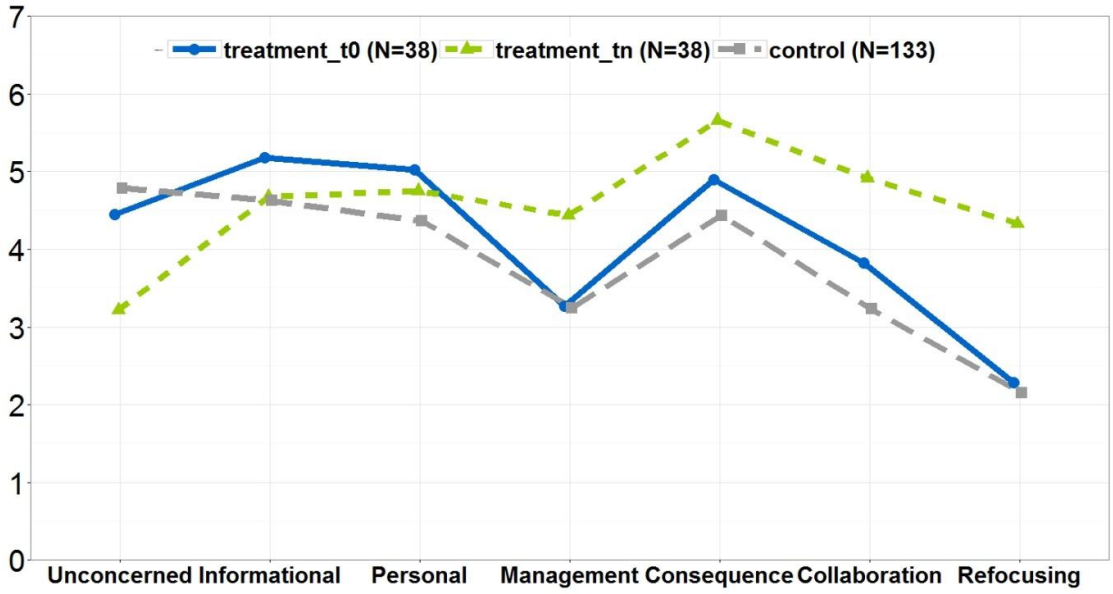

Figure 1: SoC profiles of the PROFILES treatment group and control group

In addition we are able to show a positive impact of the inquiry-based science teaching of our pre-service teachers regarding the MoLE assessments of the participating pupils (N=110) at the end of the project week (see Figure 2).

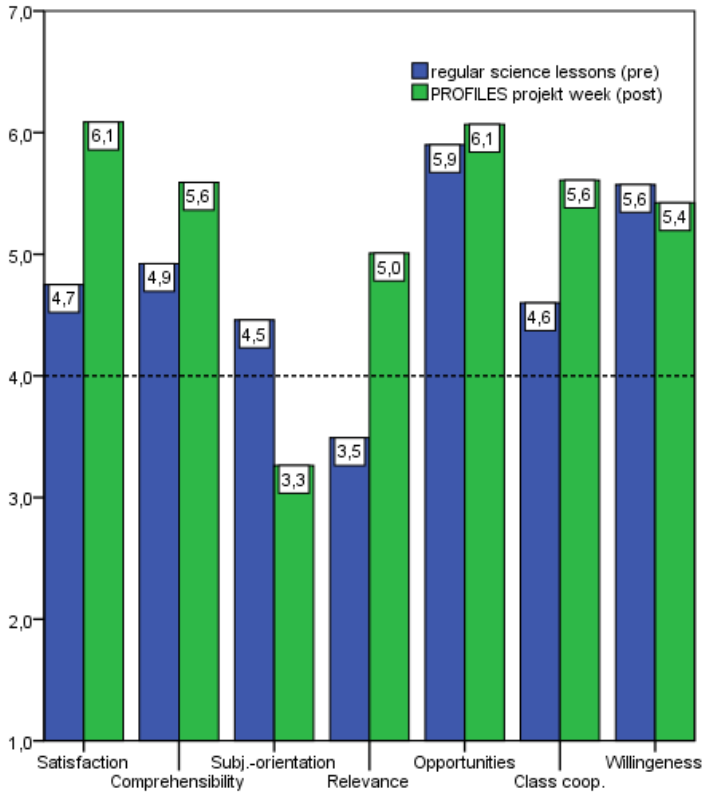

Figure 2: Pre and post results of MoLe assessement (N=110)

Conclusion and impact

Due to the evidence we found it can be concluded that the adapted SoC questionnaire is suitable to gain insights into pre-service teachers' attitudes and concerns towards IBSE in general, and to evaluate educational course offers (such as this FUB CPD programme) within the framework of pre-service science teachers' educational courses at university in particular (Schneider & Bolte, 2012).

Taking everything into account we can state that our teacher students benefit from this FUB CPD programme. Also the participating pupils' gained from the PROFILES project week hence they assessed the motivational learning environment in these classes as more favourable than their regular classes.

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2 Crossing Borders in Science Teaching – 'Project Team Science' participates in the European Science on Stage Festival 2013 in Słubice

by Sabine Streller (Freie Universität Berlin, Germany)

Introduction

Science on Stage is a network of teachers of all kinds of schools, who teach science and technology subjects. It offers a platform for a Europe-wide exchange of ideas and concepts for science education. One focus of Science on Stage is on connecting teachers, who present successfully implemented ideas for science lessons to their colleagues and have the opportunity to further inspire one another at project stalls, in workshops, in presentations and on stage (for further information see www.science-on-stage.de). This exchange of ideas takes place on national and European festivals. From the 25th until the 28th of April 2013, the European Science on Stage Festival took place in Słubice (Poland) – this time, also PROFILES teachers from Berlin and Cyprus participated in this festival.

In May 2012, 'Project Team Science' (German: „Projektgruppe Naturwissenschaften" [ProNawi]) – a group of Berlin PROFILES teachers working on the project "Once upon a time… fairy tales in science lessons" – successfully applied for the participation in the national Science on Stage Festival in Berlin. In the course of the national Science on Stage selection process the Berlin PROFILES group was able to convince the Science on Stage jury which included teachers and teaching methodologists of their ideas. Therefore, ProNawi was invited to present their "good-practice"-ideas for science lessons to the audience of the European Science on Stage Festival as a member of the German delegation.

'Project Team Science'

'Project Team Science' (ProNawi) is a group of interested teachers who teach science to pupils of 5th and 6th grade at Berlin schools, who are willing to further develop and improve their lessons, and who started to participate in the ProNawi-programme of 'Freie Universität Berlin' in 2010 in the course of the PROFILES-project.

After the teachers had first worked on competence development in the area of 'scientific inquiry' during their monthly meetings, the second year of ProNawi aimed at developing flexible lesson building blocks (so called PROFILES modules) based on this knowledge. In early stages of science education these modules serve as an introduction to scientific working methods and thinking procedures. During the development of the modules an emphasize was put on the concept of 'Inquiry-based Science Education', every day life relevance of the topics to be chosen, as well as on including possibilities to differentiate among the pupils during the lesson.

Fairy-tale ideas for science teaching

In the project "Once upon a time…" fairy tales form the context and are the starting point (the scenario) for inquiry-based learning in science lessons of primary schools. In addition to learning and practicing scientific working methods, the focus with regard to content is on "everyday substances".

The aim of the project "Once upon a time …" is to engage students in the topic "everyday substances", which is typical for elementary science education, from a new, unusual perspective. We chose fairy tales as a context.

On the one hand fairy tales, stories and fables are popular with children; on the other hand they are full of scientific aspects. Four fairy tales by the Brothers Grimm and Hans-Christian Andersen turned out to be particularly adequate for the topic "everyday substances" (Figure 1), but there are certainly more.

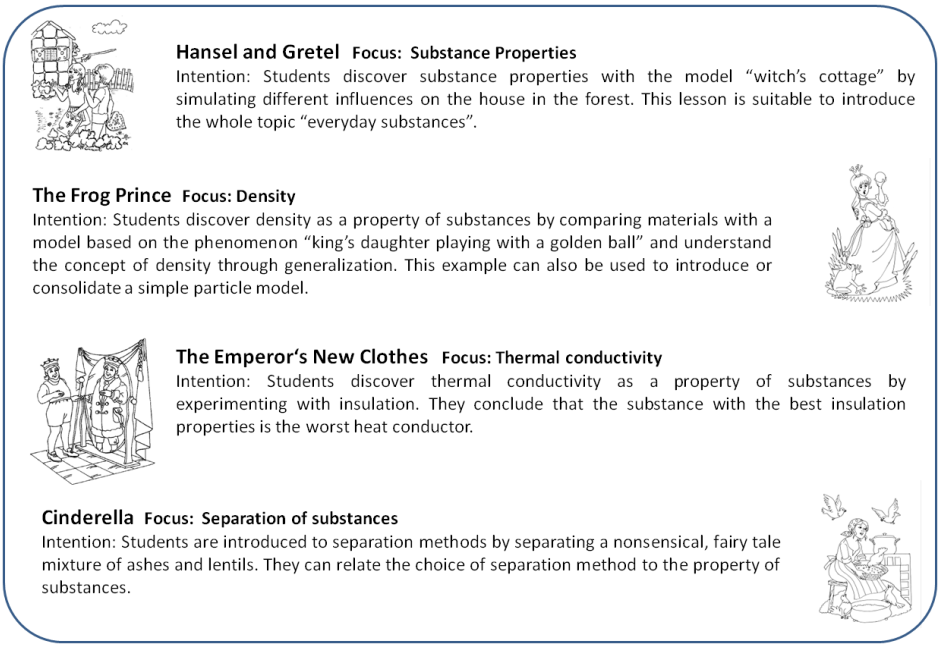


Figure 1: Overview of the lesson building blocks, contents and intentions of the sequence "Once upon a time …"

Based on these fairy tales, we have designed our modules. All of these building blocks and the corresponding material are directed at 10 to 12 year old children of every type of school and learning stage. The following figure shows an overview of the developed or adapted lesson plans (Figure 1)

All lesson building blocks follow a similar pattern:

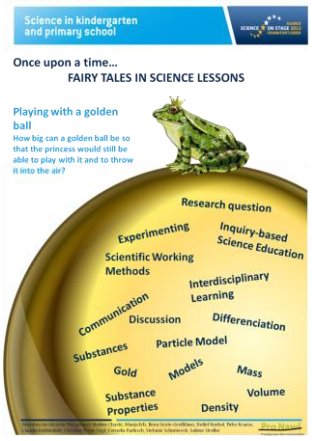
1. The starting point is a **fairy tale**, which can be read out as a whole or in parts. Pictures can be used for illustration: The students can draw a picture or color the attached picture while listening.
2. The students discover the **scientific issues** in the fairy tale and pose one or several **questions**.
3. They develop ideas and **hypotheses** to test these questions and **plan experiments**.
4. They conduct the **experiments** or model experiments **independently** or with supporting worksheets.
5. Finally, they present, compare and discuss their **results** and check if the original **question** can be **answered**.

ProNawi on Stage

On the European Science on Stage Festival, 450 teachers from 25 different countries took part.

Six members of ProNawi presented the project "Once upon a time… fairy tales in science lessons" to the participants and to the general public. On Saturday, the 27th of April 2013 – the open day of the festival – more than 150 interested teachers visited the festival, informed themselves about the projects and talked to the presenters (Figure 2). The ProNawi group presented a poster (Figure 3) and various self-developed materials during the 'Science Fair'.

Since the fairy-tale modules enjoyed great popularity and many visitors were interested in these ideas, ProNawi is now going after the publication of the fairy-tale modules, to allow an even wider public access to the units and materials. Furthermore the ProNawi teachers offered the intention to develop and organize CPD workshops for interested colleagues. This can be seen as evidence regarding the professional development of the ProNawi teachers in the direction of 'taking ownership' and becoming innovative 'lead teachers'.



Picture 1 & 2: Visitors at the stall of ProNawi's project „Once upon a time…" with golden balls – models of the unit "The Frog King" © Sabine Streller

Figure 2: Poster for the Science on Stage Festival – „Once upon a time…"

The module "The Frog King", "Hansel and Gretel" as well as "The Emperor's New Clothes" were all developed by ProNawi. The module "Cinderella" (Streller 2009) was adapted. The members of the project are: *Nadine Chasté - Manja Erb - Ilona Grote-Großklaus - Detlef Knebel - Pirko Krause - Claudia Frühinsfeld - Christine Prem-Vogt - Cornelia Radusch - Stefanie Schmiereck - Sabine Streller*

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3 Module Example: Can Traffic Accidents be Eliminated by Robots?

by Bulent Cavas (Dokuz Eylul University, Turkey) and Jack Holbrook (ICASE, UK)

This module leads to a decision making activity related to ways to decrease traffic accidents. Robotics (in this activity, lego mindstorms NXT 2.0) is used where the main science background will be on the reflection of the light at the grade 6 and 7 level. The activity includes the construction of robots which are able to read different wavelengths of light using light sensor. Various sensors will add to constructed Robots (designed as a model car) and experiments are carried out to seek ways to prevent traffic accidents.

Learning outcomes expected from the module. Students will be able to:	Construct a robo-car, controlled by, light sensors for decreasing/increasing the speed of the car according to different- coloured roads and how to present the results in a tabular form/ diagrams.
	Write suitable computer programmes using NXT 2.1 programming to control the speed of the car.
	Collaborate as member of a group in designing and carrying out appropriate activities from writing the computer programme to solving problems associated with the use of the robot.
	Explain transmitted, absorbed and reflected light, for both white and coloured light and the purity of reflection from different coloured roads.
	Explain wavelength of light in the context of the electromagnetic spectrum and the manner in which light sensors function.
	Decide with justification, whether robots can be viably used to reduce the number of road accidents.
Curriculum content	Transmission and reflection of Light; Light as part of the electromagnetic spectrum.
Anticipated time	4 lessons
Initiating the teaching	Road accidents cause many deaths in Turkey. There are many reasons for it. The most important reason is the drivers' inattentiveness when they are driving, especially in the late hours. Most Turkish drivers do not follow the traffic signs related to speed limitation and with increased cars on the roads, many traffic accidents have occurred in the past 10 years. According to the Security Department of Turkey, 4236 people died in 2008; 4324 people in 2009 and 4045 people in 2010 as a direct result of traffic accidents. Are you happy with these results? Would you be interested in exploring ideas about ways traffic accidents can be reduced (and maybe eliminated)? Let us build robot cars and explore how science and technology might be able to play a role using light sensors.
The specific tasks for students are:	Constructing a robo-car using lego mindstorms NXT 2.0; controlling the speed of the robo-car using suitable computer software related to light sensors.
	Undertake additional experiments to determine the effectiveness of speed control the robo-car related to different coloured/material surfaces.
	Undertake a group discussion so as to make a justified group decision on whether realistic (acceptable, cost effective, reliable) ways can be possible using light sensors to decrease the number of traffic accidents.

4 Report on Conferences and Meetings

PROFILES Consortium Meeting, Klagenfurt, Austria

The meeting of the PROFILES consortium members took place in Klagenfurt (Austria) from 14th to 18th April 2013. Over 40 participants came from partner countries. In a spring-like atmosphere current issues and further project steps were discussed among the partners. Furthermore, several workshops by the work package leaders were offered at this meeting. Rachel Mamlok-Naaman, Dvora Katevich and Avi Hofstein gave an overview on how to foster and evaluate science teacher's ownership and supported the participants in creating their own "ownership profile". Claus Bolte gave a first insight into the outcomes of the students' gains analysis showing the effectiveness of PROFILES lessons. Franz Rauch pointed out how involvement of participants in the ISBE-Network could be improved; additionally Peter Holub, coordinator of the Carinthian Science Network IMST (Innovations Make Schools Top), explained the development of regional and local networks in Austria with special emphasis on the Carinthian network. Before and after this 2-days meeting, the project's steering committee members reported on progress and challenges in the different work packages and discussed about the next PROFILES Book as well as the next international PROFILES conference that will take place in August 2014 in Berlin.

Picture 1: PROFILES Consortium Members at the Lindwurm of Klagenfurt © Mira Dulle

Picture 2-4: Workshops on the assessment of student's gains, Ownership, and Networking © Mira Dulle

Picture 5: Group discussions © Mira Dulle

Meeting of the PROFILES work package leaders, Vienna, Austria

Picture 4: The PROFILES work package Leaders © Mira Dulle

From 6th to 8th January 2013, the PROFILES work package leaders gathered in Vienna, Austria, to discuss the achievement of project objectives, the current status of the PROFILES deliverables and further steps to be undertaken in order to lead the project to success.

NARST Conference, Rio Grande, Puerto Rico

The annual international conference of NARST (National Association for Research in Science Teaching) took place from 6th to 9th April 2013 in Wyndham Rio Mar, Rio Grande. PROFILES partners ran two symposia and presented posters and papers regarding their work and insights within the project during the conference to further disseminate the PROFILES project's outcomes, its ideas, CPD approaches and objectives. Further information is available on: http://www.narst.org/annualconference/2013conference.cfm

5 Future Events

EARLI Conference, Munich, Germany

From 27th to 31st August 2013, the 15th Biennial Conference of the European Association for Research on Learning and Instruction (EARLI) will take place in Munich, Germany. Eleni Kyza, PROFILES member from Cyprus, will attend the conference to present the project and further disseminate its objectives. Further information is available on: http://www.earli2013.org/

ESERA Conference, Nicosia, Cyprus

The 10th biannual Conference of the European Science Education Research Association (ESERA) will take place from 2nd to 7th September 2013, in Nicosia (Cyprus). The theme of this ESERA conference is "Science Education Research for Evidence-based Teaching and Coherent Learning". PROFILES consortium partners are looking forward to present some papers and run two symposia on a) the PROFILES International Curricular Delphi Study and b) Promoting Motivational Science Education for 21st Century Scientific Literacy.
Further information is available on: http://www.esera2013.org.cy/ngcontent.cfm?a_id=1

WorldSTE 2013, Kuching, Malaysia

The fourth World Conference on Science and Technology Education (WorldSTE2013) will be held in Kuching, Malaysia from 29th September to 3rd October 2013. Organized by the International Council of Association for Science Education (ICASE), holding official relations with UNESCO, the World Conferences bring together policy makers, curriculum developers, scientists, science and university edu-

cators and researchers, science teacher association officers and of course primary and secondary science teachers. PROFILES partners are planning a symposium on PROFILES modules for robotics, datalogging and the use of microscale equipment. Further information is available on: http://worldste2013.org/index.html

Symposium on Chemistry and Science Education, Bremen, Germany

The 22nd Symposium on Chemistry and Science Education, entitled "Science Education Research and Education for Sustainable Development", will be held from 19th to 21st June 2014 at the University of Bremen. Some of the PROFILES partners will share their expertise in relation with the focus of this symposium; furthermore the programme will include a poster session. Further information can be found via the following link: http://www.idn.uni-bremen.de/chemiedidaktik/symp2014/index.html

2nd International PROFILES Conference, Berlin, Germany

From 25th to 27th August 2014, the PROFILES Consortium would like to invite all interested colleagues to the "2nd (and final) PROFILES International Conference on 'how to enhance IBSE and Scientific Literacy' in Europe." This Conference will take place in Berlin. Project results will be presented to stakeholders and to other invited guests from schools and other educational practices and colleagues from other FP6, FP7 and/or projects related to the Conference's topic are especially invited! And all are invited to submit a brief proposal for the foreseen "interactive poster presentation" at the PROFILES conference. Further information regarding the current status of the "2nd (and final) PROFILES International Conference on 'how to enhance IBSE and Scientific Literacy' in Europe" is available and will be regularly updated on http://www.profiles-project.eu/.