PROFILES PROJECT FINAL REPORT

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1 Executive summary of the PROFILES project

PROFILES is an acronym for **P**rofessional Reflection-**O**riented **F**ocus on **I**nquiry-based **L**earning and **E**ducation through **S**cience and one of the European FP7-funded projects in the field of "Science in Society". PROFILES is also the name of a well balanced consortium of experts from different fields of science education and science educational initiatives from 22 different partner institutions in 21 different countries.

The PROFILES consortium was engaged in activities – divided into 8 work packages – which finally aim at the **Dissemination (WP8)** of ***IBSE*** through the adaption, development and improvement of innovative **Learning Environments (WP4)** and by conducting (long-term) **Teacher Training** courses **(WP5)** - which we (the PROFILES consortium members) would rather like to label as Teacher **"*Continuous Professional Development*" *programs*** (in short: ***CPD programs***). The PROFILES CPD programs are created based on pedagogically and theoretically sound models of professionalization which are realized in practice in order to raise the self-efficacy of science **Teachers** to take **Ownership (WP6)** and to reduce their professional concerns about developing more effective ways of teaching science to their students in order to enhance their **Student Gains (WP7)**. The activities within the PROFILES project have been supported by the **Involvement of different stakeholder groups** (**WP3**) and by inspiring C**ooperation and Support** actions **(WP2)** among the PROFILES consortium members, as well as by supportive **Management** structures **and** thorough internal and external **Evaluation** processes **(WP1)**.

Looking back on the PROFILES project, the PROFILES consortium is able to report that the following aims have been reached and various outcomes have been achieved:

- An empirically-based feedback from more than 2600 stakeholders reflecting the current situation of the science education system in the 21 partners' countries and focusing on possible improvements was examined through the PROFILES (Inter-)National Curricular Delphi Studies on Science Education (WP3).
- More than 220 PROFILES modules in total (among them, more than 75 PROFILES modules in English) are available for download via the International PROFILES websites, ready to be implemented and used in science classrooms (see WP4).
- Different models of CPD programs for teachers have been developed and tested. In total 1588 teachers participated in the PROFILES long term CPD programs and enhanced their professional skills (WP5).
- More than 15% of the PROFILES teachers developed a high(er) level of teacher ownership regarding contemporary science education and became "PROFILES lead teachers"(WP6).
- A theoretically sound and empirically proven instrument to analyse students' assessments of the motivational learning environments in their science classes exists in 17 different languages for the use by teachers interested in the evaluation of their science teaching. Furthermore, evidence of how to improve students' (intrinsic) motivation to learn science was achieved by analysing data sets of more than 28000 students from 20 different countries (WP7).
- PROFILES teacher networks were initiated and existing networks were strengthened on a local, regional, national and international level and PROFILES activities were disseminated; e.g. through: the PROFILES (Inter-)National websites, the 3 Books of PROFILES (in English), project flyers and the 6 newsletters (provided in the partners' local languages; including English), the 2 PROFILES International Conferences as well as a large number of PROFILES presentations at national and international science teachers meetings and conferences (N~740) and approx. 400 PROFILES publications in science education journals or other places (see WP8).

2 Summary description of the PROFILES project context and objectives

2.1 Context of PROFILES Project

PROFILES is an acronym for **P**rofessional Reflection-**O**riented **F**ocus on **I**nquiry-based **L**earning and **E**ducation through **S**cience and one of the European FP7-funded projects in the field of "Science in Society". PROFILES is also the name of a well-balanced consortium of experts from different fields of science education and science educational initiatives from 22 different partner institutions in 21 different countries (see Chapter 5 of this report).

The colleagues involved in the PROFILES project were engaged in activities which finally aim at the **Dissemination (WP8)** of ***IBSE*** through the adaption, development and improvement of innovative **Learning Environments (WP4)** and by conducting (long-term) **Teacher Training** courses **(WP5)** - which the PROFILES consortium members prefer to label as Teacher "***Continuous Professional Development*" *programs*** (in short: ***CPD programs***). The PROFILES CPD programs were created based on pedagogically and theoretically sound models of professionalization and realized in order to raise the self-efficacy of science **Teachers** to take **Ownership (WP6)** and to reduce their professional concerns about developing more effective ways of teaching science to their students in order to enhance their **Student Gains (WP7)**. The activities within the PROFILES project were supported on the one hand by the **Involvement of different stakeholder groups** (e.g. students, science teachers, science educators and science education researchers as well as scientists; **WP3**) and on the other hand by vivid **cooperation and support (WP2)** actions of the PROFILES consortium members, as well as by promoting **management** structures **and** thorough internal and independent external **evaluation** processes **(WP1)**.

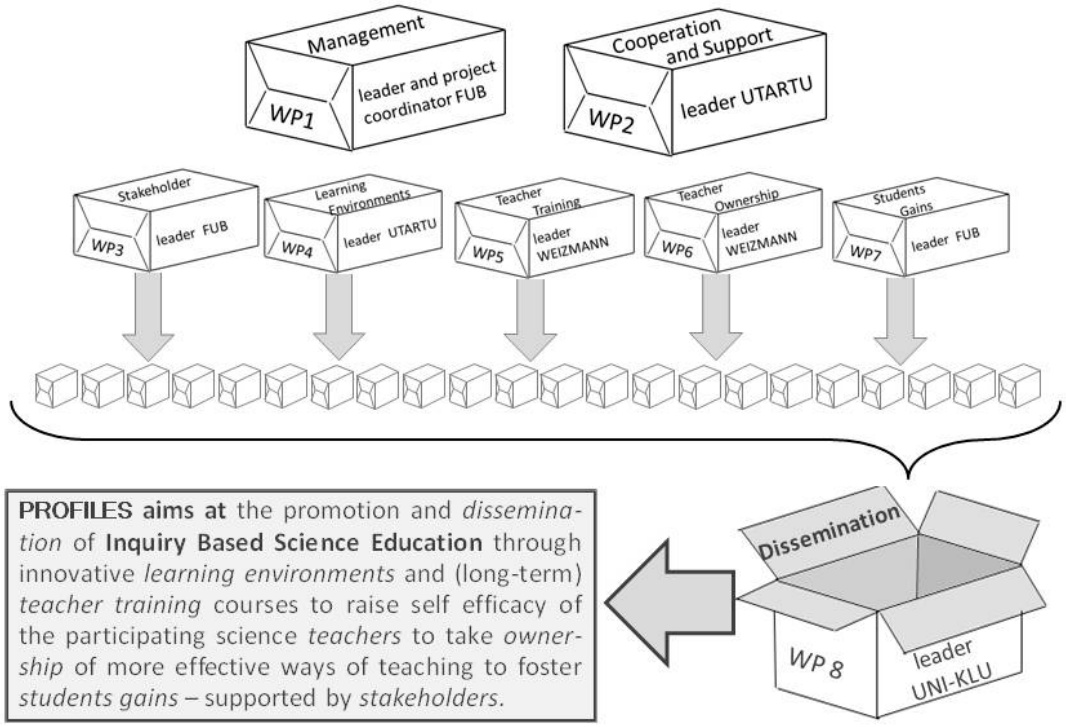

Figure 1. PROFILES Work packages and aims

The anticipated overall impact of the PROFILES project and hence its major value gives teachers, educators and CPD providers more confidence and greater awareness of the intentions of a contemporary science education in a democratic society governed by socio-economic and scientific related factors.

PROFILES is anticipated to be a model to guide stakeholders in all fields of (science) education in recognising that science education is more than teaching science contents or concepts, and to convince stakeholders that in modern science education it is essential to pay close attention to student-centred approaches of learning and education. Cognitive learning through IBSE should focus on science with relevance to everyday life and society values. IBSE, in combination with student-centred teaching and learning approaches, is the most promising strategy to increase the number of students who learn and value the sciences, and finally maybe choosing a career in the sciences, but most of all becoming more and more scientifically literate.

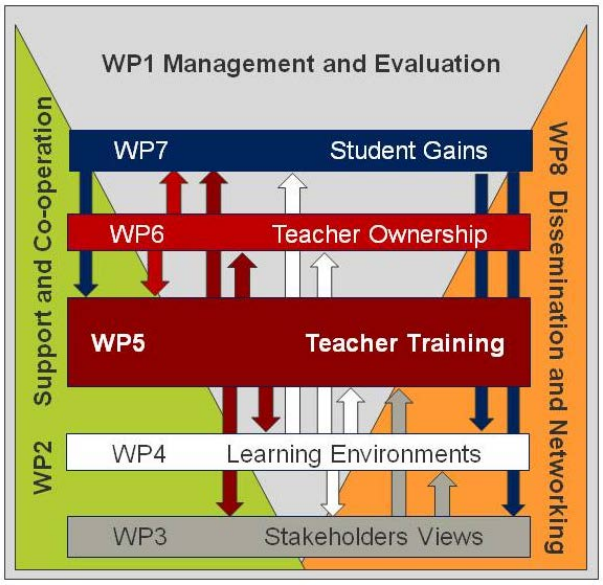

Figure 2. Interdependence of the PROFILES Work packages

Within the education system of each partners' countries, the PROFILES project aims were followed via eight interdependent work packages (see Figure 1 and Figure 2).

The description of the PROFILES project' objectives (see Chapter 2.2, below), the work performed and the main results achieved will be summarized and discussed in this report along the eight work packages (see Chapter 3 and 4).

2.2 Objectives of PROFILES Project

Since the start of the PROFILES project (on 1st December 2010), and until the end (on 31st May 2015) all PROFILES consortium partners were involved in the project's tasks and supported by the PROFILES work package leaders and the coordinator as required. The work within the project is divided into eight specific **Work packages (WP)**. The following objectives have been followed by the PROFILES consortium based on the Annex I (Version 1, 2010; Version 2, 2013; Version 3, 2014) (rf. Chap. 3.2.1; cf. PROFILES Annex I - DoW 2010; 2013; 2014) and were finally achieved by the end of the project's live span.

Work package 1 (Leader FUB): Management and Evaluation (see Annex I – Version 3, 2014, 5)

O1.1 Developing a shared strategy of co-operation and support between partners and the European Commission.

O1.2 Mobilising and co-ordinating financial provision throughout the partner network.

O1.3 Creating an interactive international website for the project (for all partners) and a template for the national project homepage of each partner for the establishment of a virtual community for science educators throughout Europe.

O1.4 Planning and networking in collaboration with teachers and stakeholders for conferences and video-conferences.

Work package 2 (Leader UTARTU): Co-operation and professional support (see Annex I – Version 3, 2014, 8)

O2.1 To ensure partner familiarity with the project philosophy and depth of activity developments to be undertaken by the various partners and partner groups.

O2.2 To provide professional project support based on partner needs and diagnostic feedback to guide project partners, during the lifetime of the project.

O2.3 To support strong partner preparations for training, intervention, reflective practitioner development and dissemination/leader functioning related to PROFILES effectiveness by partners against project expectations.

O2.4 To guide professional cohesion and sharing of experiences based on partner operations and developments of best practice related to project goals.

O2.5 To provide recommendations for further developments in the future.

Work package 3 (Leader FUB): Stakeholders involvement and interaction (see Annex I – Version 3, 2014, 12)

O3.1 To solicit stakeholder's views on the purpose and objectives of school science teaching related to an impact on best teaching practice of inquiry based science education within the PROFILES project.

O3.2 To involve stakeholders in reviewing PROFILES best practice strategies based on a reflection model developed in the project.

O3.3 To seek stakeholder reaction to teaching strategies associated with gaining teacher ownership of PROFILES approaches.

O3.4 To seek stakeholder reaction to student outcomes when taught by teachers implementing best practice strategies of the PROFILES project.

Work package 4 (Leader UTARTU): Learning environments (see Annex I – Version 3, 2014, 15)

O4.1 To identify teacher needs and plan accordingly an intervention training programme with school science teacher teams using evidence-based best practice strategies.

O4.2 To create teacher training modules suitable for the promotion of IBSE teaching for enhancing students' scientific literacy.

O4.3 To establish a mechanism for the implementation of the intervention programme for the teacher teams to enable teachers to reflect on their practices and consider alternative best practices.

O4.4 To translate teaching training modules and accompanying teacher modules for use in the local situation.

Work package 5 (Leader WEIZMANN): Teacher training and intervention (see Annex I – Version 3, 2014, 19)

O5.1 To plan a training programme using evidence-based best practice strategies regarding the inquiry approach to science teaching and learning based on teacher identified needs.

O5.2 To establish a mechanism for operationalising a professional development programme in which partners (and lead teachers) will implement strategies from teacher training.

O5.3 To establish a mechanism for the implementation of the intervention programme for the (lead) teachers to reflect on their training in implementing teaching modules.

O5.4 To create a reflective model of best practice among the partners and among the leading teachers.

O5.5 To plan a mechanism for infusing PROFILES training and intervention into pre-service teacher training programmes.

Work package 6 (Leader WEIZMANN): Teacher ownership (see Annex I – Version 3, 2014, 22)

O6.1 To seek meaningful feedback from teachers on their level of self efficacy in IBSE teaching.

O6.2 To identify when a teacher has successfully adopted reflective best practices and exhibits teacher ownership.

O6.3 To identify and carry out mechanisms to disseminate reflective best practice to other teachers and to teacher educators within the country and Europe-wide

O6.4 To guide teachers to plan and carry out action research activities with themselves as the instigator and coordinator.

O6.5 To reflect on outcomes from the action research cycle and encourage further cycles as appropriate .

O6.6 To publish action research outcomes for the benefit of other teachers,

O6.7 To producing case studies of innovative best practice in operation.

Work package 7 (Leader FUB): Student gains (see Annex I – Version 3, 2014, 25)

O7.1 To gain diagnostic feedback from students about their science learning (with special emphasis on the development of scientific inquiry skills) and scientific literacy (with special focus on their scientific related attitudes and prototypes and their interest in learning science in and outside school instruction) taking place from the project.

O7.2 To analyse stakeholder feedback towards the approaches used in teacher training and intervention and towards student learning outcomes participating in PROFILES

O7.3 To provide feedback to participating teachers on outcomes of their teaching.

O7.4 To make recommendations to other teachers how to optimise science teaching and learning.

Work package 8 (Leader Uni-KLU): Dissemination and networking (see Annex I – Version 3, 2014, 28)

O8.1 To develop regular publicity materials on the project and its developments.

O8.2 To disseminate outcomes from stakeholders and from evaluation of innovations and the teacher ownership in the languages of the partners.

O8.3 To encourage partners to publish journal articles at local, European and international levels.

O8.4 To coordinate major presentations at mid and final conferences associated with the project.

O8.5 To coordinate and ensure dissemination of conference papers at a local, European and international level.

O8.6 To publish case studies of evidence-based IBSE in operation derived from partners and make available on the website.

O8.7 To publish regular newsletters for teachers and stakeholders at a local and European level.

O8.8 To initiate teachers' networking models at a school, regional, inter-regional and Europe-wide levels as a dissemination and discussion mechanisms to all stakeholders and beyond.

3 Description of the main S&T results and foregrounds of the PROFILES project

3.1 Regarding Work package 1: Management and Evaluation (Leader: FUB)

Summary of progress towards objectives and tasks as well as significant results of WP1
Within **work package 1 (Management and Evaluation)** the coordinator organized and conducted – supported by the other work packages leaders and in cooperation with all PROFILES partners – the "Kick off Meeting" (MS1.1; D1.1) as well as the "1st (MS1.4; D1.3) and the 2nd PROFILES International Conference" (MS1.5; D1.3). Besides, the coordinator and his team created a structure for the PROFILES International Project Website (MS 1.2; D1.2) which should be used as a template for the creation of the partners' local websites and produced a PROFILES Project Booklet/Flyer template (MS 1.4), which templates build the basis for the adaption and/or development of the respective PROFILES partner's local flyer (D1.2).

A first version of the *PROFILES international website* of the coordinator was activated from the start of the project in December 2010. This website was continuously maintained and kept up-to-date. A second International Website was created by the leader of WP8 (Dissemination and Network), the UNI-KLU team in Austria, as a second source for dissemination. Bit by bit all PROFILES partners followed this practice and developed their local PROFILES website in their national language. Finally, *22 different PROFILES local websites in 17 different languages* consist since the beginning of the project – or in the case of KaU (Sweden), UCPH (Denmark) and ILIAUNI (Georgia) since these partners joint the consortium (see WP8). Thus, 22 different PROFILES websites support the dissemination of the PROFILES intentions, promotes its cooperative actions and foster the distribution of the (evidence-based) outcomes and insights based on the PROFILES activities.

Two *PROFILES International Conferences* and – of course – the so-called "*PROFILES Kick off Meeting*" were organized and realized by the PROFILS Coordinator with support by the other PROFILES Work package Leaders within the PROFILES project life span. More than 280 colleagues and stakeholders (in total) participated in the two PROFILES International Conferences.

Within the framework of the PROFILES International Conferences, *two Books of PROFILES* have been published (Bolte et al., 2012; Bolte & Rauch, 2014). Furthermore, another – *a third Book of PROFILES* (a book on best practice focusing on case studies carried out in the framework of the PROFILES project) was edited and published by the PROFILES work package leaders and the scientific representative of the PROFILES partner ICASE (Bolte et al, 2014).

Regarding the *PROFILES flyers*, all partners adapted the template provided by the coordinator, translated the texts *in the 17 different languages* of the consortium and *disseminated* their flyers *on a local, regional and national levels, and* many of these flyers – especially the general project leaflets in English – was distributed at international conferences *in Europe and worldwide* (see WP8) to keep colleagues and other stakeholder interested in the PROFILES Project in general, on its topics and issues in particular informed (see WP8). More than 20000 PROFILES flyers (~ 13250 printed and < 7100 digital project's flyers) have been distributed by different approaches of dissemination (see WP8).

Worth to mention and not to underestimate is the fact that all partners of the PROFILES Consortium as a whole and especially *the 22 members of the PROFILES Steering Committee experienced how to run such a huge and demanding FP7 funded project like PROFILES and that the partners became familiar with the regulations and procedures of how to realise and/or*

to manage a project funded by the European Commission, for example in the context of the FP7's Science in Society initiative.

Besides, the coordinator assesses the *PROFILES management structure* established in the frame of the project, which was continuously strengthened and followed during the projects' live span, as a significant result. The same can be stated regarding the structure and framework of the PROFILES project as a whole. The PROFILES Project was created as a huge project involving 22 partner institutions from 21 different countries all of them working on the eight different work packages with very demanding tasks and ambitious objectives (see Chapter 2).

3.2 Regarding Work package 2: Partner co-operation and professional support (leader UTARTU)

Summary of progress towards objectives and tasks as well as significant results

WP2 was designed to offer professional support to partners and to reassure partners they had appropriate access to help when needed during the project so as to be confident they were operating in line with the philosophies, directions and standards deemed appropriate for the PROFILES project by the collective expectations of partners and stakeholders. Related to this, an important component was that all aspects of this project were well understood by partners, especially the underlying ideas and approaches embedded within the project and that partners had similar visions with respect to the expectations from the project.

Inevitably, WP2 was an over-riding work package interrelated with all other work packages and providing support and guidance to partners wherever this was needed. In this regard, the leader of WP2 in cooperation with the other WP leaders:

- ensured that all partners were familiar with the project philosophy by means of a power-point presentation, specifying the meaning attached to PROFILES acronym - the 'P' (for "professionalism"), the 'ROF' (for "reflection oriented focus"), the 'IL' (for "Inquiry learning") and the 'ES' (for the "Education through Science" philosophy) the PROFILES activities are based on;
- guided partners to recognize the uniqueness of the "PROFILES 3 stage model", which was building on an earlier FP6 project – called PARSEL;
- sought to support the drive to determine teacher needs (developed under WP4) to consolidate developments under the project philosophy and which could be addressed via Continuous Professional Development (CPD under WP5), based on actual teacher needs questionnaire or other appropriate approaches (e.g. focus group discussion etc.);
- supported steps to guide the adaptation of PARSEL modules (or modules from other sources) so as to derive PROFILES module.

After two rounds of CPD operations, the leader of WP2 developed a special questionnaire (D.2.2 report, appendix 2) which was administered to partners to determine the degree of understanding about the PROFILES uniqueness and philosophy. The questionnaire was also used to find out about the manner in which modules, used by partners, were interpreting the major philosophical PROFILES approach. This was seen as important to promote student involvement and the importance of creative and process skills through experimental work, stressing the need for a scientific question as the starting point and ensuring conceptual science development through interpreting outcomes. The questionnaire also sought partner's comments on the strength and weaknesses of implementing PROFILES as intended.

The leader of WP2, in association with work package leaders, solicited data from partners, related to progress and needs across all PROFILES activities. Additionally, partners who requested support were offered face-to-face contacts within consortium meetings irrespective of their need. Discussions also took place related to partner support during Leaders Steering Meetings in

Israel (March 2011); Lyon (August 2011); Rome (July 2012); Vienna (December 2012; January 2013); Berlin (September 2012; August 2014; March 2015).

Partner cooperation and support was significant at 5 key levels:

1. During the consortium and steering committee meetings, when minutes were recorded and disseminated among the partner.
2. Frequent communication via e-mails and skype calls, based on individual partner needs and, in a form of sub-groups' video conferences.
3. Specific training, discussion and other means of guidance during visits to partners.
4. Support offered during the international conferences (e.g. small group discussions, individual guidance or workshops provided by the WP leaders and other consortium members).
5. Support and guidance offered to prepare articles to PROFILES books, create posters and conference presentations (in cooperation with the other WP leaders, especially the leaders of WP8 and WP1).

Support, in association with other work packages leaders, was undertaking with individual partners during the following international conferences:

- ESERA, in Lyon, Aug 2011 (FUB, LU, UEF, UniHB, MU, CUT, UNIVPM, FUB, WEIZMANN, UTARTU, UNI-KLU, ICASE);
- ICCE in Rome, July, 2012 (LU, UNIVPM, UMCS, ICASE, UTARTU; WEIZMANN; UNI-KLU; FUB);
- ESERA in Cyprus, August 2013 (ICASE, CUT, UEF, MU, KaU, VUT, LU, UCPH, FUB, WEIZMANN, UTARTU UNI-KLU);
- NARST in Puerto Rico, April 2013 (FUB, UTARTU, WEIZMANN UCPH),
- IOSTE in Turkey, November 2014 (DEU, ICASE, VUT, MU, FUB, UTARTU);
- NARST in Pittsburgh, April 2014 (WEIZMANN, UTARTU, UCPH),
- NFSUN (Nordic Research Symposium on Science Education), in Helsinki, June 2014 (FUB, UTARTU, KaU, UCPH, UEF);
- ECRICE in Jyvaskϋla (UTARTU, UEF, KaU, WEIZMANN, MU, VUT, UL, UVa, UMCS, UNIVPM, ICASE);
- NSTA in Chicago (UCC, DEU, UTARTU, ICASE);
- NARST in Chicago (WEIZMANN, FUB, UTARTU, UCPH, ICASE).

Specific training/discussion visits were made to:

- France (Nantes ICASE group), September 2011,
- Dundee, February 2011;
- UL in Slovenia, April 2012;
- UCC in Ireland, February 2013;
- UPORTO in Portugal, October 2013;
- UEF, Finland, in August 2014;
- UNIVPM, Italy, in September 2014;
- UCC, Ireland in October 2014;
- DEU, Turkey in October, 2014 and
- ICASE group in Nantes, France, January 2015.

New partners, joining during the project – KaU, UCPH and ILIAUNI - were visited and workshops were offered by the coordinator (WP1, WP3 and WP/) and WP5 leader. Besides, KaU was visited by the WP4 leader. Furthermore, the partner from ILIAUNI spent 3 months in Berlin at FUB in 2014 to gain experience in finalising PROFILES tasks.

Partner-to-partner visits were encouraged to take place to put into practice IBSE ownership and ongoing dissemination and /or to strengthen PROFILES international networks (for example UL visit to FHNW).

Eight consortium meetings were organised and held in cooperation with the PROFILES Coordinator, other WP Leaders and in some cases with the local host partner. Minutes of meetings were taken by the WP2 leader and the Coordinator, and once approved, circulated among partners with a request to place these on their partner website. The minutes (D2.3) covered:

1st PROFILES Consortium and Steering Committee Meeting in Berlin, December 2010.
2nd PROFILES Consortium and Steering Committee Meeting in Tartu, May 2011 (held in conjunction with a PROFILES 3 day workshop).
3rd PROFILES Consortium and Steering Committee Meeting in Ein Gedi, Israel, February 2012.
4th PROFILES Consortium and Steering Committee Meeting in Berlin, August 2012 (held in conjunction with the PROFILES 1st International Conference).
5th PROFILES Consortium and Steering Committee Meeting in Klagenfurt, Austria April 2013.
6th PROFILES Consortium and Steering Committee Meeting in Porto, Portugal, November 2013.
7th PROFILES Consortium and Steering Committee Meeting in Berlin, August 2014 (held in conjunction with the PROFILES 2nd International Conference).
8th PROFILES Consortium and Steering Committee meeting in Istanbul, Turkey, April 2015 (linked with a EURASIAN IOSTE Symposium within which 14 PROFILES partners disseminated their best practices to a wider audience).

Six skype meetings took place between work-package leaders, focusing on different issues e.g. learning environment (WP4), the dissemination of PROFILES at the 2015 ESERA, and three sub–group video conferences were organised during the last reporting period (D.2.3).

Outcomes of these activities enhanced partners' solidarity and supported partners in fulfilling.

3.3 Regarding Work package 3: Stakeholders involvement and interaction (Leader: FUB)

Summary of progress towards objectives and tasks as well as significant results

Within Work package 3 "Stakeholders involvement and interaction" all PROFILES partners started to involve stakeholders by adapting and translating the template of a "PROFILES Booklet/Flyer" which they then disseminated as a "PROFILES appetiser" among local, regional and national actors (such as science education students at university, trainee science teachers, in-service science teachers, and trainee science teacher educators and the science education research community) via mail, e-mail and the PROFILES International Project website as well as via their local PROFILES websites and printed in the frame of national and international conferences (see also WP1 and WP8 as well as www.profiles-project.eu).

From the beginning of the project, the PROFILES partners continued to involve stakeholders. They discussed purposes and objectives of science teaching and learning in school in general as well as the impact of inquiry based science education in particular - especially the effects of the PROFILES type CPD programs (see WP5), of science teaching and learning based on PROFILES modules and approaches (see WP4) and of the impact these activities had on the development of PROFILES teachers ownership (see also WP6) and on PROFILES students gains (see also WP7).

Besides, the PROFILES partners shared their insights in the PROFILES (Inter-)National Curricular Delphi Study on Science Education (rf. **O3.1**) among the partners and – of course – with a huge number of stakeholders in their country. To remember: For this purpose, the PROFILES Consortium agreed on a shared strategy of how to conduct the PROFILES Curricular Delphi Study on IBSE in each partner's country and especially on the size and composition of the stakeholder sample (app. 100 participants in total) and the specific sub-samples (app. 25 participants per sub-sample). The targeted sample includes different stakeholders that are concerned with science education, such as students, science education students at university, science teachers (including trainee science teachers, in-service science teachers, and trainee science teacher educators), science education researchers and scientists.

All of the partners finished the three rounds of their PROFILES (National) Curricular Delphi Study on IBSE and sent their Interim Reports to the leader of WP3 (FUB; rf. **D3.1, D3.2 and D3.3**). With 22 partners having finished their 'PROFILES National Curricular Delphi Studies on Science Education' in an appropriate and scientifically sound manner, the number of participating stakeholders even surpasses the sum of the targeted 100 stakeholders involved per partner. On the whole, the achievements of the partners' National Curricular Delphi Studies can be considered a very solid basis both for consulting stakeholders in a partner country and for the following "International Curricular Delphi Study" carried out by the leader of WP3 (FUB; rf. **D3.5**).

With 3093 participants in total in the first round of the PROFILES Curricular Delphi Studies, the number of involved stakeholders exceeds the targeted number of 2200 stakeholders (22 x ~100), and the leader of WP3 conducted a meta-analysis based on this wide data base. By means of this meta-analysis it was possible to discover conceptual similarities and differences in the terms "science education" and "scientific literacy" based on sound Europe-wide data source (FUB; rf. **D3.5**). As approximately 3100 stakeholders have given feedback and shared their views on a desirable science education within the (Inter-)National PROFILES Curricular Delphi Study on IBSE, this can be assessed as a remarkable success.

Insightful results were received from the three different rounds of the PROFILES National Curricular Delphi Studies on IBSE, and the significant results can be reported:

Within the first round, insightful statements were collected with respect to how scientifically sound aspects of desirable and modern science education in Europe can be reconstructed from the perspectives of different stakeholders (and stakeholder groups, which are students, teachers, science educators and scientists) in the partners' countries. The results of the PROFILES Curricular Delphi Study's first round indicate considerable overlaps in the collective opinions in the participating countries and served to provide first orientation concerning the development of learning and teaching materials and the preparation of CPD programs for teachers (see WP4 and WP5). More detailed information is also provided in the Interim Reports on the different rounds of the PROFILES Curricular Delphi Study on Science Education of the FUB Working Group (see **D3.1, D3.2** and **D3.3**).

Within the second round, more specific assessments by the stakeholders in the participating countries were collected and more sophisticated and reliable insights were received. Assessments were made both regarding the priority of the different aspects of desirable (inquiry based) science education investigated by means of the PROFILES Delphi Study and regarding their realization in practice. In particular, the results of the second round have revealed which aspects of desirable science education are seen by the stakeholders in the participating countries as most (or less) important and relevant in order to provide educational offers to enhance scientific literacy. Aspects that are seen as most important include, e.g. aspects related to the promotion of students' interests in science, the connection

between science and everyday life and more general skills such as “analysing and drawing conclusions”, “application of knowledge”, “critical assessment”, and “acting responsibly and reflectedly”. Lower priorities are assigned to aspects related to traditional science disciplines and sub-disciplines. The practice assessments show that, contrary to the priorities, mainly aspects of traditional curriculum framework, science disciplines and sub-disciplines and scientific concepts are seen as highly present in science education, whereas many of the highly prioritized aspects are perceived as being less realized in current practice. The results also show which aspects of science education are realized best or (over-)emphasized and, most importantly, which relevant deficiencies in educational practice are to face and to overcome. The results of the second round indicate common tendencies among the partner countries’ science education practice and towards the need for action especially regarding aspects related to enhancing students’ interests in science, the relation between science and everyday life, the implementation of IBSE and other overarching educational goals such as critical assessment, acting reflectively and responsibly, and the application of knowledge can be identified. Taking into account the stakeholders’ views and opinions with regard to the more differentiated assessments provides the opportunity to enhance the development of learning and teaching materials and the preparation of CPD programs for teachers (see WP4 and WP5) on a more specific level. More detailed information is also provided in the Interim Report on the Second Round of the PROFILES Curricular Delphi Study on Science Education of the FUB Working Group (see **D3.2**).

Within the third round, further assessments by the stakeholders were collected in the partners’ countries regarding concepts of desirable science education that were identified in the second round as well. The priority assessments and the estimations of the realization of the concepts in practice, as well as the calculations of priority-practice-differences show notable overlaps among the countries with available Delphi Interim Reports of the 3rd round. First common tendencies point towards a shortfall of the concepts of desirable science education (awareness of the sciences in current, social, globally relevant and occupational contexts relevant in both educational and out-of-school settings, intellectual education in interdisciplinary scientific contexts of general science-related education and facilitation of interest in contexts of nature, everyday life and living environment) especially in the field of secondary education. These results hold out the prospect of further enhancement of project activities within WP4 and WP5 as well as a basis for practice-focused and political consulting from different perspectives. More detailed information is also provided in the Interim Report on the 3rd Round of the PROFILES Curricular Delphi Study on Science Education of the FUB Working Group (see **D3.3**).

Besides these significant results, more notable and scientifically grounded results emerged from the meta-analysis of the PROFILES National Curricular Delphi Studies on IBSE (see **D3.4** and **D3.5**) and are to be reported. In his “Report on the findings obtained from the stakeholders and its implications…” (**D3.4**, 2014, pp. 20-21), the leader of WP3 concludes: “In the context of the “International PROFILES Curricular Delphi Study on Science Education”, issues and aspects of science education that can be considered meaningful and pedagogically desirable for the individual in the society today and in the near future were collected in different countries. Through a systematic analysis of the categories in the PROFILES partners’ classification systems, developed based on their stakeholders’ statements in the first round and the priority and practice assessments of these categories in the second round of the national Delphi studies, it was possible to provide first empirically based insights into “a European perspective on current science education.”

A certain consensus between stakeholders from the participating countries about the aspects that are relevant for science education could be identified. According to the *priority*

assessments, the most important aspects and issues of science education from a European perspective are more general skills and competencies related to scientific thinking and reasoning, such as analysing and interpreting data and observations as well as applied and critical thinking. Furthermore, the high priority value of basic scientific knowledge could imply that these general skills and competencies should and have to be based on and considered in interaction with basic scientific knowledge. In contrast to this, aspects that are most present in European science education [*the stakeholders' practice assessments*] seem to be specific scientific contents and concepts of specific sub-disciplines as prescribed by the national curricula in the partners' countries. This misrepresentation is further illustrated when considering the *priority-practice differences*. While scientific concepts in sub-disciplines show a relatively close match between importance and extent of realization, general skills and competencies related to scientific thinking and reasoning as well as students' motivation are strongly underrepresented in science education practice in Europe. This finding can be related to what is defined by the European Commission (2007, p. 6) as one of the main goals of science education – to equip every young person with the skills necessary to live and work in tomorrow's society, "which rely heavily on technological and scientific advances of increasing complexity".

Besides the PROFILES (Inter-)National Curricular Delphi Studies, the PROFILES partners organized the National Stakeholder Meeting(s) in their countries, and in September 2012 and in August 2014, the two PROFILES International Conferences on IBSE took place in Berlin at FUB. More than 300 stakeholders (in total) from more than 25 different countries attended this conference to discuss and share their views on how to optimize science education practice (see also Chapter 3.1 and Chapter 3.8). Throughout the conference, a strong focus was set on the implementation of inquiry-based science education, and the experiences with PROFILES modules developed according to stakeholders' views and needs in the frame of the PROFILES CPD programs (see WP4 and WP5). More elaborate and detailed information on the discussions and insights of the conference can be found in the two PROFILES Books of invited presenters (Bolte et al., 2012; Bolte & Rauch, 2014). Both books are accessible via the PROFILES websites (see also WP1 and WP8).

3.4 Regarding Work Package 4: Learning environments (Leader: UTARTU)

Summary of progress towards objectives and tasks as well as significant results

One goal of WP4 was to enable partners to adapt or create and implement learning environments (materials for teacher CPD courses and/or modules) for innovative science teaching and learning. These materials and modules should reflect teachers' needs with respect to the intentions of the PROFILES project and enable meaningful teaching and learning of science. Therefore, the development of PROFILES modules formed a major component of the PROFILES CPD programs and guided the partners in their preparation of training materials for use during their CPD program, based on the educational and philosophical approaches of PROFILES, but also addressing PCK needs of teachers (such as assessment (see WP7), goals of education, IBSE and intrinsic motivational issues through relevant-based scenario contexts.

All partners developed at least six PROFILES modules in their own national language. Partners were then guided by the WP4 leader to translate at least two of the modules they created from their national language into English, so that these modules in English could finally appear for dissemination on their own website. The English PROFILES modules on the partners' local website were linked to the main PROFILES project websites for wider dissemination.

In order to research PROFILES teachers' need, an instrument was developed by the leader of WP4. All PROFILES CPD providers used this instrument or approaches to investigate their

teachers' professional oriented needs, so PROFILES modules (developed under WP4) are based on both, on the teachers' needs and on the PROFILES project's philosophy. Finally, the PROFILES modules were put to the test within the framework of WP5 and evaluated by teachers involved in the CPD programs in terms of their ownership of PROFILES ideas (guided by the leaders of WP6) and regarding the students (guided by the leader of WP7) via identification of motivational student gains.

The main results and foregrounds regarding the work carried out within WP4 can be listed as followed:

1. The creation of a diagnostic tool – called the "Teacher Needs Questionnaire" (TNQ) – used to determine teacher's degree of self-efficacy with respect to confidence and competence in eight important science education areas. A number of articles related to TNQ were published by partners, which made possible follow-up usage of the instrument by in-service CPD providers and the science education research-community.
2. Various materials to support PROFILES CPD courses (such as Powerpoint™ slides and handouts, which were used in introducing PROFILES to partners) which were made available to partners.
3. All partners developed teacher training materials (exemplary modules, Powerpoint™ slides, videos etc.) for running their PROFILES CPD sessions (as outlined by the leader of WP4 in deliverable D4.2). Those training materials were made available to teachers on local websites. The success in using such materials in the CPD meetings was reported under WP5 within the CPD operation.
4. Throughout the life span of the project, PROFILES modules and their classroom use became one of the major WP4 outcomes. All partner's websites include modules related to the PROFILES project, the initial source of which is either the PARSEL project (a forerunner of PROFILES) and their local adaptations or creations of own modules developed in the frame of the PROFILES CPD programs in cooperation with the CPD providers. In both cases modifications for local use or adaptations against PROFILES project philosophy were made. But more than expected, partners also created new modules, which were developed either for their CPD programs or as an outcome from the CPD provision. Annex 1 and 2 of D.4.4 show the variety and contextual richness of modules published on partners' websites. Furthermore, to highlight relevance and to enable student participation in deriving the science question(s) to be the driving component of the inquiry foreseen to be carried out during the PROFILES lessons, all modules were based on a 3-stage model and strive to follow three crucial criteria:
   a) a module title or focus which has a society orientation or which focuses on an everyday life situation using words familiar and meaningful to students,
   b) promoting science learning for enlightened and responsible citizenry (e.g. incorporate STL and the PROFILES "Education through Science" philosophy as indicated by the stated specific learning objectives and students' competences), and
   c) covering science concepts and contents for the intended scientific learning by students fostering higher order cognitive learning with special attention to the development of IBSE and experimentation skills.

All modules were designed to encompass at least 3 key sections; namely:

1. a front-page covering the title, abstract, competences and intended subject conceptual learning;
2. student materials focusing on the students' activities or tasks and including an initial student relevant context-based scenario and
3. a teacher guide providing suggested teacher support and guidance in a useful format.

While the number of modules used and / or developed across partners varied (see D4.2), at least 2 modules per partner were made available in English on the local websites. Also, at least 6 modules were placed on the local websites of each partner in the local language. PROFILES modules are available in more than 17 different languages; e.g. Czech, Danish, English, Estonian, Finnish, Georgian, German, Greek, Hebrew, Italian, Latvian, Polish, Portuguese, Romanian, Spanish, Swedish, Turkish (see Appendix 1 and Appendix 2 of D4.4) covering a range of teaching levels.

Altogether, the total number of PROFILES modules published in English is 76. Of these, 15% are intended for use at the primary level (below grade 7), 70% are at the lower secondary level (grades 7-10 – a major PROFILES target as relevance and interest are key PROFILES targets) and 15% are at the upper secondary level (above grade 9/10). In many cases, it is possible to adapt modules for use at different grade levels – often with minor modifications only. Although PROFILES modules are interdisciplinary in many cases, one may see a special or main subject emphasis. From the WP4 leader's viewpoint, 40 % of the modules target chemistry as the main subject conceptual area, 28% biology, 14% general science, 13% physics and 4% have a focus on mathematics within a socio-scientific scenario.

The number of modules created in the local languages is greater than 230 (modules created by English speaking countries not included) and the PROFILES partners still continue to update their websites.

PROFILES modules were disseminated during Europe-wide conferences (e.g. ESERA 2011 and 2013; IOSTE Eurasian symposium 2013 and 2015; ECRICE 2014, NFSUN, 2014, the Dortmund and Bremen Symposia on Science Education 2012 and 2014), and other science teacher meetings such as Association for Science Education (ASE) in the UK 2013 and 2014, and at Scientix 2011 and 2014).

The dissemination of PROFILES modules also took place outside Europe, for example in the USA at NARST 2013, 2014, and 2015 (by UTARTU, FUB, WEIZMANN); in the Asian region, for example: in November 2014, the leader of WP4 UTARTU and ICASE conducted one week workshops twice in Guilin (China) 2013 and 2014 as well as one week in Hong Kong (China) 2014. As part of these workshops, four modules were translated into Chinese. Furthermore, PROFILES workshops were also offered during ICASE World Science Conference in 2013, Malaysia, and in March 2015, an extensive introduction of PROFILES modules took place at NSTA in Chicago (USA), where four PROFILES partners (UTARTU, ICASE, DEU, UCC) presented their work and reported on their PROFILES experiences.

More than 30 articles have been written by partners on PROFILES modules, most of them have been published in PROFILE books whilst seven have been published in internationally reviewed journals and five were published in a German science teachers' magazine. In addition, one PhD thesis related to PROFILES modules was defended in 2013 at UTARTU and another one at UNI-HB. More PhD defences will take place in 2015, all linked with usage of PROFILES modules and ideas (e.g. at FUB).

Looking towards the future from a WP4 perspective, more than eight PROFILES partners submitted and gained acceptance for their proposals to the ESERA conference which takes place at the end of August/beginning of September 2015 in Helsinki. Furthermore and just as examples, in July 2015 the FUB team will hold lectures and conduct workshops based on PROFILES modules and other activities a) in Australia at the CONASTA Conference in Perth and b) in July/August 2015 at the NICE Conference in Tokyo (Japan). Besides, a poster presentation on evaluation of PROFILES modules will be presented at CONASTA 2015 by a staff member of UTARTU who is currently studying for one semester at the University of Perth (Western Australia).

3.5 Regarding Work package 5. Teacher Training and Intervention (Leader: WEIZMANN)

Summary of progress towards objectives and tasks as well as significant results

The main objective of work package 5 (WP5) is to prepare PROFILES teachers for implementing the PROFILES modules in their classroom. To follow this objective, teachers attended PROFILES continuous professional development (CPD) programs in order to increase teachers' (scientific) content knowledge (CK) and their pedagogical content knowledge (PCK), so that they will be able to scaffold their students in acquiring the specific skills needed for teaching PROFILES oriented approaches (e.g. IBSE, decision making, presenting the relevance of socio-scientific issues asking questions, etc.). The CPD programs are based on a specific CPD model (see Figure 3). This model, developed by the WP5 leaders, aims at enhancing teachers' self-efficacy in implementing the various skills, pedagogy, rationale, and philosophy of the PROFILES project. In addition, the PROFILES CPD programs should enable the participating teachers to enhance their content-knowledge and pedagogical-content knowledge related to the various PROFILES oriented modules developed or adopted within the long term CPD programs. Guidance for partners and their respective professional development providers (CPD providers) was conducted during various PROFILES steering committee meetings in the first two years of the project (e.g. at the PROFILES Consortium Meeting in Tallinn/Tartu, May 2011 and in Ein Geddi, Feb. 2012). The partners got familiar with the framework of PROFILES CPDs (see Figure 3) that describes the stages of teachers professional development they undergo during and following the CPD interventions.

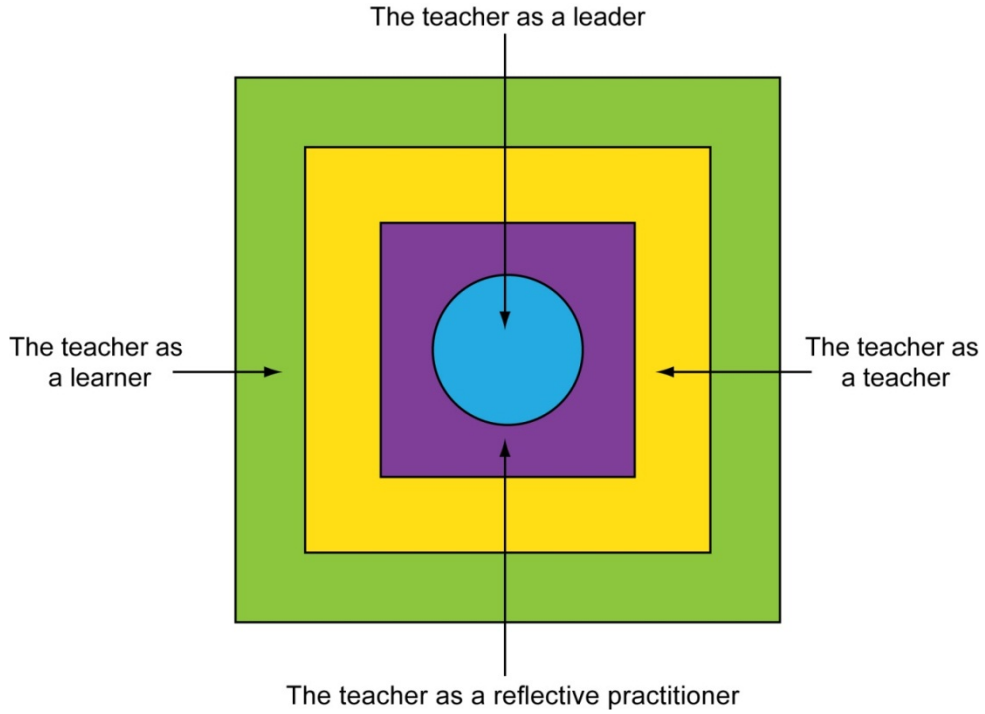

Figure 3: Four Stages of a typical PROFILE teacher's professional development

The main results of the PROFILES CPD programs are the great number of teachers who participated in the PROFILES CPD courses as well as the CPD model(s) for teachers continuous professional development that were tried, evaluated and shaped on the basis of the experiences (feedback) submitted by the PROFILES partners and their CPD providers.

In total, during two (or in some partner countries even three) terms of providing PROFILES long term CPD courses, 1588 teachers underwent one of the PROFILES-based, one-year-long

professional development programs. Each teacher was involved in a minimum of 50 hours of face-to-face and/or on-line pedagogical activities.

Different approaches were used within the PROFILES CPD programs. The most significant approach that was implemented by the PROFILES partners to enhance their teachers' professional development and skills was: *The teacher as curriculum developer*. This is a method and approach in which a group of teachers is intensively and collaboratively involved, during the CPD courses, in the process of developing and implementing curricular materials (such as the PROFILES modules). Based on the data obtained from the 22 partners, the leaders of WP5 reported that during a PROFILES CPD term, more than one method was used to attain the PROFILES CPD goals; namely: the action research technique, the focus groups method and/or the evidence-based CPD approach.

In addition, PROFILES partners requested their teachers involved in the CPD program to provide evidence for the implementation of the modules in the classroom. The source of evidence could be e.g. video vignettes or pictures from their classes when they were learning science the PROFILES way, students' portfolios or posters, analysed questionnaires, or interviews with groups or single students. These sources were assembled in personal or groups' portfolios or e-portfolios (see WP6).

By conducting at least two (or in some cases even more) CPD rounds and by comparing the PROFILES partners' feedback regarding the 1st and the 2nd CPD rounds, the leaders of WP5 were able to report on positive changes in the partners' CPD providers professional behaviours.

In general, the WP5 leaders indicated that (for example):

- In the two (or three) CPD terms there were valid developments and many dissemination initiatives started, but from the 2nd round onwards these activities were much wider and more visible.
- In the 1st term only adapted modules were used as a starting point for one's own curriculum development while in the 2nd term many new modules were developed.
- More dissemination was done in the 2nd (or the 3rd) CPD term.
- The number of 'PROFILES Lead Teachers' increased.
- More and more internal networks were established and strengthened.
- More teachers developed a sense of ownership (some of them got involved in the second and/or third term as CPD providers).
- The sources of evidence to assess the effectiveness of PROFILES based implementations by the teachers in their respective classes increased during the projects life span.

Based on the partners' reports the leaders of WP5 saw clear evidence that, in general, a significant change and improvement between the two CPD terms occurred. The leaders of WP5 suggest that this was due to gaining more experience in the 1st CPD term, involving leading teachers in the 2nd (and/or 3rd) CPD term, as well as to the development of self-efficacy and ownership among the PROFILES teachers and especially among the PROFILES CPD providers.

Based on feedback the leaders of WP5 obtained from partners, using on-line questionnaires, e-mails, and via face-to-face conversations conducted during the various steering committee meetings, the leaders of WP5 are in a position to propose a revised PROFILES CPD Model which can be recommended for the implementation of future PROFILES-type CPD programs (see Figure 4).

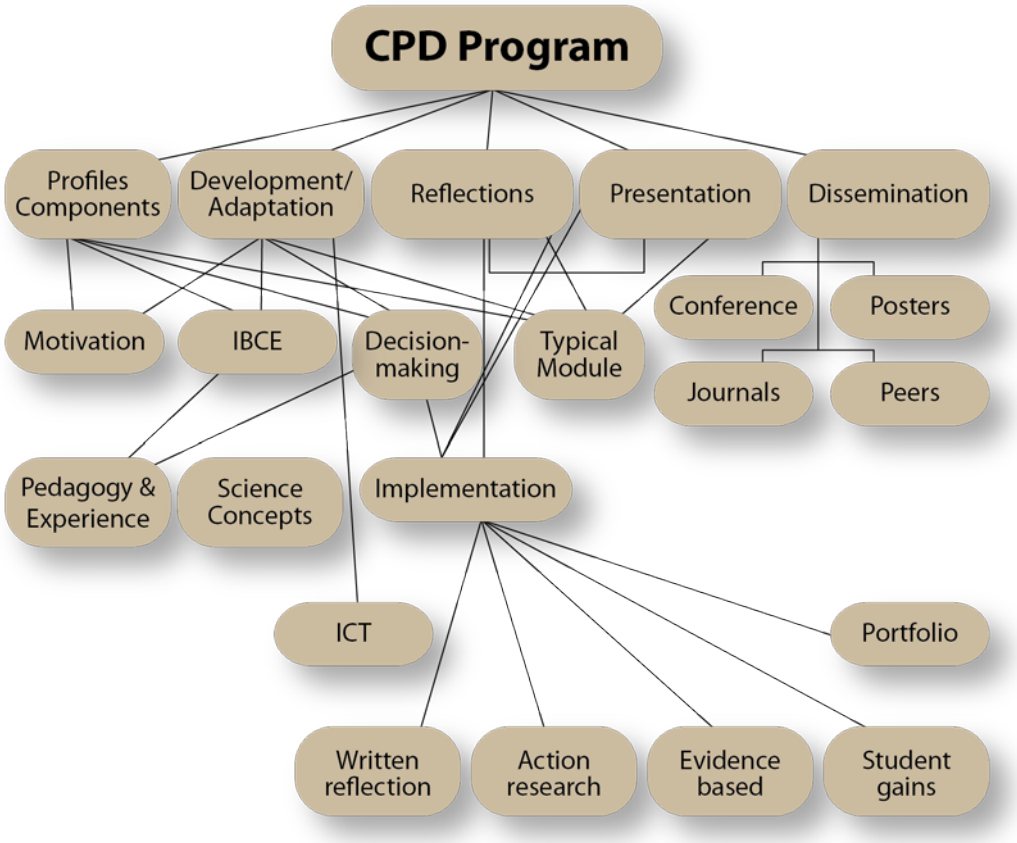

Figure 4: Scheme for an effective PROFILES CPD

To sum up, the PROFILES partners reported on a significant change and improvement between the two (or three) CPD terms in general. It is suggested that this is due to gaining more experience, to involving leading teachers in the 2nd (and/or 3rd) CPD term and to the development of self-efficacy and ownership (see WP6) among the CPD providers and the leading teachers who were involved the PROFILES CPD activities.

3.6 Regarding Work package 6. Teacher ownership (Leader WEIZMANN)

Summary of progress towards objectives and tasks as well as significant results

Work Package 6 (WP6) was mainly concerned with achieving a high(er) level of the teachers' ownership regarding PROFILES and increasing the profession oriented self-efficacy of teachers who underwent a PROFILES CPD program. In the context of PROFILES, developing a sense of teacher ownership regarding PROFIELS means that teachers show a profession-oriented attitude in which PROFILES in its various facets (the project's philosophy, its modules as well as its teaching and learning approaches) has become a part of their professional behaviour and an educational concept they can identify themselves with. The term teachers' self-efficacy represents – in the context of the PROFILES project - the participating teachers' self-assessment of their ability to cope with the goals, pedagogy and content of PROFILES modules; both during the CPD program and also during the implementation of PROFILES in their respective classroom. Furthermore, one of the main goals of WP6 was to study and evaluate how the teachers who participated in the PROFILES CPD programs developed their ownership and enhanced their professional self-efficacy.

Therefore, one of the first tasks of the WP6 leaders was to explain to the partners and their CPD providers the meaning and characteristics of the two theoretical concepts – namely: "teachers'

development of a sense of ownership" and "teachers' self-efficacy" – and to recommend possibilities how to assess and evaluate these in the framework of the PROFILES CPD programs provided by the partners in the context of WP5. To be more concrete: The evidence for the development of self-efficacy and a sense of ownership was obtained via several methods described in detail in the various WP6 deliverables. These methods included: a samples of portfolios and/or e-portfolios provided by the PROFILES teachers, a sample of case-studies regarding a specific teacher and/or a group of teachers (see also PROFILES Book #2: Bolte et al. 2014) and finally the analyses of data collected by means of three questionnaires aiming at assessing the teachers' development of self-efficacy and ownership, taking into account the partners and/or their CPD providers feedback.

Based on different educational and pedagogical theories as well as on the participating teachers' reflective essays on their practice – as one part of the teachers' portfolios/e-portfolios – the leaders of WP6 observed and identified important variables (or categories) that indicate the development of a sense of ownership and self-efficacy, namely:

- Regarding the study of teachers' self-efficacy the variables: Self-efficacy (a) in students engagement, (b) in instructional strategies, (c) in teaching science using the inquiry methods and (d) regarding the PROFILES project initiatives as a whole;
- Regarding the research on the teachers' "stages of concerns" the variables: (a) general concerns and awareness, (b) informational, (c) personal, (d) management, (e) consequences (or gains for the students), (f) collaboration and (g) refocusing, and
- Regarding the teachers' reflective essays on their practice the variables: (a) professional development, (b) promotion of the teacher's image in class and (c) among their colleagues (peers), (d) the teachers' empathy with the PROFILES rationale and objectives, and (e) their willingness of sharing and disseminating PROFILES ideas.

Taking the *teachers' portfolios and e-portfolios as well as the case studies of the partners* into account, the leaders of WP6 observed different levels of ownership which were pointed out to partners and between the 1st and the 2nd CPD terms. In addition it was found that teachers enhanced their professional skills within the PROFILES CPD programs - especially referring to the implementation of the IBSE oriented strategies. The leaders of WP6 found also evidence that the positive experience of the PROFILES teachers in their classes was strongly based on their experiences in the CPD workshops. Another indication for the development of sense of ownership can be seen in the willingness of PROFILES teachers' to continue their involvement in the PROFILES project and in the dissemination of their CPD program's insights and outcomes. Besides, there is evidence that teachers are willing to actively continue their own CPD; for example as participants in follow up workshops, or as leaders and CPD provider who are active and engage in future CPD projects and who then become partners in the local PROFILES team(s). Especially the partners' case-studies provided evidence that teachers want to share their positive experiences with their colleagues (or peers) and want to disseminate the project as a whole, but also the PROFILES modules developed by themselves and in cooperation with other PROFILES teachers during the CPD programs.

Besides these significant results based on the qualitative studies of the WP6 leaders, empirically sound and statistically based approaches were used in order to assess and evaluate the PROFILES teachers' development of ownership and of their self-efficacy in teaching PROFILES based science lessons.

For example: In order to study *the development of pre-service science teacher's sense of ownership*, a working group of the FUB team used an educational theory originally developed in the USA by Hall and Hord titled Teachers' "Stages of Concerns" (SoC), and adapted a questionnaire based on this construct. The theoretical construct and the questionnaire based on it, focus on eight different stages of concerns the teachers are dealing with.

The SoC Theory and the questionnaire adapted and tested by Bolte and Schneider (2012; 2014) proved to be scientifically sound and helpful in order to assess and evaluate pre-service science teachers' professional development. In the framework of their studies, Bolte and Schneider were able to show – based on empirical evidence – that student teachers who undertook one of the various CPD programs the FUB team provided, developed their professional attitudes in a positive manner. The pre-service teachers who participated in this CPD program of the FUB (which served in the FUB framework as a treatment sample group) described themselves – compared to a sample of students teacher without any PROFILES experiences who served as a control-group – as more open minded regarding IBSE. Furthermore, the FUB team was able to underline by evidence that - regarding the pre-post-test comparison of the treatment-group (the PROFILES teacher students') data - the participating PROFILES teacher students were positively affected by this PROFILES CPD program (see Figure 5).

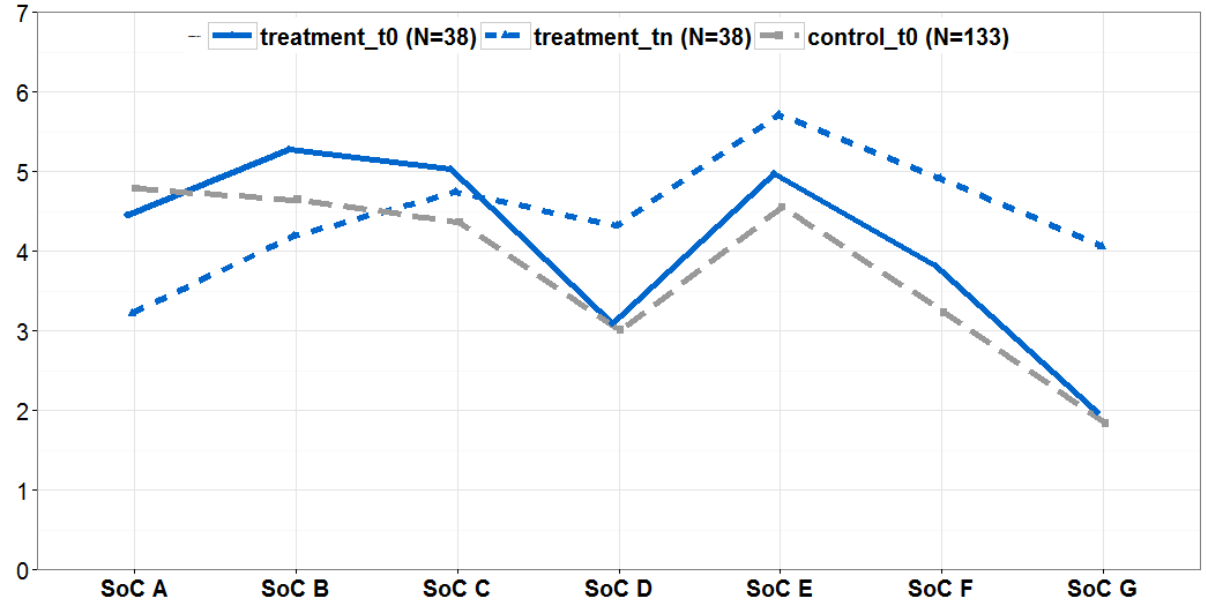

Figure 5: Graphical results of the SoC in Berlin (FUB)

The SoC-questionnaire and the design for the evaluation of teachers' ownership introduced by the FUB team were adapted by the PROFILES team at ILIAUNI (in Georgia). In cooperation with the FUB team, the PROFILES group at ILIAUNI administered the SoC instrument to study their PROFILES CPD treatment developed for Georgian in-service science teachers. In this case, the working group at ILIAUNI and FUB was able to show the positive impact of the Georgian PROFILES CPD program for in-service teachers.

Thus it can be concluded that the SoC-questionnaires proved to be useful for the evaluation of CPD programs – such as the PROFILES CPD courses – for pre- and in-service (science) teachers. The studies and the results of the studies – only touched upon here – have been presented at various conferences and are published already both in the Books of PROFILES and in other conference proceedings as well as in science education journals.

For the purpose of *assessing the teachers' self-efficacy*, the leaders of WP6 developed and implemented a specific questionnaire. This questionnaire consists of four categories (and 20 items in total, which have to be assessed on a 1-9 point-rating-scale. The questionnaire, its related categories and the items were validated regarding their content by the leaders of WP6 and their lead teachers**.**

This questionnaire was used by many partners (see Figure 6) and administered to their CPD teachers only once towards the end of the 2nd CPD term. The results of the data analyses are presented in Figure 6. The results shown illustrate that the level of the teachers' self-efficacy regarding the four categories is higher than the theoretical mean score (median). Mean scores of the teachers' self-efficacy assessments which are higher than 4.5 express that these teachers assess themselves as able to fulfil their professional tasks and expectations in a positive manner.

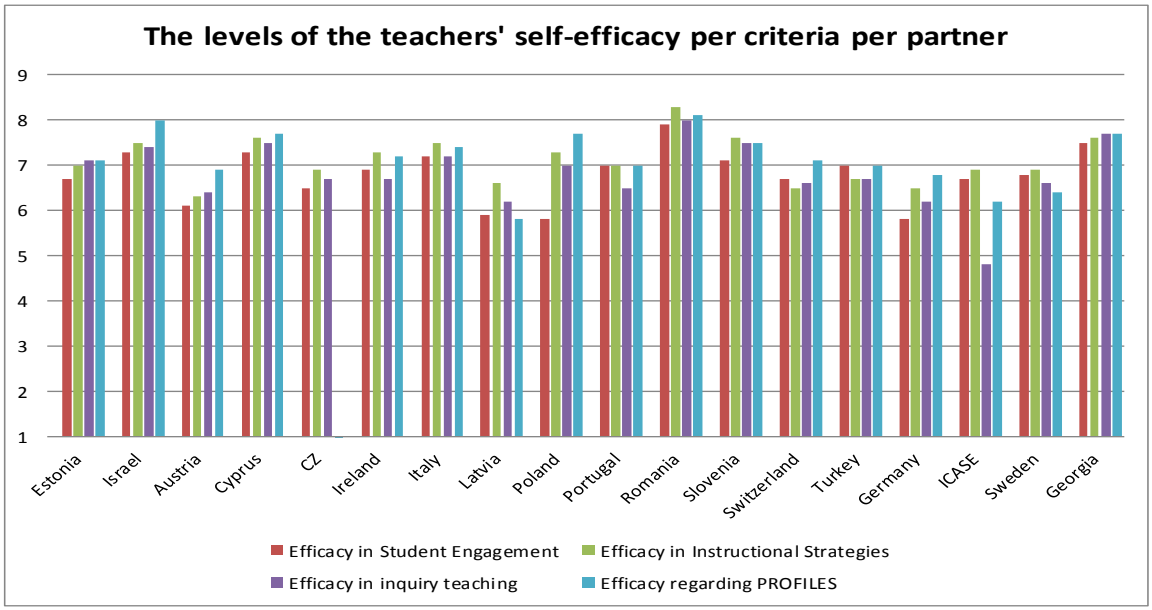

Figure 6. Averages in the four self-efficacy criteria

A 3rd method to assess teachers' professional development effected by a PROFILES CPD program was introduced by the team of UCPH in Denmark. This partner used the STEBI questionnaire which consists of two scales of which one assesses self-efficacy. The partners at UCPH found out that their teachers' self-efficacy was enhanced by being involved in the PROFILES CPD program adapted by their CPD providers.

The results of the studies conducted in the framework of WP6 provided evidence for the effectiveness of the CPD models and programs used by the partners. Clearly, the two main CPD strategies, namely the development of an innovation and its implementation in the classroom, complement each other and provide a significant platform for teachers' personal development. Furthermore, it can be stated that all PROFILES CPD programs which have been evaluated had a significant impact on the participating teachers. Although not all PROFILES teachers developed the highest level of ownership – which would apply to teachers who became a "PROFILES lead teacher" – the PROFILES partners are convinced that a reasonable number attained this level. The PROFILES consortium is sure that this would not be the case if PROFILES had conducted only short-term teacher training workshops (e.g. lasting only one afternoon or only a full day) instead of the long-term PROFILES CPD programs lasting at least 40 hours over a period of one academic year. Furthermore, another key for success can be seen in the framework of the various PROFILES CPD programs which focused strongly on the participating teachers' professional needs and which were based on innovative approaches to optimize science education and to enhance students' science learning as well as their scientific literacy.

3.7 Regarding Work package 7: Student Gains (Leader: FUB)

Summary of progress towards objectives and tasks as well as significant results

In the framework of the PROFILES project, the leader of the PROFILES WP7 (Student gains) adapted assessment instruments that relate to cognitive, meta-cognitive, inquiry learning, problem solving, decision-making as well as variables to evaluate students' (intrinsic) motivation to learn science. These assessment instruments have been discussed with the partners at several consortium and steering committee meetings. The discussion led finally to the partners' decision to use at least the so called "MoLE" instrument in its REAL- and IDEAL-Version. In order to "Evaluate (PROFILES) Students' Gains" in a proper and scientifically sophisticated manner, the leader of WP7 introduced approaches for data collection and analysis. As a result of this, the consortium further agreed to conduct the MoLE questionnaires before and after a PROFILES intervention ("pre-post-data collection") or alternatively to poll students after a respective PROFILES intervention ("treatment group sample") and to compare these data with the data collected of students comparable to the PROFILES students ("control group sample").

The fact that the PROFILES Steering Committee agreed to focus on one theoretical framework for the students' gains evaluation and on one (main) approach (a pre-post-test design) to analyse the (PROFILES) students' gains can be assessed as a first significant success. As a result of this, the PROFILES Project provides a very well and broadly tested instrument for the analysis of students' gains in general and for the evaluation (of the development) of students' (intrinsic) motivation to learn science in particular; namely the "MoLE Instrument" developed and introduced by the leader of WP7 (see D7.4).

In the framework of the PROFILES Project studies, the scientific value of this instrument was tested in 20 different countries and based on a data source of 28463 (23788 PROFILES and 4675 non-PROFILES) students from 1364 different classes (1141 PROFILES and 223 non-PROFILES classes) as fed back by the 21 (of 22[1]) PROFILES partners involved in this work package (see D7.2 and Table 1).

This leads to the next significant result of the work carried out by the PROFILES partners in WP7, because the MoLE instrument is now available – not only translated but also tested on a broad empirical base – in more than 17 different languages (e.g. in Czech, Danish, English, Estonian, Finnish, Georgian, German, Greek, Hebrew, Italian, Latvian, Polish, Portuguese, Romanian, Spanish, Swedish, Turkish; see also D7.1).

Additionally, the leader of WP7 received different reports on "PROFILES Students' Gains Evaluation" from the 21 PROFILED partners involved in this work package. These reports are based on the analyses of their students' assessments regarding the motivational learning environments in the PROFILES and (non-)PROFILES science lessons, which were analysed at least from three different viewpoints or focussing on three different (sub-)samples.

These reports of the PROFILES partners' "Students' Gains Evaluation" build the basis for the narrative meta-analysis carried out by the leader of WP7 (FUB).[2]

As agreed in the PROFILES Annex I (DoW, 2010; 2014), the PROFILES consortium expected to collect data of (21 x ~1000 students) for the PROFILES Students' Gains Evaluation. Focussing on the total number of students involved in the PROFLES Students' Gains

[1] Only one of the 22 PROFILES partners (Partner #22: ICASE) was not involved in WP7 (see PROFILES DoW, 2010; 2014).

[2] An empirically based meta-analysis on the students gains data collected by the partners is currently in progress. Results from this statistic oriented research is expected to receive till December 2015. Of course, these results and findings will be presented at various science education conferences and published in science education journal.

Evaluation as a whole, the leader of WP7 is able to report that the PROFILES consortium did fulfil this task. With more than 28000 students involved in the PROFILES Students' Gains evaluation, the number of expected students was even exceeded.

Table 1. Sample of the PROFILES Students' Gains Evaluation (Staus Quo: 3rd Feb. 2015; D7.2)[3]

Partner	**PROFILES teachers**	**PROFILES classes**	**PROFILES students**	*Non-PROFILES classes*	*Non-PROFILES students*	No. of classes	No. of students
FUB	36	53	1177	*0*	*0*	53	1177
UTARTU	55	49	1057	*0*	*0*	49	1057
WEIZMANN	*58*	*58*	*1155*	*0*	*0*	*58*	*1155*
UNI-KLU	52	64	793	*0*	*50*	64	843
CUT	71	108	1755	*2*	*33*	110	1788
MU	52	56	1008	*50*	*783*	106	1791
UEF	29	58	1032	*0*	*0*	58	1032
UCC	47	77	1326	*0*	*0*	77	1326
UNIVPM	30	115	2393	*7*	*137*	122	2530
LU	60	67	1136	*19*	*332*	86	1468
UMCS	32	3	637	*3*	*462*	6	1099
UPORTO	38	0	653	*0*	*0*	0	653
VUT	87	97	2160	*31*	*662*	128	2822
UL	59	62	1194	*46*	*931*	108	2125
Uva	0	0	901	*0*	*0*	0	901
FHNW	32	37	846	*2*	*40*	39	886
DEU	70	65	1075	*0*	*0*	65	1075
UniHB	24	33	744	*0*	*0*	33	744
KaU	42	51	786	*0*	*0*	51	786
UCPH	15	18	490	*10*	*204*	28	694
ILIAUNI	40	70	1470	*53*	*1041*	123	2511
Σ	929	1.141	23.788	223	4.675	1.364	28.463

In deliverable D7.4 the leader of WP7 provided the conclusion(s) of the respective PROFILES partners' "Students' Gains Evaluation" report which focus on the analyses of the partners' total sample of PROFILES students. The 21 students' gains evaluation reports of PROFILES partners involved in this work package are available via the PROFILES (protected) website.

The meta-analyses of the partners' students' gains evaluation reports carried out by the leader of WP7 and his team lead to the overall conclusion that the PROFILES interventions conducted in the partners' countries by the PROILFES CPD teachers using PROFILES modules and/or PROFILES IBSE oriented teaching approaches lead to success. Either the pre-post-test analyses or the results of treatment-control-group comparisons prove the advantages of the PROFILES teaching and learning approaches compared to regular science lessons. The findings of the PROFILES partners regarding their students' gains evaluation are based on empirical evidence, and the results of this study comply with the standards of science education research (D7.4).

[3] If deviations between the numbers in this table of the partners' students' gains report(s) occur, then these deviations do occur because partners selected data sets of low quality or partners collected further data in the meantime (between 3rd February and 30th April 2015).

Therefore, the results of the PROFILES Students' Gains Evaluation (D7.4) can be assessed as being of great importance for science education, especially in the respective partner country but also beyond. The PROFILES consortium is convinced that the findings of the PROFILES students' gains evaluation will impact on both the development of future pre-service and in-service science teachers CPD programs (see WP5) and the improvement of science education practice in formal and informal learning settings. The insights the PROFILES teachers received from the analyses of their students' assessment regarding the motivational learning environment in their (PROFILES) science classrooms may also impact the development of teachers sense of ownership because the analyses show – in almost all cases – that PROFILES oriented science teaching leads to an increase of the students' intrinsic motivation to learn science and to better appreciate their science lessons.

3.8 Regarding Work package 8: Dissemination and networking (Leader: UNI-KLU)

Summary of progress towards objectives and tasks as well as significant results

The leader of WP8 supported the project partners in setting up and maintaining their local **websites**, providing news and information about the project and its outcomes, teaching materials, posters, research results, presentations and further materials. Furthermore, the PROFILES local website of Austria (WP8 leader) as well as the PROFILES International website offer access to the PROFILES teaching modules adapted or developed by the partners (see WP4) (see Table 2).

By April 2015, approx. 13240 printed and 7100 digital **project flyers** have been distributed by all partners (O8.1). The flyers can be accessed under the links provided in Table 2.

From August 2011 until July 2014 six **PROFILES Newsletters** were published in English and German by WP8 – assisted by the PROFILES partners – and forwarded to all partner institutions (O8.7, see D8.3). The newsletters include contributions from PROFILES partners about modules and activities, experiences and project outcomes. Additionally, each newsletter contains reports on meetings and an outlook to future conferences. The international and local newsletters can be accessed under the links provided in Table 2.

From 2012 to 2014 the leaders of WP8 and WP1 published in cooperation with the other work package leaders **three "PROFILES Books"** consisting contributions of all PROFILES partner institutions (see also Chapter 3.1):

Bolte, C., Holbrook, J., & Rauch, F. (Eds.). (2012). *Inquiry-based Science Education in Europe: Reflections from the PROFILES Project.* Berlin: Freie Universität Berlin (Germany) / Klagenfurt: Alpen-Adria-Universität Klagenfurt (Austria). ISBN 978-3-00-039403-4

Bolte, C., Holbrook, J., Mamlok-Naaman, R., & Rauch, F. (Eds.). (2014). *Science Teachers' Continuous Professional Development in Europe: Case studies from the PROFILES project.* Berlin: Freie Universität Berlin (Germany) / Klagenfurt: Alpen-Adria-Universität Klagenfurt (Austria). ISBN: 978-3-9816683-0-8

Bolte, C., & Rauch, F. (Eds.). (2014). *Enhancing Inquiry-based Science Education and Teachers' Continuous Professional Development in Europe: Insights and reflections on the PROFILES Project and other Projects funded by the European Commission.* Berlin: Freie Universität Berlin (Germany) / Klagenfurt: Alpen-Adria-Universität Klagenfurt (Austria). ISBN: 978-3-9816683-1-5

Table 2. PROFILES websites, flyers and newsletters

Partners' National PROFILES websites	PROFILES Flyers	PROFILES Newsletters (numbers)
Freie Universität Berlin (FUB) – Germany (Coordination)	International PROFILES Website http://www.profiles-project.eu/res/Flyer_partners/PROFILES-Flyer_FUB-dt-11-05-03.pdf?1327580786	http://www.profiles-project.eu/Dissemination/PROFILES_Newsletters/index.html (6) http://www.profiles-project.eu/de/Newsletters/index.html (6)
University of Tartu (UTARTU) – Estonia	http://www.lote.ee/profiles/wp-content/uploads/2013/12/Flyer-Estonian.pdf	http://www.lote.ee/profiles/?page_id=108 (6)
Weizmann Institute of Science (WEIZMANN) – Israel	http://www.profiles-project.eu/res/Flyer_partners/Israel_Profiles_Prospect_12-4-12.pdf?1334825788	http://stwww.weizmann.ac.il/g-chem/profiles/newsletter.html (6)
Alpen-Adria-Universität Klagenfurt (UNI-KLU) – Austria	http://www.profiles-project.eu/res/Flyer_partners/PROFILES_Flyer_UNIKLU_neu-2.pdf?1336638609	https://ius.uni-klu.ac.at/misc/profiles/articles/view/31 (6)
Cyprus University of Technology (CUT) – Cyprus	http://www.profiles-project.eu/res/Flyer_partners/Cyprus_PROFILES_flyer_May2011_GR.pdf?1327580828	http://www.cut.ac.cy/profiles/newsletters.html (9)
Masaryk University Brno (MU) – Czech Rep.	http://www.profiles-project.eu/res/Flyer_partners/Czech_flyer.pdf?1327580824	http://profiles.ped.muni.cz/aktuality.php (6)
University of Eastern Finland (UEF) – Finland	http://www.profiles-project.eu/res/Flyer_partners/Finland_profiles_flyer_in_Finnish.pdf?1327580820	http://www.uef.fi/fi/profiles/in-english (6)
University College Cork (UCC) – Ireland	http://www.profiles-project.eu/res/Flyer_partners/Ireland_PROFILES_flyer_1-2_001.pdf?1327583688	http://chemweb.ucc.ie/Pro2/Publications.htm (6)
University of Universita Politecnica delle Marche (UNIVPM) – Italy	http://www.profiles.univpm.it/node/10	http://www.profiles.univpm.it/node/11 (7)
University of Latvia (LU) – Latvia	http://www.profiles-project.eu/res/Flyer_partners/Latvia_10-11-12-en_Flyer2a-Arial_LV1.pdf?1327580799	http://www.profiles.lu.lv/materiali/ (6)
University of Maria Curie-Sklodowska (UMCS) – Poland	http://phavi.portal.umcs.pl/at/attachments/2014/0702/114642-fleyer.pdf	http://www.umcs.pl/pl/projekt-profiles,5413.htm#page-5 (6)
University of Porto (UPORTO) – Portugal	http://www.profiles.org.pt/?page_id=10	http://www.profiles.org.pt/?cat=3 (6)
Valahia University Targoviste (VUT) – Romania	http://www.profiles-project.eu/res/Flyer_partners/Romania_Leaflet_PROFILES_VUT_RO_June_2011.pdf?1327580782	http://profiles.ssai.valahia.ro/pg/expages/read/Diseminare/ (8)
University of Ljubljana (UL) – Slovenia	http://www.profiles-project.eu/res/Flyer_partners/Slovenian_flyer_PROFILES_Letak_1_SLO_2_new.pdf?1334579920	http://www2.pef.uni-lj.si/kemija/profiles/glasilo.html (6)
University of Vallalodid (UVa) – Spain	http://www.profiles-project.eu/res/Flyer_partners/Spain_PROFILES-Flyer_for-all-en-12-01-13_espa__ol.pdf?1327580769	http://www.profiles.uva.es/documents.html (6)
University of Applied Sciences Northwestern Switzerland (FHNW) – Switzerland	http://blogs.fhnw.ch/profiles/files/2011/11/PROFILES-Schweiz.pdf	http://blogs.fhnw.ch/profiles/profiles-newsletter/ (6)
Dokuz Eylul University (DEU) – Turkey	http://www.profiles-project.eu/res/Flyer_partners/Turkey_Flyer_Turkishson.pdf?1327580761	http://www.icaseonline.net/deu-profiles/newsletters/ (6)
Karlstadt University (KAU) – Sweden	http://www.profiles-project.eu/res/Flyer_partners/Flyer_KaU_Swe_20120229-1.doc?1330506759	https://www.itslearning.com/kau/profiles/news/ (6)
University of Bremen (UniHB) – Germany	http://www.chemiedidaktik.uni-bremen.de/profiles/index.php?option=com_content&view=article&id=111&Itemid=118	http://www.chemiedidaktik.uni-bremen.de/profiles/index.php?option=com_content&view=article&id=111&Itemid=118 (6)
International Council of Associations for Science Education (ICASE) – UK	http://www.icaseonline.net/profiles/wp-content/uploads/2013/06/flyer.pdf	http://icaseonline.net/profiles/dissemination/newsletters/ (6)
Ilia State University (ILIA UNI) – Georgia	http://profiles-georgia.iliauni.edu.ge/images/PROFILES_Flyer.pdf	http://profiles-georgia.iliauni.edu.ge/index.php (6)
University of Copenhagen (UCPH) – Denmark	http://www.ind.ku.dk/profiles/materialer/ProfilesFlyerDanish-frit_oversat.pdf	http://www.ind.ku.dk/profiles/nyhedsbreve/ (6)

The PROFILES Books #1 and #3 are books of invited presentations of the two International PROFILES conferences that were held in 2012 and 2014 in Berlin (O8.4, see D8.5 and D8.7 and/or Chapter 3.1). The PROFILES Book #3 is the book of PROFILES best practice (O8.6, see D8.6) and includes evidence-based case studies of PROFILES partners, focusing on the four areas of the involvement of stakeholders, namely on PROFILES Curricular Delphi Studies, the PROFILES modules, PROFILES CPD programmes and their impact on teachers ownership as well as on PROFILES networking. The three PROFILES Books are published as paperback but can also be accessed under the PROFILES International Websites for download via (a) the Coordinator's website:
http://www.profiles-project.eu/Dissemination/PROFILES_Book/index.html
and (b) the Austrian PROIFLES website of the WP8 leader:
http://ius.uni-klu.ac.at/misc/profiles/articles/view/31.

To disseminate the project in general, its aims, outcomes and products to the scientific community, the leader of WP8 encouraged partners in conducting **presentations** at various national and international conferences (O8.2) and to **publish journal articles** at local, European and international levels (O8.3 and O8.5). PROFILES partners published approx. 265 articles, of which 40 were published in peer reviewed journals. Furthermore, two PROFILES special Issues were published by the partners of ICASE and UL in Slovenia: *CEPS Journal*, Volume 4, N°1, 2014 and *Science Education International*, Volume 25, Issue 2, Special Issue, 2014. Besides, the most popular teacher journal in Germany – the *MNU Journal* [MNU: Der mathematische und naturwissenschaftliche Unterricht (in English: Lessons in Mathematic and Science)] was mainly dedicated to feature the PROFILES project activities. In 9 different articles of this journal PROFILES partners from nine different institutions report about their various project activities (see MNU, Volume 67, Issue 6, 2014 (ISSN 0025-5866).

Another objective of PROFILES in general and WP8 in particular is the establishment of a PROFILES **teachers' network** (O8.8, see D8.8), which is interrelated to other teachers' networks operating on a local, regional, national or Europe-wide scale. The leader of WP8 supported and advised partners in the establishment of PROFILES networks in their countries.

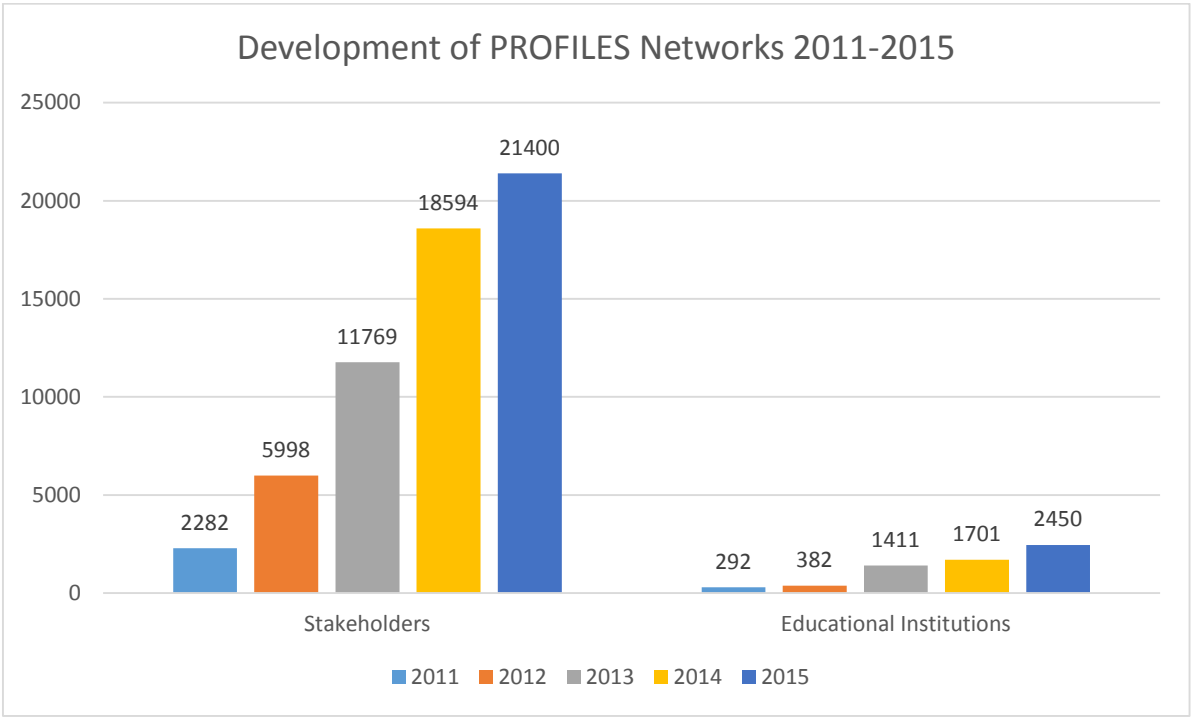

Figure 7: List of PROFILES Network data from 2011-2015

Over the years partners extended their PROFILES Networks significantly by including more and more stakeholders (teachers, teacher educators, representatives of ministries) and institutions (e.g. schools, publishers and NGO's, etc.). By April 2015, PROFILES networks (in connection with other Science education networks) include approx. 21400 stakeholders and approx. 2450 educational institutions in all PROFILES partner countries (see Figure 7). Furthermore, various PROFILES partners involve also (approx. 160) non-educational institutions.

At the end of the PROFILES Project the leader of WP8 can conclude that the various means of dissemination:

- 22 local websites,
- 13240 printed and 7100 digital project flyers
- at least 6 local newsletters per partner,
- 3 PROFILES books,
- 265 publications,
- 842 presentations and other dissemination activities (workshops, flyers, etc.)
- 22 local teacher networks including approx. 21400 stakeholders

were a suitable approach to widely disseminate the project in general and its philosophy, objectives and outcomes in particular at local, national and international level.

4 Potential impact of the PROFILES project (including the socio-economic impact and the wider societal implications of the project so far) and the main dissemination activities and exploitation of results

4.1 (Potential) Impact of the PROFILES project activities within WP1: Management and Evaluation, its main dissemination and exploitation of results

The PROFILES project was created - concerning the number of partners to be involved and the foreseen life span - as a huge and, regarding its objectives, aims and tasks, as a (very) demanding and ambitious project. The same can be stated regarding the management and evaluation (WP1) of the PROFILES project.

Therefore (and as mentioned already in Chapter 3 of this report), a commendable impact of the PROFILES project activities is that the 22 partners of the PROFILES Consortium became familiar with procedures of how to apply for funds (for example in the framework of the future Horizon 2020 calls) and of how to create a proposal for a project such as PROFILES. In this context the partners experienced also the regulations of the European Commission on how to coordinate and manage a project such as PROFILES. In the frame of the PROFILES project the partners also experienced how to cooperate within such a huge consortium, how to support the other project partners and how to create reports on the work to be delivered to the leaders of the different work packages and the coordinator.

It is difficult to assess the impact of the dissemination activities initiated within WP1 (e.g. the creation of the International and Local PROFILES website(s) or the dissemination of the PROFILES booklets/flyers). Also difficult to assess is the impact of the two PROFILES International Conferences on an evidence-based foundation because the initiators of the PROFILES project unfortunately did not plan a systematically based evaluation of the conferences' attendees. Nevertheless, even if we failed to ask the PROFILES Conference attendees for feedback (in a scientific and systematic manner), it is admissible to reflect on the 'learning and cooperative atmosphere' the participants of the PROFILES Conferences experienced. Based on this, we can conclude that the two PROFILES International Conferences have been a big success. Especially the "Science Education Fair", which was created and conducted by the PROFILES teachers, can be assessed as very successful because of the very vivid and inspiring discussions which took place among the teachers and the other stakeholders and because of exchange of different experiences, PROFILES modules, and ideas for innovative science teaching and learning among the participants. Moreover, PROFILES teachers presented the work they had carried out within their PROFILES CPD and convinced other colleagues to reflect on their work and maybe to follow the lesson plans and PROFILES modules they provided. Furthermore, while observing the professional discussion and the interaction among the colleagues it could also be seen that these teachers developed a high(er) level of ownership and that these engaged teachers can be assessed as "PROFILES Lead Teachers" (see also Chapter 4.6 regarding PROFILES Teachers Ownership).

Another criterion for the assessment of the (potential) impact of the PROFILES project activities are the three books published in the framework of PROFILES. These Books of PROFILES have been published in English (Bolte et. al, 2012; 2014, Bolte & Rauch, 2014) and disseminated as hard copies (200 per edition). Besides, the Books of PROFILES are also available – on open access – for download from the PROFILES International and Local website(s).

Besides, the PROFILES team at FUB – namely the teachers and CPD providers of one of the FUB PROFILES CPD programs – created another "Book of PROFILES", which consists these PROFILES lead teachers' interpretation of PROFILES based Learning Environments (Streller

& Erb, 2014). The title of this book is “Es wa(h)r einmal” … [in English: Once upon a time – Fairy Tales in Science Lessons]. The initiative to write a book on the teachers’ experiences and their creative and innovative work in the frame of their PROFILES CPD courses came from the participating teachers themselves. First, they sent a proposal to present their work and the modules they created at a national teacher competition called “Science on Stage (Germany)” in Berlin 2011. At this event the teachers presented with great success their work they had created in the PROFILES CPD. This event and the feedback the PROFILES teachers received from the participating teachers was so promising that they also applied to present the PROFILES “Fairy Tale Modules“ at the “International Science on Stage“ convention in Lublin (2012). As the PROFILES teachers succeeded, they were invited to present their work at this international conference – also with big success. On the way back from this conference the idea of writing the “Fairy Tale Book” was born. Since then, a reasonable number of invitations to disseminate this work reached these teachers, and the teachers (in cooperation with their CPD provider) followed these invitations in order to disseminate their work and the outcome of this PROFLES CPD program. Something like this can be reported for a group of PROFILES teachers from Cyprus who also attended – with great success – the National and International “Science on Stage“ convention(s).

Furthermore it is worth mentioning that within the PROFILES project various candidates started and/or almost finished their PhD theses, which are based on the philosophy and theoretical background of the PROFILES project (e.g. at FUB, UTARTU, UEF and UNI-HB). All these PhD theses will be published acknowledging the support of the EC (FP7 program) in general and the PROFILES Project in particular and will increase the impact of PROFILES.

4.2 (Potential) Impact of the PROFILES project activities within WP2: Cooperation and Support, its main dissemination and exploitation of results

The intended and actual impact of WP2 was to draw attention to problems and issues faced by partners and to seek mechanisms to address these issues with other work package leaders. As mentioned in Chapter 3.2, WP2 was expected to impact on the work of all other work packages, and hence dissemination was related to interactions with other WP leaders and all partners.

In some cases a delay in the flow of information had a negative impact on the operation of other work packages. In particular, this caused greater expenditure of time for work package leaders, as additional conversations and contacts were necessary. Because of the frequently convened consortium and steering committee meetings and the extensive support of the partners by all WP leaders, for example by conducting workshops or round tables at meetings or by e-mail exchange, phone and skype conversations, it was possible to conserve resources of the other partners while ensuring the progress of the project.

4.3 (Potential) Impact of the PROFILES project activities within WP3: Stakeholders Involvement and Interaction, its main dissemination and exploitation of results

As related in Chapter 3.3, all partners conducted and finally completed their *National PROFILES Curricular Delphi Studies on Science Education* and submitted their reports. The data of the partners yielded a solid basis for making sound analyses and providing meaningful insights to enhance other PROFILES project activities carried out especially in WP4 and WP5. For example the results from the PROFILES National Curricular Delphi Study – and especially the *calculation of the priority-practice-differences* – served as a meaningful basis for the development and/or adaptation of PROFILES Learning Environments (rf. WP4) as well as for the planning and realisation of the PROFILES teachers’ continuous professional development (CPD) programs (rf. WP5). Furthermore, the results and the insights received from the analyses of the PROFILES Curricular Delphi Studies did and will surely impact science education

practice in the PROFILES partners' countries: As reported in Chapter 3.3, many PROFILES teachers have reached a higher level of teacher ownership and professionalization within PROFILES CPD courses (see WP6). Since these teacher became familiar with the results of the PROFILES Delphi Study they were positively influenced by the insights they gained through the PROFILES Delphi Studies results. The results from the national Delphi Studies – especially the calculation of the priority-assessments of stakeholders – serve as valuable landmarks and offer the teachers orientation for planning their science lessons in a contemporary manner. The same can be stated for the results of the Delphi-Reports meta-analysis. In this case the PROFILES partners, their teachers and stakeholders became aware how – from a European perspective – current science education practice should be planned and realized.

In the context of the "*International PROFILES Curricular Delphi Study on Science Education*", issues and aspects of science education that are considered meaningful and pedagogically desirable for the individual in the society today and in the near future were collected and analysed in 21 European countries. A certain consensus between stakeholders from the participating countries about the aspects that are relevant for science education could be identified. According to the *priority* assessments, the most important aspects and issues of science education from a European perspective are competencies related to higher order thinking. Furthermore, the high priority value of basic scientific knowledge implies that these competencies should be based on and considered in interaction with basic scientific knowledge. In contrast to that, aspects that have a rather high *practice* assessment in European science education are specific scientific contents and concepts of specific sub-disciplines as emphasised often by the national curricula. This misrepresentation is further illustrated when considering the *priority-practice differences*. All aspects that were identified and assessed by stakeholders are underrepresented in science education in Europe, most prominently competencies related to higher order scientific thinking.

As pointed out in the beginning, the main goals as well as the main concerns regarding science education in Europe are comparable. Therefore, the leader of WP3 assumes that the presented results on science education gathered in the 21 different PROFILES countries from more than 3000 stakeholders involved in science and science education are relevant for a professional reflection-oriented and evidence-based science education practice in Europe and in other countries as well. In particular, the results of the meta-analysis of the "International PROFILES Curricular Delphi Study on Science Education" provide starting points for comparisons, reflection and improvement of different science education systems.

As reported above, it is expected that the dissemination of the findings of the PROFILES International Curricular Delphi Study on Science Education will also enhance science education practice within Europe and beyond the European borders (rf. WP8) because the PROFILES (Inter-)National Delphi Study can be assessed as unique. This can be stated since the leader of WP3 has been working on the topic of 'Curricular Delphi Studies in Science Education Research' for more than 20 years. In this time he never became aware of a cooperative action in the field of curricular Delphi Studies which a) involved so many participants (stakeholders/experts) in a respective Delphi Study (usually the number of participants in such studies are less than 50 experts in total), nor b) has he found a Curricular Delphi Study carried out in a scientifically sound manner in more than one country. This really makes the 'PROFILES (Inter-)National Curricular Delphi Studies(Study)' and the work carried out by the PROFILES consortium within WP3 special; in each of the PROFILES partners countries, in Europe as a whole and worldwide.

In 2014, the leader of WP3 finished the meta-analysis on the reports of the partners' national PROFILES Delphi Studies. Results of the 'International PROFILES Curricular Delphi Study'

have been presented – e.g. at the '2nd PROFILES International Conference on Scientific Literacy in Europe' in Berlin, August 2014. First results of this study are published (Gauckler, Schulte, & Bolte, 2014) in the '3rd Book of PROFILES' (Bolte & Rauch, 2014) and disseminated at national conventions (e.g. in Germany the GDCP Conference (see also Bolte & Gauckler, 2015) or on an European and worldwide level (e.g. at the ICCE Conference 2014 in Toronto, Canada or at the NARST Conference 2015 in Chicago, USA; see also WP8). Further dissemination of insight into the PROFILES International Curricular Delphi Study are planned beyond the project's life span and proposals for conference presentations have been accepted already, for example in Germany at the GDCP Conference in Berlin (September 2015), in Europe at the ESERA Conference in Helsinki, Finland (in August/September 2015) and the ECER Conference in Budapest, Hungary (in September 2015), as well as worldwide for example at the CONASTA Conference in Perth, Australia (in July 2015) and the NICE Conference in Tokyo, Japan (in July 2015).

Further dissemination and exploitation of results regarding the work carried out within WP3 (Stakeholder Involvement and Interaction) can be reported. First we can confirm that more than 20000 PROFLES Project flyers have been disseminated via postal mail, e-mail or distributed by partners attending national and/or international conferences. Furthermore, the PROFILES consortium values the involvement of stakeholder and the interaction with them in the frame of the PROFILES National Stakeholder meetings and especially at the two PROFILES International Conference which took place in Berlin (2012 and 2014) with more than 300 participating stakeholders from more than 25 different countries. In this context it is also worth mentioning that especially at the 2nd PROFILES International Conference in 2014 also colleagues and scientific representatives from nine other projects funded by the EC in the FP7-SiS program attended and introduced their projects in an interactive poster session as well as in the PROFILES Book of Invited Presenters (Bolte & Rauch, 2014). As the PROFILES partners started at an early stage of the project with their (National) Delphi Studies on Science Education, the leader of WP3 can look back on various situations where results of these studies have been presented and/or published. One of those events has been the ESERA Conference 2013 in Nicosia, Cyprus, where the leader of WP3 organized in cooperation with other project partners a symposium on the insights from PROFILES Curricular Delphi Studies in different partner countries.

All in all, the insights from the PROFILES Delphi studies and the insights emerged from various face-to-face discussions with PROFILES stakeholders at the two International PROFILES Conferences (in 2012 and 2014) and at the National PROFILES Stakeholder Meetings can be assessed as indicatory and highly valuable to classify current and to optimize future science education practice in the PROFILES partners' countries as well as in Europe as a whole. On the basis of the results of the PROFILES International Curricular Delphi Study on Science Education in Europe and reflecting the discussions at the PROFILES Conferences and Stakeholder Meetings, it can be stated that the improvement of science educational practice is still a common European challenge and a key issue of European societies.

4.4 (Potential) Impact of the PROFILES project activities within WP4: Learning Environments, its main dissemination and exploitation of results

Since the PROIFLES Learning Environment - and the use of PROFILES module driven teaching - was at the very heart of PROFILES, the activities in and the outcomes of WP4 impacted heavily on the work of other work packages; most noticeable on WP5 and WP8. Modifying already existing modules from the other projects and developing new modules was undertaken as part of the PROFILES CPD programs. Later on, those modules went through the quality check by the partners before they were published on partners' local websites and

disseminated via the PROFILES International Websites. Modules development locally, led in several countries (e.g. Estonia, Romania, Finland, Latvia, Czech, Israel, Spain, Germany etc.) towards creation of new science courses, whether at general education level in schools, or at pre-service or at in-service level in science teacher education institutions.

Through sharing CPD training materials and PROFILES classroom teaching modules across partners, it was possible to impact positively on partners' further CPD operations and to increase the range of materials and teaching modules made available through PROFILES in the different partner countries. The modules have been successfully implemented first within the various CPD programs across partners, and finally within classroom teaching in and after the two (or even three) PROFILES CPD terms. Furthermore, the impact of the PROFILES modules was increased by the various channels of dissemination to other teachers; for example via networking, local teacher meetings and conferences and especially via the two PROFILES International Conferences. The sharing of materials and modules across partners was facilitated by making English versions of locally developed PROFILES modules available via the PROFILES website.

Special attention was given to working with partners to check the quality of modules created by teachers during the PROFILES CPD courses and the classroom intervention. The exercise, undertaken by the partners, in asking teachers to develop modules as part of the CPD program, led to a multitude of modules being created for students at different grade levels beyond the actual PROFILES target age group. This led to wider use of PROFILES 3 stage approach especially at primary level. The integration of the adaptation and/or development of PROFILES modules into the long-term CPD programs were assessed by the partners and their CPD providers as a good indicator of self-efficacy acquired by the PROFILES teachers undertaking the PROFILES CPD courses and workshops (see WP5 and WP6).

The PROFILES stakeholders conferences (the two international, but maybe even more the local stakeholders meetings) consolidated PROFILES philosophy among science educators and other employees involved in the science education system and confirmed the importance of the "3 Stage Model" approach PROFILES modules are based on. It was very much appreciated that various PROFILES modules focus on the socio-scientific questions and try to bridge the gap between science and society issue and that other modules are dedicated to open pathways towards career awareness and the promotion of creativity, reasoning, collaboration and cooperation among the students involved. In consequence, the evaluation on PROFILES students' gains shows – based on evidence – that using PROFILES modules in science classrooms leads to positive impact on students' learning and increases their motivation to learn science (see WP7).

4.5 (Potential) Impact of the PROFILES project activities within WP5: Teacher Training, its main dissemination and exploitation of results

One of the main concerns of the project is its impact on the society in general as well as on the school system – especially on the system of science education – in particular. As mentioned in the PROFILES contract (*5.2.2.1 SiS-2010-2.2.1-1 Supporting and coordinating actions on innovative methods in science education: teacher training on inquiry based teaching methods on a large scale in Europe*), the "difficulty with teacher training is sustainability, once the training or intervention ends. The teacher may undergo a change of beliefs during the intervention, but this change is only temporary in that, when the intervention is over, other pressures and concerns of the teacher and the lack of support, all too often means that the teacher reverts back to his/her previous practice" (see Rannikmae, 2001, in PROFILES DoW, 2013, p. 21).

The concern mentioned above was taken into account while planning the PROFILES professional development workshops based on the “4-Stage-CPD-Model” mentioned in Chapter 3.5. During the PROFILES project, the teachers who participated in the project experienced various models of long-term continuous professional development programs and approaches recommended to enhance (science) teachers professionalism (e.g. action research, teachers as curriculum developers, focus group discussion or evidence-based professional development workshops). As mentioned in Chapter 3.5, the PROFILES CPD activities aimed at implementing the PROFILES modules as well as the PROFILES rationale and its teaching philosophy by reflective teachers. Reflection was found to be very important for the teachers to understand the change and the path they underwent during the PROFILES CPD terms. Reflection is a well-known method for teacher's professional development; therefore, the teachers participating in PROFILES had various reflection breakpoints; for example, about their own professional development, about the implementation of innovative approaches to enhance their students’ learning in class and about the process they went through during the sequence of PROFILES CPD workshops and other meetings.

The WP5 leaders conducted a few workshops in which the partners and their CPD providers experienced the various models of professional development (see D5.5). As the framework of these workshops and additional guidance are available for download by leaders and for the use in further PROFILES (oriented) CPD programs via the website of the WP5, this can be assumed to be one of the main outcomes of WP5. The PROFILES consortium is convinced that the CPD models created in the context of WP5 – the more general “4-Stage-CPD-Model” (see Figure 3) and the more differentiated “PROFILES CDP Model” (see Figure 4) – will impact future CPD programs for science teachers in the partner countries and beyond.

During the whole project, the partners were asked to reflect on the various models of professional development workshops, in order to learn and suggest improvements in further professional development programs. Based on the partners' feedback and reports, the leaders of WP4 conclude that the partners conduct effective and fruitful workshops and long-term CPD programs in their countries. These initiatives were planned with the goal in mind to enhance their teachers' (scientific) content knowledge (CK) and their pedagogical (PK), as well as their pedagogical content knowledge (PCK) regarding the implementation of the various PROFILES modules that were adopted (see WP4), as well as the teaching and learning approaches combined with the PROFILES philosophy of teaching science. The PROFILES partners fed back that, as the PROFILES project proceeded, their teachers learned to focus better on the experiments they used in the classroom and labs and that the teachers suggested that they achieved better and more productive team work skills. Regarding the number of teachers involved in the PROFILES project’s long term CPD programs, the PROFILES consortium assesses this as an impact the PROFILES project initiated on the culture of the PROFILES partners in-service science teachers education system.

Several partners conducted action research as part of the workshop. All of them related in their reports to the aspect of teachers' reflections to describe the implementation of the modules as a proper method to increase and evaluate their teachers’ ownership development (see WP6). Almost all the groups described discussion or focus groups as a good approach to brainstorm on issues related to the adaptation of innovative teaching and learning modules taking into consideration the existing curriculum. The value of the teachers’ professionally- oriented focus in their reflection on the implementation was expressed as very supportive in the frame of peer assessment conducted throughout the implementation phase of the modules in the science classroom by the teachers who were involved in the PROFILES CPD programs. This feedback of the PROFILES teachers can also be assessed as an impact the PROFILES project had (and hopefully still has) on increasing the quality level of the partners’ science education practice.

More evidence for effective implementation of PROFILES modules and the PROFILES philosophy of teaching and learning science by teachers in their respective schools was reported (e.g. in the frame of the "PROFILES Students Gains Evaluation; see WP7).

From the partners' reports, the leaders of WP5 assumed that the PROFILES CPD programs enhanced the teachers' professional level, and one of the most important outcomes of these programs is that PROFILES teachers developed a higher level of ownership towards PROFILES (seeWP6). The PROFILES partners are convinced that these teachers will continue to scaffold their students in acquiring the IBSE skills, decision making and asking questions.

Looking towards the future, it is expected that the *PROFILES lead teachers* will continue to operate in their communities. In addition, we hope that effective CPD models and the IBSE strategies which were exercised within the PROFILES project will be used in similar projects conducted in Europe and elsewhere.

4.6 (Potential) Impact of the PROFILES project activities within WP6: Teachers Ownership, its main dissemination and exploitation of results

One of the important components of WP6 was working with the teacher teams who provided inter-teacher support, feedback on their reflections and practices in successfully moving towards teacher professionalism. The leaders of WP6 assume that the nature of the PROFILES continuous professional development (CPD) activities – namely long-term face-to-face and (if appropriate or seen as effective) the on-line CPD activities – provided the teachers with opportunities to develop and to strengthen their self-efficacy and to foster their sense of ownership towards the PROFILES project. Teachers' self-efficacy refers to the teachers' beliefs in their own capability to organize and conduct courses of action required to successfully accomplishing a specific teaching task in a particular context. Ownership means that teachers feel that the project belongs to them and is not imposed on them.

In order to find out whether the development of self-efficacy as well as of sense of ownership were achieved, the WP6 leaders disseminated a questionnaire, asked the partners to send portfolios (see D6.3) and case studies of their teachers (part of the PROFILES project assignments), and then analysed these documents. The triangulation of the data provided the PROFILES consortium with valid evidence about the teachers' professional development, their self-efficacy and their development of sense of ownership (see for example details in D6.4).

Based on the findings we can conclude that that the CPD program has been a proper platform for the development of the teacher as: (1) a learner, (2) a teacher, (3) a reflective practitioner, and (4) a leader. The teachers experienced professional development, especially referring to the IBSE strategy. There is evidence of the positive experience of the teachers in class as a result of the professional CK, PK and CPK development of the teachers, which students noticed. The project gave the teachers opportunities to present their modules, to share their thoughts and ideas as well as their challenges, with peers. It seems as if they found a way to teach as they believe teachers should.

We assume that the model of the CPD workshop leads to professional development of the teachers' self-efficacy and to a sense of ownership towards inquiry-based learning and education through **s**cience. Most of the teachers claimed that the projects' workshops which they attended may serve as a good model for further professional development aimed at improving science teaching and learning.

Looking towards the future, it is expected that the development knowledge and practical strategies for the development of ownership – the methods to enhance teachers' sense of ownership in pre- and in-service training programs of science teachers, as well as the methods

and strategies to assess the development of self-efficacy and of teachers' stages of concern – will support the planning of future CPD programs and the evaluation of the CPD programs' impact. Our experiences with the PROFILES CPD programs and the models they were based on show how the development of leadership among teachers becomes possible and likely. It should be mentioned that in some countries that participated in the PROFILES project, PROFILES modules and the related pedagogies are used for the method of accreditation of science teachers.

4.7 (Potential) Impact of the PROFILES project activities within WP7: Students' Gains Evaluation, its main dissemination and exploitation of results

As mentioned in Chapter 3.7, all partners finished their studies and submitted their reports on their students' gains evaluation. All reports of the partners sound very positive and promising.

Before the partners could start their students' gains evaluation, many partners had to become familiar with the methodology of systematic science education research. In many partner countries, the statistical approach chosen by the consortium to research students' motivation and the impact of the PROFILES interventions on their students' motivation was almost unknown. The same can be stated regarding the procedure of data collection and the data transfer from the questionnaires used and filled in by the students in the classroom to a digital screen used later on for the data calculation. Also the pre-post-test design and/or the treatment-control-group design to evaluate changes and/or to compare different – but comparable – groups of students seemed to be something new (and innovative) for some of the partners; and especially for many PROFILES teachers who collected the data and – in some cases – who conducted the data transfer and the data calculation. Therefore, it can be concluded that the work carried out in WP7 to support the partners, their CPD providers and their teachers to conduct an empirically-based study to evaluate the success and/or to identify difficulties in the frame of a science classroom intervention was something new that the colleagues learned. The leader of WP7 is convinced that this led to an increase concerning the teachers' professional skills and broadened their competencies in assessing students' learning. Taking the results and insights the students' gains analyses provided into account (see below), it is now very likely that the teachers involved in the students gains' evaluation processes may use approaches like this in the future. If this is the case, this will be a remarkable impact on assessing students' learning and science teaching - not only focusing on the students' cognitive or content-based learning outcomes.

Also worth mentioning regarding the expected impact of the PROFILES project activities within WP7 is the fact that all partners used the same instrument (the MoLE Questionnaire) and approach to evaluate the PROFILES intervention and their students' gains affected by the PROFILES treatment. In order to fulfil this consortium agreement the partners had to translate – and in some cases – to adapt the MoLE questionnaire. Now, this theoretically sound and scientifically tested instrument is available in 17 different languages (e.g. in: Czech, Danish, English, Estonian, Finnish, Georgian, German, Greek, Hebrew, Italian, Latvian, Polish, Portuguese, Romanian, Spanish, Swedish, Turkish). The consortium is optimistic that the existence of this instrument (in 17 different languages) will have an impact on future projects who are interested in a proper and scientifically sound evaluation, either in follow-ups of PROFILES based or PROFILES oriented projects or on other projects (funded by the EC in the framework of Horizon 2020).

The data source (in total) for analysing the PROFILES students' gains when the students experience the PROFILES science teaching and learning approaches and the PROFILES modules, yielded a solid basis for making sound analyses in order to evaluate the impact of the PROFILES interventions in general and as a whole. Regarding the reports of the partners, there

are only in (very) few cases restrictions one could or maybe should take into account. However, apart from these few exceptions, the data collected, the analyses carried out and the findings the PROFILES partners received, provide meaningful insights in the work of the PROFILES partners, of the teachers involved in the PROFILES CPD programmes, and the PROFILES interventions these teachers realized in their science lessons. Besides, the results of the PROFILES partners' students' gains analyses show – on a broad basis of empirical evidence – that the PROFILES project activities finally reached the students and that the PROFILES intervention lead to a positive impact on the students' intrinsic motivation to learn science and to better appreciate their science lessons. This positive impact of the PROFILES project activities can be stated for all partners involved in WP7 (see D7.4). Furthermore, it can be stated that this will probably have an impact on the quality of science learning and the improvement of science education because motivation is a pre-condition to get people involved and interested in science beyond the time they go to school and they have to attend science lessons. Without young adults who are interested in science and intrinsically motivated to learn or do science, a society – as well as Europe – may desperately look for new and future scientists, but won't find enough.

Furthermore, the findings of the PROFILES Students' Gains Evaluation show what could and what should be done within a PROFILES partner's school and science education system to enhance their students' gains in science lessons. Taking into account the empirical based evidence the PROFILES project provides either regarding the PROFILES teacher ownership investigation (see WP6) and/or concerning the PROFILES students' gains evaluation (discussed in this chapter 3.7) the PROFILES findings offer helpful suggestions how other PROFILES project activities could be optimised (for example in the frame of WP4 (Learning Environment) and/or WP5 (Teacher Training). These findings and insights helped and will help in the future to improve science teachers CPD programs and science education practice in schools. This can be concluded for the PROFILES activities in particular and for other or future projects in the fields of science education in Europe and abroad which try to foster IBSE, and by this to enhance scientific literacy among their citizens.

The methodology of the PROFILES students gains evaluation and the instrument use for this purpose have been introduced to the PROFILES consortium and the teachers and also to the wider science education community; for example in the three Books of PROFILES and surely at the two PROFILES International Conferences in Berlin 2012 and 2014, but also at other national and international conferences on science education (e.g. at ESERA 2011; 2013; at NARST 201X; 2015; at GDCP 2011; 2012; 2013; 2014). More dissemination is planned even if the PROFILES project will be finished by then (e.g. at ESERA 2015; ECER 2015; ConASTA 2015, NICE 2015; GDCP 2015).

PhD-theses are in progress and almost finished which mainly focus on the students' gains analyses in the framework of PROFILES (e.g. in UEF and FUB). Thus we can assume that the work carried out within WP7 did also lead to an impact on science education research.

As mentioned in Chapter 3.7, the leader of WP7 and his team are currently working on a statistically based meta-analysis of the PROFILES students' gains data. As the data source consists of more than 28000 students from approximately 1400 different classes from 21 countries in Europe, this data source and the activities of the partners which finally led to this, can definitely be assessed as very influential for the science education research community once these data are analysed. This will be the case in the respective PROFILES partner's country, in Europe and – we suggest – worldwide.

4.8 (Potential) Impact of the PROFILES project activities within WP8: Dissemination and Network, its main dissemination and exploitation of results

Through various means of dissemination, the impact of the PROFILES project was reinforced on mainly two levels, namely on the materials level and on the awareness level.

Through PROFILES newsletters, local websites and the three PROFILES books, the evidence-based best practice materials and the related reflective pre-service and in-service teachers continuous professional development (CPD) programmes associated with them, were made available to a wide range of science teachers across Europe.

Through the publications and presentations of teachers' case studies and their experiences within the PROFILES CPD courses, as well as by the development and implementation of PROFILES teaching materials and modules, a wide range of teachers became aware of innovative IBSE teaching approaches based on suitable evidence and about the underlying philosophies.

Furthermore, the established PROFILES networks facilitated the exchange of experiences and mutual learning among science teachers operating on a local, regional, national or Europe-wide scale (see D8.2 and D8.8). The PROFILES networks and the consortium members are interlinked to other national, European and international networks, such as ICASE, ESERA, IOSTE, NARST. Thus, the geographical width and outreach of PROFILES made a strong impact on science education across Europe and beyond.

Deliverable D8.8 includes a short description and a graphical representation of every PROFILES network. Accordingly, PROFILES networks include science teachers in schools, pre-service science teacher students, teacher educators as well as *lead teachers* (see WP6) in teacher education institutions, other national and international science or educational networks and some networks also include the ministry of education. Engaged *PROFILES lead teachers* act as multipliers and ensure the continuity and dynamic development of the networks.

By April 2015 the PROFILES networks include approx. 21400 stakeholders and approx. 2450 educational institutions as well as approx. 160 non-educational institutions (see Figure 7 in Chapter 3.8). This result exceeds the initial expectation of reaching 15750 teachers, according to the PROFILES DoW (2010; 2014).

The findings of questionnaires filled by the project partners outline the supporting and hindering factors in the PROFILES network process (see D8.8). 23% of the PROFILES partners mention that their PROFILES networks are supported by other institutions and networks. Another fostering factor is the interest, motivation and enthusiasm of the participants involved in the network process (20% of the PROFILES partner mentioned this). The two main hindering factors are seen in the additional time that networking requires (mentioned by 30% of the PROFILES partners) as well as the workload that teachers are facing in the partner countries (fed back by 23% of the PROFILES partners). These findings offer an insight in the operation of networks and are relevant for the facilitation and management of networks in general.

The establishment of PROFILES networks was an important measure, not only to disseminate the project philosophy and outcomes, but also to facilitate its continuity after the official end of the PROFILES project. Looking in the future, it is expected that the *PROFILES lead teachers* (see WP6) operating within every PROFILES network, as well as the activities and vital co-operations with other stakeholders and networks will support a sustainable and dynamic continuity of the PROFILES networks in the partner countries and beyond, even after the official end of the PROFILES project.

5 The address of the PROFILES project public website and relevant contact details

The following table provides a list of links leading to the PROFILES public website(s) in the PROFILES partners' local language. Two "PROFILES International websites" are provided by (a) the leader of WP1 (Management and Evaluation – FUB) and (b) the leader of WP8 (Dissemination and Network – UNI-KLU).

In addition, one can find further relevant contact details of the 22 PROFILES Consortium Institutions (e.g. the postal mailing address) and the addresses of the PROFILES partners' scientific representative who was mainly involved in the PROFILES project.

Table 3: PROFILES International and Local Website(s) of all Consortium Members as well as Contact Details of the PROFILES Consortium Institutions (Status Quo: 29th May 2015)

	Partner Institution – Country (Acronym)	**Scientific Representative – Contact – Website(s)**
1	Freie Universitaet Berlin – Germany (FUB)	Prof. Dr. Claus Bolte Freie Universität Berlin Department of Biology – Chemistry - Pharmacy Devision of Chemistry Education Takustraße 3 D 14195 Berlin - Germany Phone: +49-(0)30-838 56708 Fax: +49-(0)30-838 55919 E-Mail: didaktik@chemie.fu-berlin.de Website: http://www.profiles-project.eu/
2	University of Tartu – Estonia (UTARTU)	Prof. Miia Rannikmae University of Tartu Center for Science Education Vanemuise 46 Tartu 51014 Estonia E-Mail: miia.rannikmae@ut.ee Website: http://www.lote.ee/profiles/
3	The Weizmann Institute of Science – Israel (WEIZMANN)	Prof (Emeritus) Avi Hofstein Rachel Mamlok-Naaman The Weizmann Institute of Science Department of Science Teaching Rehovot 76100, Israel Tel: +972-(0) 8-9343811 Fax: +972-(0)8-9344115 E-Mail: avi.hofstein@weizmann.ac.il E-mail: rachel.mamlok@weizmann.ac.il Website: http://stwww.weizmann.ac.il/g-chem/profiles/
4	Alpen-Adria-Universitaet Klagenfurt – Austria (UNI-KLU)	Prof. Dr. Franz Rauch (Head of Institute) Institute of Instructional and School Development (IUS) Alpen-Adria-University Klagenfurt Sterneckstrasse 15 9020 Klagenfurt – Austria Tel ++43 463 2700 6137/++ 43 664 23 24 6 25 Fax ++43 463 2700 6199 E-Mail: franz.rauch@aau.at Website: http://ius.uni-klu.ac.at/misc/profiles/pages/home

Table 3: PROFILES International and Local Website(s) of all Consortium Members as well as Contact Details of the PROFILES Consortium Institutions (Status Quo: 29th May 2015)

5	Cyprus University of Technology – Cyprus (CUT)	Assistant Professor Eleni A. Kyza, Ph.D. Cyprus University of Technology Department of Communication and Internet Studies P.O. Box 50329 3603, Limassol, CYPRUS Phone: +357 25002577 Fax: +35725002695 Email: Eleni.Kyza@cut.ac.cy, /Eleni.Kyza@gmail.com Website: http://www.cut.ac.cy/profiles/
6	Masaryk University – Czech Republic (MU)	Assoc. Prof. Dr. Josef Trna Masaryk University Institute for Educational Development and Innovation (head) Department of Physics, Chemistry and Vocational Education Faculty of Education Porici 7 60300 Brno - Czech Republic Phone: +420-549495191 Fax: +420-549491621 E-Mail: trna@ped.muni.cz Website: http://profiles.ped.muni.cz/
7	University of Eastern Finland – Finland (UEF)	Prof. Dr. Tuula Keinonen University of Eastern Finland School of Applied Educational Science and Teacher Education B.O.Box 111 80101 Joensuu – Finland Phone: +358 5288818 E-Mail: Tuula.Keinonen@uef.fi Website: http://www.uef.fi/profiles
8	University College Cork – Ireland (UCC)	Dr Declan Kennedy MSc, MEd, PhD, HDE, FICI. Senior Lecturer in Science Education University College Cork Department of Education Ireland Tel (office): (021) 4903469 / Tel (mobile): (086) 1002226 Fax: (021) 4270291 E-mail: d.kennedy@ucc.ie Website: http://chemweb.ucc.ie/Pro2/PROFILES-ucc.htm
9	Università Politecnica delle Marche – Italy (UNIVPM)	Liberato Cardellini Università Politecnica delle Marche Dipartimento SIMAU Via Brecce Bianche, 12 60131 Ancona – Italy Phone: +39 071 2204 400 Fax: +39 071 2204 401 E-Mail: l.cardellini@univpm.it Website: http://www.profiles.univpm.it/

Table 3: PROFILES International and Local Website(s) of all Consortium Members as well as Contact Details of the PROFILES Consortium Institutions (Status Quo: 29th May 2015)

10	University of Latvia– Latvia (LU)	Dace Namsone University of Latvia The Center for Science and Mathematics Education Zellu iela 8 Riga LV1002 - Latvia Phone +371 67033741 E-Mail: dace.namsone@lu.lv Website: http://www.profiles.lu.lv
11	Universiteit Utrecht Netherlands (UU)	left the PROFILES project
12	Uniwersytet Marii Curie-Skłodowskiej – Poland (UMCS)	Dr hab. Ryszard M. Janiuk Uniwersytet Marii Curie-Skłodowskiej Faculty of Chemistry Department of Chemical Education, Pl. M.Curie-Skłodowskiej 3 20-031 Lublin, POLAND Phone: +48815375691 E-Mail: rmjaniuk@poczta.umcs.lublin.pl Website: http://www.umcs.pl/pl/projekt-profiles,5413.htm
13	Universidade do Porto – Portugal (UPORTO)	Prof. João Paiva Universidade do Porto Faculdade de Ciências da Universidade do Porto Departamento de Química e Bioquímica Rua Campo Alegre 687 4169-007 Porto – Portugal Phone: E-Mail: jcpaiva@fc.up.pt Website: http://www.profiles.org.pt/
14	Universitatea Valahia din Targoviste – Romania (VUT)	Prof. Dr. Gabriel Gorghiu Universitatea Valahia din Targoviste Departmentul pentru Pregătirea Personalului Didactic (Teacher Training Department) 5 Moldovei Street 130093 Targoviste, Romania Phone: +40-245-220694 Fax: +40-245-211078 E-Mail: ggorghiu@gmail.com Website: http://profiles.ssai.valahia.ro/
15	University of Ljubljana – Slovenia (UL)	Assoc. Prof. Dr. Iztok Devetak University of Ljubljana Faculty of Education Department of Biology, Chemistry and Home Economics Kardeljeva pl. 16 1000 Ljubljana –Slovenia tel. +386(0)1 58 92 204 fax. +386(0)1 58 92 233 E-Mail: Iztok.devetak@pef.uni-lj.si Website: http://www2.pef.uni-lj.si/kemija/profiles/

Table 3: PROFILES International and Local Website(s) of all Consortium Members as well as Contact Details of the PROFILES Consortium Institutions (Status Quo: 29th May 2015)

16	University of Valladolid – Spain (UVa)	Prof. Dr. Angela Gomez-Niño University of Valladolid Department of Cell Biology, Histology and Pharmacology FEYTS (School of Education and Social Work) Campus Miguel Delibes Valladolid 47011, Spain. Phone: +34/ 983423858 Fax: +34/ 983423436 E-Mail: angela@biocel.uva.es Website: http://www.profiles.uva.es/
17	Lingköping University Sweden (LiU)	Did not join the PROFILES project
18	Fachhochschule Nordwestschweiz – Switzerland (FHNW)	Prof. Dr. Peter Labudde Fachhochschule Nordwestschweiz Pädagogische Hochschule Riehenstrasse 154 CH-4058 Basel - Schweiz Phone: +41 61 228 51 01 E-Mail: peter.labudde@fhnw.c Website: http://blogs.fhnw.ch/profiles/
19	Dokuz Eylül Üniversitesi – Turkey (DEU)	Doç.Dr.Bülent Çavaş Dokuz Eylül Üniversitesi Buca Eğitim Fakültesi Fen Bilgisi Eğitimi ABD. Buca-Izmir 35150/Turkey Phone: +90 232 3012294 Fax: +90 232 4204895 Mobile: +905324267927 E-Mail: bulent.cavas@deu.edu.tr Website: http://www.profiles-deu.net/
20	United Kingdom (UnivDUN)	left the PROFILES project
21	Universitaet Bremen – Germany (UniHB)	Prof. Ingo Eilks University of Bremen - Department of Biology and Chemistry Institute for the Didactics of the Sciences (IDN) - Chemistry Education Leobener Str. NW2 28334 Bremen, Germany Phone +49 421 218-63280/-63281 Fax+49 421 218-63288 E-Mail: ingo.eilks@uni-bremen.de Website: http://www.chemiedidaktik.uni-bremen.de/profiles/
22	International Council of Associations for Science Education – United Kingdom (ICASE)	Jack Holbrook International Council of Associations for Science Education (ICASE) College Lane Hatfield, Herts AL10 9AA, UK Phone: +372 56 984083 E-Mail: jack.holbrook@ut.ee Website: http://www.icaseonline.net/profiles/

Table 3: PROFILES International and Local Website(s) of all Consortium Members as well as Contact Details of the PROFILES Consortium Institutions (Status Quo: 29th May 2015)

23	Karlstads Universitet – Sweden (KaU)	Prof. Shu-Nu Chang Rundgren, PhD Karlstads Universitet Department of Engineering and Chemical Sciences 65188 Karlstad - Sweden Phone: +46(0)732807568 E-Mail: shunuchang@gmail.com Website: https://www.itslearning.com/kau/profiles/about/
24	University of Copenhagen – Denmark (*UCPH*)	Prof. Jan A. Nielsen University of Copenhagen Department of Science Education Øster Voldgade 3 DK-1350 Copenhagen K Phone: +45353 20361 E-Mail: janielsen@ind.ku.dk Website: http://www.ind.ku.dk/profiles/
25	Ilia State University – Georgia (ILIAUNI)	Prof. Dr. Marika Kapanadze Ilia State University 3/5 K. Cholokashvili Ave 0162 Tbilisi Georgia Phone: E-Mail: marika_kapanadze@iliauni.edu.ge Website: http://profiles-georgia.iliauni.edu.ge/index.php