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D 5.1 Evaluation of field trials of innovative practices in science education

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SUMMARY

Science and technology (S&T) education is vital to increase the science literacy in modern societies and to stimulate more young people to opt for careers in S&T. Because there are considerable differences in S&T education among and sometimes within countries, it is promising to adopt an adaptive strategy to its innovation that allows a fit to the specific conditions of each of the countries.

In this report, we present first results of field trials with innovative practices in S&T education. They have been carried out within the project "kidsINNscience. Innovation in Science Education – Turning Kids on to Science", a collaborative SICA project funded under the Seventh Framework Programme of the European Union, see www.kidsINNscience.eu). The main questions addressed are:

1. What strategies for teaching and learning in S&T motivate teachers and learners in the participating countries?
2. What similarities and differences are there in innovating S&T teaching and learning in the participating countries?

At the start of kidsINNscience, a collection of Innovative Practices (IPs) originating from the participating countries – Austria, Brazil, England, Germany, Italy, Mexico, the Netherlands, Slovenia, Spain and Switzerland– was compiled. It comprises 80 IPs from pre-primary to upper secondary level. An IP aims to improve the regular teaching and learning in S&T with respect to a problem nationally perceived as important. Its qualities can be in contents and/or in teaching and learning methodologies. Every innovation is relative to a cultural context.

28 selected IPs were transferred into other partner countries by adapting them to the new national and local context. During the school years 2010/11 and 2011/12, a total of 186 teachers were involved, teaching 181 classes and teaching groups at 98 schools. 4104 learners from pre-primary to upper secondary level and from pre-service teacher education were reached. 20 schools, 19 teachers and 198 learners participated in more than one implementation. The selection and adaptation of the IPs was carried out in close collaboration with the teachers implementing the IPs in field trials. These covered a broad range of subjects, ran over various time spans and were carried out in different numbers and languages, in accordance with the priorities and possibilities of the respective country.

The formative evaluation of the field trials focuses on their effectiveness with respect to the problem addressed and three additional important areas of innovation of S&T education: Diversity and Inclusiveness, gender aspects and activity based and learner centered approaches such as IBTL (inquiry-based teaching and learning). For this, the University of Zurich aggregates the National Evaluation Reports, in which the project partners summarize the results and experiences of the field trials in their country.

Each of the ten countries selected and implemented a unique set of IPs. A majority of the IPs were implemented in a single country (64%). Hence, a range of innovative practices should be offered in order to allow for an adapted strategy to innovating S&T teaching in a given country.

The features facilitating a successful adaptation and implementation of an IP in another country are manifold, as the field trials show. Ideally,

- the original IP is attractive and close to the learners and the teacher and matches the syllabus or curriculum (or can be matched)
- alternatively, the syllabus or curriculum are flexible, i.e. contain a section where the topic is not predetermined
- the educational authorities, colleagues and parents are supportive towards innovation
- the teachers are free to adapt the IP according to their needs (context and interests)
- the teachers are interested in their professional development with respect to teaching methodologies and disciplinary knowledge and willing to reflect on their teaching and important issues in S&T education, such as Diversity and Inclusiveness, Gender and IBTL
- the professional development stretches over a certain amount of time and allows the exchange with critical friends (experienced colleagues or experts from teacher education and science education research)

In the field trials, the general motivation and engagement of teachers and learners was high (86% and 100% of the summaries, respectively). The feature appreciated most frequently was “practical activities” (38% of the statements), e.g. hands-on activities to manipulate and experiments, which are open-ended and serve a purpose, such as to decide among alternative explanations. The majority of the implementations are judged effective (78% of the summaries). In other words, the teachers were frequently satisfied with the outcome of the field trial and felt they had achieved the objective(s) with respect to the problem addressed by the field trial.

For successful field trials, the support by the researchers was helpful to and needed by the teachers in several respects: the choice of an IP appropriate to the teacher’s context and the problem addressed, pedagogic and disciplinary expertise during adaptation and sometimes the implementation, and the frame of kidsINNscience (documentation and evaluation procedures). Accordingly, access to persons with the necessary content and pedagogical knowledge should be provided to support teachers innovate their teaching.

This was particularly important in relation to activity based and learner centered approaches such as IBTL. Teachers were found to have a segmented understanding of the scope of IBTL, in terms of which activities it encompasses and from which age learners are able of doing inquiries. With respect to gender-balanced teaching, the focus of professional development of teachers should first of all make aware of and provide opportunities to reflect on gender differences. In the field trials, teachers rarely perceived gender differences as a problem in their teaching context. However, when paying attention to this aspect gender differences became apparent, especially at secondary level. Diversity and Inclusiveness were often given in the field trials by the composition of the class, such as learners with special educational needs, a high number of learners with migration background and low skills in the language of instruction or multi-grade classes.

It is the value of a context like kidsINNscience to make teachers pay attention to these important issues in S&T education. This is highly desirable – if these aspects are integrated in the learning set-up, learners’ motivation was found to increase, even if the learners had not perceived any problem in one of these areas.

1. INTRODUCTION

kidsINNscience. Innovation in Science Education – Turning Kids on to Science[1] is a research project involving ten partners in Europe and Latin America that aims to identify and promote innovative approaches for teaching and learning science. The objectives are to improve performance and interest in S&T among young people and to facilitate educationalists at different positions in the educational system to operate more creatively within the system and to help generate changes toward active learning systems.

The basic assumption is that innovations in S&T education work efficiently if they meet agreed quality criteria and are adapted to the local circumstance and conditions. Therefore, kidsINNscience proposes to adopt adaptive strategies to enable participating countries to learn from each other and to develop feasible innovation plans and carry out effective pilots that fit the specific needs and conditions of a given country.

Accordingly, the main questions that kidsINNscience addresses are:

1. What strategies for teaching and learning in S&T motivate teachers and learners in the participating countries?
2. What similarities and differences are there in innovating S&T teaching and learning in the participating countries?

What strategies to innovate S&T teaching and learning would work in the participating countries, taking into account the contexts and characteristics of S&T teaching and learning in each country?

Steps taken

Up to date (September 2012), following steps have been realized within kidsINNscience to find solutions to the challenges in S&T teaching and learning in the participating countries:

First, an initial set of quality criteria to describe and compare S&T practices and methodologies was agreed upon (Lorenz 2010, internal project report). Second, in each participating country, innovative practices meeting the quality criteria were collected and described (Mayer & Torracca 2010). Third, each country selected five innovative practices originating from other partner countries for adaption to the national educational conditions. This selection and the subsequent adaptation took place in close collaboration with the teachers implementing the innovative practices in field trials (Jiménez-Aleixandre & Eirexas-Santamaría 2010). During the school years 2010/2011 and 2011/2012, the adapted innovative practices have been implemented in a number of schools (Ogrin 2012, internal project report). An overview of the field trials is given in Chapter 2.

In this report, we are answering the first two main questions that kidsINNscience addresses. For this purpose, the results of the field trials in all participating countries are compared. The field trials are evaluated with respect to feasibility and effectiveness of activities. In addition, diversity and inclusiveness, gender aspects and activity based and learner centred approaches such as IBTL (inquiry-based teaching and learning) are explicitly addressed.

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1 kidsINNsience is a collaborative SICA project funded under the 7th Framework Programme of the European Union. Participating countries are Austria, Brazil, England, Germany, Italy, Mexico, the Netherlands, Slovenia, Spain and Switzerland. Duration: November 2009 to July 2013. For more information, see www.kidsinnscience.eu

Based on this evaluation of the field trials, the common set of quality criteria for innovation in teaching and learning of science will be revised (Task T5.2, deliverable due to November 2012). Finally, country-specific strategies for innovating S&T education will be formulated (Task T5.3, deliverable due to February 2013). The adaptive nature of the project strongly contributes to the feasibility of proposed innovations of science education.

2. OVERVIEW OF THE FIELD TRIALS OF INNOVATIVE PRACTICES IN SCIENCE EDUCATION

The collection of innovative practices compiled in Deliverable 3.1 of kidsINNscience (Mayer & Torracca 2010) is at the start of the two years of field trials in the ten participating countries in kidsINNscience. There, 80 practices in science and technology (S&T) education are described that comply with the definition of innovation adopted in the project:

"A good practice is innovative if it aims to change and/or improve the learning/teaching regular context: the innovation should address one of the problems nationally perceived as important and should be in contents – and/or in approaches to contents – and in teaching/learning methodologies. Every innovation is relative to a cultural context and a good innovation should present successful results concerning the problem addressed." (Mayer & Torracca, p. vii)

In the following, we refer to the practices described in Mayer & Torracca (2010) as original "Innovative Practices" (IPs).

2.1 Which Innovative Practices were implemented in which countries?

The ten participating countries implemented a considerable fraction of the original IPs described (35%). The 28 IPs implemented originate from nine countries (see Table 1). A possible explanation that no IP from the Netherlands was selected might be their scope – most belong to bigger programmes for new science education approaches. This makes it difficult to transfer them to another educational system. For details on the process of selection and adaptation, see Jiménez-Aleixandre & Eirexas-Santamaría (2010).

Of the 28 IPs, 18 IPs were implemented in a single country (64%), six in two countries (21%), three in three countries (11%), and one in four countries (4%). This means that teachers and researchers considered different approaches and contents suitable for the innovation of S&T education in their countries. This might be related to different problems addressed in the individual countries or different contexts (e.g. priorities of education policy, curricula, school levels, language). Further analyses are needed to answer this (see also Chapter 5.4).

Table 1. Overview of the implementation of Innovative Practices (IP). The order from and information about the original IP is according to Mayer & Torracca (2010). IPs shaded in grey were implemented in several countries. Implementations took place during the school years 2010/11 and 2011/12.

Origin				Implementation										
School level		Title Innovative Practice	Country of origin	Austria	Brazil	England	Germany	Italy	Mexico	Netherlands	Slovenia	Spain	Switzerland	Number of countries
Preprimary	1	Potatoes don't grow on trees	Italy	■			■					■	■	4
	2	Multimodal explanation on nervous system in Childhood Education	Mexico										■	1
Primary	3	Posing the question "why" to reach comprehension. Science learning and language in primary school	Austria					■						1
	4	Sunny side up	Austria			■								1
	5	Apple, apple, apple	Austria						■					1
	6	"Natlab"-Mitmach & Experimentierlabor – Laboratory for experimentation and "do it yourself" activities	Germany								■			1
	7	"Water" – research on the "wet" element	Germany	■										1
	8	Modelling of invisibles structures	Italy	■		■								2
	9	Science in family	Mexico	■		■					■			3
	10	Walk about through the body in 80 pulsation: the circulatory system	Switzerland	■	■				■					3
	11	Explore-it – grasping technology	Switzerland	■			■							2
Lower secondary	12	Renewable Energy	Austria					■						1
	13	Science Blogs	Brazil						■			■		2
	14	A minimum aquarium	Italy						■					1
	15	The "parallel globe": perceiving ourselves on a spherical Earth	Italy		■									1
	16	Developing Analogical Thinking: Atom Model	Slovenia		■									1
	17	Cooking with the sun	Spain	■				■			■			3
	18	Physics and toys	Spain			■	■							2
	19	X-rays a combination of physics and human biology/medicine	Switzerland									■		1
	20	The mobiLLab	Switzerland				■							1
	21	Air to breathe – asthma and air pollutants	Switzerland		■									1
	22	Drama and Science	England					■						1
Upper secondary	23	Physics and Sports	Austria							■			■	2
	24	Secrets of culinary art in science experiments	Austria					■						1
	25	"The principle of Le Châtelier" – a different way: experimenting along the national education standards	Germany	■										1
	26	Mobile education project – "Science on Tour" to schools in the state of Brandenburg/Germany	Germany								■			1
	27	The weekly "5 minutes of science news"	Slovenia		■							■		2
	28	Kitchen Chemistry: a teaching sequence for introducing scientific knowledge of women	Spain						■					1

2.2 Basic data on the field trials of Innovative Practices

The implementations of the 28 IPs covered a broad range of subjects, ran over various time spans, addressed different age classes, were carried out at different times in different numbers, countries and languages. The field trials have been documented in an internal project report (Ogrin 2012). At this point in time, we are able to present only a small fraction from this rich data here, focusing on the overall picture and comparison among the participating countries.

During the course of the two cycles of field trials (school years 2010/11 and 2011/12), a large number of schools, teachers and learners participated in kidsINNscience (see Table 2 and the Annex). In the ten countries, a total of 186 teachers were involved. They taught 181 classes and teaching groups at 98 schools. 4104 learners were reached (49.8 % of them female) from pre-primary to upper secondary level, and in two incidents of pre-service teacher education. Of these, 20 schools, 19 teachers and 198 learners participated in more than one implementation (see Chapter 5.2). It is important to note that these overall figures cannot display the diversity of the field trials. Further analyses are needed to embrace the contexts and contents, amongst others.

In two countries, only a limited number of field trials could be carried out. In Brazil, the field trials were significantly delayed by the late approval from the Brazilian Ethical Review Committee[2] – it arrived only after the consortium partners were to report their results to UZH for this report. Therefore, only five out of 17 field trials prepared could be implemented, implementations could not last longer than one week and in-class observations and interviews with learners by the researchers had to be discarded. Nevertheless, the field trials performed in Brazil did yield significant data and enabled a rich qualitative discussion to be incorporated into this report. In the Netherlands, only one field trial was performed due to a lack of interest from schools in participating in kidsINNscience.

The proportions of the school levels are fairly similar between the set of the 80 original IPs (Mayer & Torracca 2010) and the set of the 28 IPs implemented. For this report, the consortium agreed to apply a slightly different classification of school levels than in the collection of original IPs. The ISCED-97 levels (OECD 1999) have been developed for international comparability of education statistics and are widely recognized. They include also features of curricular structure and faculty requirements. These pedagogical aspects were considered important contexts allowing a meaningful comparison of the field trials.

Looking at the basic data according to different school levels given in Table 3, it is important to note that the numbers given here do not add up the ones according to country in Table 2. A school, IP or teacher can be nominated at several school levels. In addition, these figures are not corrected for multiple participations during the field trials. Hence, the numbers presented here reflect the data base available and experiences documented (Process Cards, final conversations and alike) which often relate to different topics but a lower number of actual persons involved.

[2] In Brazil, ethical approval of multicentric, internationally funded projects is carried out in a two-step process, first by a local Ethical Review Committee and second by the National Ethical Review Committee. The complying with the demands of the two committees and the subsequent processing took a long time. Field trials were not to start before final approval.

Table 2. Overview of the basic data on the field trials of Innovative Practices (IPs) in the ten participating countries. The figures indicate the number of schools, teachers and learners actually involved. For participation in several field trials, see text. The school levels are indicated according to the ISCED-97 levels (OECD 1999, pp. 22-23). The data for each country is compiled in the Annex.

country	number of schools	number of IPs	school levels[1]	number of teachers	number of classes[2]			learners				evaluation focus[3]		
				total (1st+2nd cycle)	total (1st+2nd cycle)	1st cycle[4]	2nd cycle[5]	age	total	number of females[6]	number of males[6]	Diversity& Inclusiveness	Gender	IBTL
Austria	19	8	0, 1, 2, 3	31	23	4	19	1,5-15	433	197	236	10	3	17
Brazil	4	5	1, 2, 3	4	5	0	5	10-18	169	93	76	0	0	5
England	6	4	0, 1, 5A	24	24	4	20	3-6, 8-11, 22plus	601	302	299	9	6	14
Germany	8	4	1, 2, 3	9	12	2	10	7-12, 14-19	274	134	140	4	1	8
Italy	9	5	1, 2, 3	18	23	11	19	6-15, 17-18	471	225	246	9	9	9
Mexico	7	5	0, 1, 2	19	25	8	17	4-7, 10-15	787	369	418	4	8	12
the Netherlands	1	1	3	1	1	0	1	18	16	8	8	1	1	1
Slovenia	25	4	0, 1, 2, 3	51	39	2	37	5-9, 12-16, 18	872	460	412	0	4	29
Spain	10	4	0, 2	11	12	3	9	3-5, 14-17	212	104[6]	86[6]	0	0	11
Switzerland	9	3	0, 1, 3	18	17	4	14	3-13, 16-17	269	141	128	3	2	7
Total	**98**	**28**	**0, 1, 2, 3, 5A**	**186**	**181**	**38**	**151**		**4104**	**2033**	**2049**	**40**	**34**	**113**

[1] 0 = pre-primary, 1 = primary, 2 = lower secondary, 3 = upper secondary, 5A = first stage of tertiary education; [2] refers also to teaching groups or multi-grade classes;
[3] a field trial could address multiple evaluation foci; [4] school year 2010/11; [5] school year 2011/12;
[6] for one class, the data on the sex ratio of the learners is not available, therefore, the numbers of female and male learners do not add up to the total number of learners

Table 3. Overview of the basic data on the field trials of Innovative Practices (IPs) according to school levels. The figures indicate the data base available, including multiple participation (see text). The data for each country is compiled in the Annex.

school levels[1]	**number of schools**	**number of original IPs**	**number of teachers**	**number of classes**[2]			**learners**				**evaluation focus**[3]		
				total (1st+2nd cycle)	1st cycle	2nd cycle	age	total	number of females[4]	number of males[4]	Diversity& Inclusiveness	Gender	IBTL
pre-primary	20	6	40	32	10	22	1,5 - 7	763	379	384	9	5	20
primary	43	13	83	81	17	64	5 - 13	1642	796	846	20	10	37
lower secondary	42	15	59	54	8	46	12 - 17	1311	655[4]	634[4]	7	15	40
upper secondary	16	7	21	22	3	19	14 - 19	486	240	246	3	4	15
first stage tertiary education (teacher education)	1	2	2	2	0	2	22+	45	35	10	1	0	1
Total[5]	**122**	**43**	**205**	**191**	**38**	**153**		**4248**	**2105**	**2120**	**40**	**34**	**113**

[1] International Standard Classification of Education, ISCED-97 (OECD 1999, pp. 22-23); [2] refers also to teaching groups or multi-grade classes;
[3] a field trial could address multiple evaluation foci;
[4] for one class, the data on the sex ratio of the learners is not available, therefore, the numbers of female and male learners do not add up to the total number of learners:
[5] not corrected for multiple participation and multiple mentions

The project kidsINNscience required that each country carries out field trials on both, primary and secondary level. This can explain the distribution of field trials across all school levels. In England, two groups of pre-service teacher students were involved, too. For the involvement of continuing teacher education, see Chapter 5.1.

Still, the primary level shows the highest prevalence of schools, teachers and learners in the field trials. This probably relates to the fact that the primary level usually comprises a higher number of years as compared to the other school levels (5-6 years vs. 2-4 years). The high number of evaluations addressing Diversity and Inclusiveness is likely to mirror the need for diversity management in the classroom at primary school level, where e.g. an inclusive approach to learners with special educational needs is taken and no structural separation according to learners' performance levels exist.

3. EVALUATION

3.1 Evaluation levels

The structure of kidsINNscience allows for comparisons on several levels. Figure 1 and Table 4 depict the different levels and the responsibilities with respect to their evaluation.

Table 4. Evaluation levels and their respective data sources and reports.

	Level	Evaluator	Source of data	Product
1.	kidsINNscience	UZH	National Evaluation Reports	D5.1 Evaluation of the field trials
2.	Cross-country cluster of IP (CCC)	UZH	National Evaluation Reports	D5.1 Evaluation of the field trials
3.	Country	consortium partner	Process Cards IP; evaluation data	National Evaluation Reports
4.	IP (for each field trial = implementation)	consortium partner, teacher	Process Cards IP; evaluation data	National Evaluation Reports

This report focuses on the comparison of the ten participating countries within kidsINNscience (Table 4, level 1). It is based mainly on the National Evaluation Reports written by the consortium partners (see below). Additional data has been taken from the documentation of the field trials (Process Cards, Ogrin 2012). The time frame for this report did not allow to comprehensively analyse the rich data collected. Further analyses carried out at a later stage will be addressing additional interesting aspects such as comparisons among adaptations and implementations of individual original IPs (levels 2, 3 and 4).

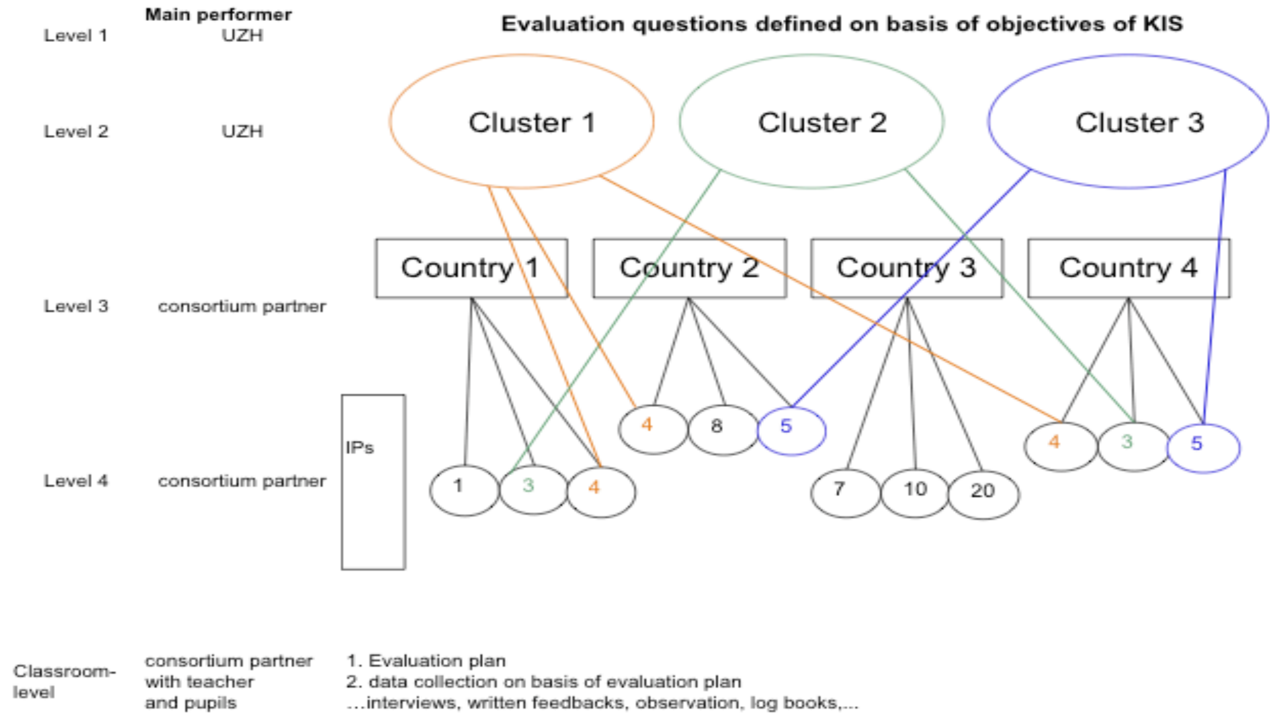

Figure 1: Evaluation levels of kidsINNscience (visualization by the Austrian Institute of Ecology (AIE))

3.2 Evaluation procedure

The task of the evaluation (Task T5.1) ran in parallel with the set up, implementation and documentation of the field trials (Task T4.2. see Ogrin 2012). Discussion started at the meeting 2 (Berlin, February 2010) when the University of Zurich (UZH) as task leader presented first thoughts on the evaluation process.

Given the diversity of the field trials and their contexts and the – for educational studies – short time frame for implementation of two school years, the consortium agreed on a formative evaluation with focus on the effectiveness of an implemented IP with respect to the problem addressed.

The following definitions were taken as a basis:

- Formative evaluation: Main aim is to learn in order to improve the quality of (intermediate) products and to locate shortcomings (Netherlands Institute for Curriculum Development SLO (2009), p. 42).
- Effectiveness: A measure of the efficacy of an action or measure in terms of achieving a specific objective. (Swiss Coordination Center for Research in Education SKBF|CSRE (2011), p. 24)

Due to the different interests and possibilities with respect to innovating S&T teaching and the active role given to the participating teachers in terms of selection, timing and adaptation of the IPs, it could not be anticipated which IPs in which contexts would be implemented over the course of the two cycles of field trials. Therefore, UZH framed a flexible evaluation procedure and predetermined only a part of the evaluation steps. It was up to the consortium partners and/or the implementing teachers to decide on the actual evaluation questions and the methods to answer these questions.

UZH developed several tools for internal use. The consortium partners were invited to give feedback on earlier versions at several occasions. This allowed adjusting the tools to the partners' need and to integrate the experiences of the 1st cycle of field trials.

"Guidelines for the evaluation of field trials of innovative methods in science education"

This document informed about the goals of the evaluation, the time line, the evaluation questions and data sources for this evaluation report, and specified the requirements for the evaluation:

- Each field trial has to address at least one of the following issues: diversity & inclusiveness, gender or inquiry-based teaching and learning (IBTL). [decision of the consortium]
- In each field trial, the perspective of the pupils/students involved is collected to triangulate the teacher's and the researcher's views. The consortium partners choose the method according to what is applicable in the context of the field trial (e.g., artifacts like lab journals, focus group interviews). [decision UZH]
- After each field trial, the teachers answer a set of questions, e.g. in a final conversation with the consortium partner or as a questionnaire. [decision UZH]

"Evaluation plan"

To assure quality and communication flow, UZH asked the consortium partners to fill in an evaluation plan before the start of each field trial. Sections to be negotiated with the teacher(s) included

– the problem addressed by the implemented IP
– the suggested solution to the problem and the definition of when the problem is "solved" (when the aim of implementation is achieved)
– the evaluation questions addressing the teacher and/or the learners
– the methods of data collection

The evaluation plans were shared within the consortium via the internal download area of the project website. UZH commented the individual evaluation plans and provided further support if necessary.

"National Evaluation Report"

Towards the end of the 1st cycle of the field trials, UZH asked each partner for a Preliminary National Evaluation Report summarizing the contexts and evaluation results of the field trials performed so far (meeting 4, Amsterdam, May 2011). Towards the end of the 2nd cycle, UZH provided the template for the National Evaluation Report based on discussions and decisions of meeting 5, Rio de Janeiro, March 2012. The National Evaluation Reports were eventually available to UZH between June and August 2012.

3.3 Data base

Each participating country collected a large and diverse data base with respect to the field trials. However, because this primary evaluation data is available only in the respective national language it is not presented directly in this report. Instead, UZH aggregates the information given in the National Evaluation Reports. In these, the consortium partners summarize the results obtained on two levels (see Table 5).

Table 5. Levels and exemplary contents of the National Evaluation Reports by the consortium partners.

Level of summary	Focus	Aspects to be addressed by the consortium partners (examples)	Range	Number of summaries available
national	all IPs adapted, implemented and evaluated in a country	- Set up of the field trials - Development from 1st to 2nd cycle - Conditions for successful transfer of innovations	3-8 IPs per country	9[1]
individual IP within a country	all field trials in a country which adapted and implemented the same original IP	Assessment with respect to - motivation and interest of teachers and learners - effectiveness - Diversity and Inclusiveness - Gender - Inquiry Based Teaching and Learning (IBTL)	1-21 implementations per IP in a country	42[2] (i.e. 1-8 IPs per country[1], referring to 28 original IPs, see Chapter 2)

[1] The Netherlands implemented one IP and summarized this on the level of the IP.

[2] Including the summaries of one IP implemented in Austria and one in Slovenia given in the Preliminary National Evaluation Reports (see Chapter 3.2). The summary of one IP implemented in Germany was not provided.

While these two levels allow for comparisons it has to be noted that the bases for them vary from country to country, in terms of how many different IPs were trialed and in how many schools and classes a given IP was implemented (see Table 5, range). In addition, the National Evaluation Reports report data from different sources, which again can vary among IPs and individual schools.

This situation can be illustrated by the ways how the three issues Diversity and Inclusiveness, Gender and Inquiry Based Teaching and Learning (IBTL) were integrated in the adaptation, implementation and evaluation of IPs:

Several countries asked teachers about each of these issues, independent of the focus of evaluation (Austria, England, Italy, Switzerland). In the other countries, Diversity and Inclusiveness and Gender were addressed and evaluated sporadically or not at all. In contrast, IBTL was included almost in all implementations and evaluations (see Table 2).

If the evaluation of a field trial focussed on Diversity and Inclusiveness, the researchers collected data e.g. by asking also for socio-demographic data in a questionnaire or by conducting focus group discussion with native speakers and non-native speakers separately. Accordingly, focus group discussions were held with girls and boys separately or data from questionnaires was analyzed according to sex if gender aspects were the focus of evaluation. Data collected on IBTL ranged from suggestions and questions of teachers when planning inquiry activities, in-class observations (sometimes in the context of co-taught activities by researchers and teachers), artefacts of the learners such as lab journals, reports and presentations of findings to interviews and questionnaires about the learners' and teachers' experiences and opinions.

Given the wide range of approaches to the field trials and their evaluation in the participating countries this report here can describe only an aggregated overall picture. The data reported nevertheless gives interesting insights in the innovation of S&T teaching and learning by adapting innovative practices from other countries. The results are presented in the next chapters.

4. STRATEGIES FOR TEACHING AND LEARNING IN S&T WHICH MOTIVATE TEACHERS AND LEARNERS IN THE PARTICIPATING COUNTRIES

A first answer to this question might be derived from the selection of the IPs implemented in the field trials. However, there is no obvious pattern to be recognized in the Table 1, such as one or a few IPs implemented in a large number of countries. It seems that the needs and approaches to innovate S&T education in the participating countries vary and ask for a wide spectrum of possibilities, blueprints and inspiration from the collection of IPs (Mayer & Torracca 2010). It will be interesting to analyze the teachers' reasons to select a particular IP at a later stage (documented in the Process Cards, Ogrin 2012).

For the National Evaluation Reports, consortium partners were asked to compile the evidence collected with respect to the motivation of the participants. The Table 6 summarizes these assessments of the teachers' and learners' motivation and engagement during the field trials. For both groups, the general motivation was judged high in the majority of the field trials and IPs (86% and 100% of the reports on the level of individual IPs, see Table 5), respectively. In 14% of the reports, teachers' initial enthusiasm was dampened during the course of the adaptation and implementation. This usually applied only to a subset of schools implementing this IP, or once only the 2nd implementation. The reasons given are the time-consuming organization, which conflicted with other school activities, esp. towards the end of the school year (2x), no access to the teaching and learning resources due to non-functional websites (2x), a delay of the anticipated learning material (1x) and learning material that was judged not suitable for the age of the learners involved as some of it broke (1x).

Also for the learners, the level of motivation and engagement could vary with time, esp. when the IP ran over several months, or among learners, e.g. when individual groups performed badly, or with task. Nevertheless, their general motivation is judged positively in all cases reporting data on this aspect.

Table 6. Motivation and engagement of teachers and learners during the field trials. The numbers refer to summaries on the level of individual IPs in the National Evaluation Reports (see Table 5).

Motivation/Engagement	Teachers	Pupils/Students
positive	31	37
positive → negative	5	
n/a	6	5
Total	42	42

In the Table 7, we summarize the features and activities and approaches that motivated the pupils and students most. Please note that the counts cannot to be taken as validated quantitative measurement because of the varying degree of detailedness of the National Evaluation Reports with respect to this aspect. Nevertheless, the categories mentioned most frequently do reflect popular aspects among the learners:

The feature appreciated most frequently was “practical activities” (38% of the statements), e.g. hands-on activities to manipulate and experiments which are open-ended and serve a purpose, such as to decide among alternative explanations. Another motivating aspect was a “connection to everyday life” (14%). This was realized by objects like toys or activities such as cooking or reading the news paper. In one case, where it was evaluated more detailed, this everyday context was explicitly appreciated by the girls. Furthermore, the pupils’ and students’ “ownership of learning” was important (13%), either with respect to the way how to solve a problem (e.g. by choosing the necessary equipment) or with respect to which topic to address and at which level. Consequently, the learners’ decisions impacted on the course of the lessons in several cases. The last category we would like to mention is an “out-of-school” setting or the use of out-of-school resources (e.g. involving parents or other relatives, visits by specialists, science museums, research laboratories such as the facilities of two consortium partners (Mexico and Slovenia)) (12%).

In addition, based on the positive feedback to many IPs, we can assume that the approaches underlying them are motivating learners.

Table 7. Approaches to teaching and learning that motivated the learners in the field trials as stated in the National Evaluation Reports from the participating countries (data reported in 32 summaries on the level of individual IPs, see Table 5).

Approaches and features that motivated the learners	Number of statements	Percentage of statements*
Practical activities	26	38%
Connection to everyday life	10	14%
Ownership of learning	9	13%
Out-of-school	8	12%
Topic	5	7%
Collaborative work	2	3%
IBTL	2	3%
ICT	2	3%
Presenting to other learners	2	3%
Interdisciplinary	1	1%
Nature of science	1	1%
Speaking about the learners' feelings and opinions	1	1%
Total	69	100%

* Due to the rounding error, the percentages of the categories do not sum up to 100%.

5. SIMILARITIES AND DIFFERENCES IN INNOVATING S&T TEACHING AND LEARNING IN THE PARTICIPATING COUNTRIES

D4.1 gives insight in the preliminary selection and first adaptations in the beginning of the 2 years of field trials (Jiménez-Aleixandre & Eirexas-Santamaría 2010). In this report, we analyze in retrospect which IPs have been implemented in the participating countries. This list of IPs differs from the one published in D4.1 for several reasons: In most countries, the selection process continued or even restarted as further teachers were recruited. Depending on their contexts and interests, these teachers opted for other IPs, e.g. because there were experiences available from a first implementation already or because another IP matched the syllabus better at the time of the field trial. In several cases, teachers cancelled their participation in kidsINNscience due to e.g. a change in school or class, new responsibilities at school, a lack of time or for private reasons like a long-term illness. As a consequence, some of the IPs originally selected for implementation have not been implemented.

The countries took individual approaches adapted to their expertise, networks and possibilities. Here, we are summarizing how the field trials were set up and run, and give a general description of the contexts and problems evaluated.

5.1 Set up of the field trials

Recruitment. All the kidsINNscience partners recruited teachers and schools among their personal contacts, usually from collaborations in other science education projects or in the context of teaching and teacher education (pre- or in-service). In Brazil, all teachers conducting a field trial were part time graduate students at UFRJ (three MA and one PhD in science and health education). In four countries, pre-service student teachers were involved in the frame of their teaching practical, disciplinary didactics or science courses (Austria, Brazil, England, Switzerland). The Swiss research partner collaborated with the teacher education institution in another language area, allowing the use of an additional set of IPs in the original language (Italian). In Mexico, the research partner visited schools close to its facility, presenting kidsINNscience and inviting them to participate.

In all countries except for Brazil and Spain, further schools and teachers participated in the field trials on their initiative. They had heard about kidsINNscience, often through peers contacted or involved. In fact, in 38% of the field trials, two or more teachers from the same school participated, in two cases even the entire staff (Austria, Italy). In Germany, a University of Applied Sciences, which had contributed an IP to the catalogue (Mayer & Torracca 2010), took charge for a set of field trials involving their network of cooperating schools. In Slovenia, several schools and teachers contacted the research partner in a different context out of which field trials in the frame of kidsINNscience developed.

Role of the teachers and researchers. During the selection, adaptation and implementation of the IPs, the teachers were the driving part, supported by the research partners where desired and necessary. The intensity of the collaboration varied and took different forms within and among countries. After the initial instruction about the frame of kidsINNscience, teachers usually adapted and implemented the IPs autonomously, reporting their experiences in the end. In two cases, the teachers translated the learning material themselves (Brazil, Germany). In four countries, the researchers facilitated the exchange among the participating teachers within and across different IPs. In Brazil, the participants of two in-service teacher education courses were involved in adaptation. After input about innovation in science education they adapted an IP of their choice, supervised by a researcher. Italy held regular meetings where the teachers discussed various issues in science education and shared their ideas and experiences. For virtual communication, a “Facebook” group was built and electronic files were shared via “Dropbox”. In Mexico, the teachers from the 1st cycle of field trials passed on their experiences to the teachers involved in the 2nd cycle in three workshops, building so-called “learning communities” (Gómez 2011). In Spain, teachers implementing the same IP developed a common adaptation and evaluation plan.

The researchers provided – where necessary – translations of the original IPs or parts of them, guidance with respect to the selection of suitable IPs, teaching methods (mainly IBTL), aspects of the Nature of Science and disciplinary content. In a few field trials, the researchers provided also teaching materials such as experimental protocols and consumables (Austria). In Mexico and Slovenia, the researchers in addition provided laboratory equipment and facilities not available or not allowed at school (see also Chapter 4, “out-of school” resources). Three consortium partners report joint teaching parts of teachers and researchers (England as a rule, Slovenia two IPs, Switzerland two implementations of one IP). These were often developed together. In many field trials, the researchers visited the teachers and their classes at school.

5.2 Running the field trials

Exchange and collaboration. In general, there was little exchange among the consortium partners apart from the teaching and learning material or translations of the selected IPs or facilitating the contacts to the authors or other implementing schools. The researchers used the project meetings for direct exchange among each other (meeting 4 Amsterdam, May 2011 and meeting 5 Rio de Janeiro, March 2012). Reasons for the low level of exchange were different timing of the field trials and the work load of researchers as well as of the participating teachers setting up, running and evaluating the field trials within the school's time frame.

Although several teachers expressed interest in international exchange with other teachers implementing the same IP only three incidents are reported. Of these, one worked (Mexico-Italy, exchange of e-mails and letters), one stopped because the implementation was not realized (Austria-England) and one was not realized because of interfering duties at the end of the Mexican school year such as the pupils graduating from Primary school (Austria-Mexico). However, there was exchange among schools at the national level in three countries and frequently within the same school (38% of the field trials, see above). In Mexico, pupils reported some collaboration across classes when several classes had to share the materials and equipment that are difficult to find or expensive, e.g. a fish tank.

In three countries, the consortium partners collaborated with national institutions for the field trials and their evaluation. They provided complementary expertise and access to their school network:

- Germany: University of Applied Sciences Lausitz, Senftenberg and Cottbus
- Slovenia: National Education Institute of the Republic of Slovenia, Ljubljana
- Switzerland: Locarno University of Teacher Education, Locarno

Development from the 1st to the 2nd cycle of field trials. In all eight countries[3] that performed field trials in both cycles (school years 2010/11 and 2011/12), the number of schools and teachers participating increased from the 1st to the 2nd cycle, as planned in the project outline. In Spain and Switzerland a second language area was involved (Spain: Castilla-León and Castilla-La Mancha (Spanish) in addition to Galicia (Galician), Switzerland: Ticino (Italian) in addition to the German-speaking area).

In these eight countries, at least one IP was adapted and implemented in both cycles. The materials and experiences were made available to the teachers performing the field trial later (from 1st to 2nd cycle or within a cycle), if possible. In Germany, the adaptation of one IP consisted of an extended test phase during the 1st cycle, followed by the actual field trials in the 2nd cycle. However, in Austria, the field trials of the 1st cycle had been stopped before implementation (one IP) and in Slovenia the change in school level required a complete change of content (one IP), such that the adaptations in the 2nd cycle could not built on the experiences of the 1st cycle.

On the other side of the spectrum, Italy and Mexico showed major consistency between the two cycles. All five IPs were implemented in both cycles, mostly by the same teachers, using the same evaluation plan and evaluation methods. Based on the experiences of the 1st cycle, the teachers had the desire to develop the adaptations further, to offer their pupils and students another opportunity to practice the innovative approaches and to consolidate their professional development. While in Mexico, the teachers taught different pupils and students

[3] In Brazil and the Netherlands, field trials were carried out only in the 2nd cycle.

in the 2nd cycle, in Italy, some teachers taught the same pupils and students as in the 1st cycle. In these cases, new contents were adapted to the basic idea of the IP in the 2nd cycle.

In the other countries, a varying number of IPs, schools, teachers, pupils or students remained the same. Changes in the collaboration with teachers were reported from two countries. Austria successfully intensified communication to prevent teachers from dropping out. Mexico organized workshops to make the link between the experiences and the experienced teachers from the 1st cycle to the newcomers in the 2nd cycle.

5.3 Context of the field trials

The majority of the field trials took place in co-educative public schools ("state schools" in the English school system). In four countries, one to three private schools participated, usually with a background in Montessori pedagogy. The majority of the schools were located close to the consortium partners' location. Consequently, the number of schools in urban settings was large (71% of the field trials). Brazil and Mexico report that schools and learners from a low socio-economic area and background may face a lack of resources (e.g. infrastructure like specialised rooms and laboratories or access to ICT facilities at school or at home).

The participating schools are not representative for the individual countries and do not allow generalizations for the entire country. Rather, the schools represent heads of schools and teachers interested in innovating S&T teaching, willing to join an international education research project.

The following characterization of the teachers is only an approximation based on data not corrected for multiple documentation of the teachers participating in several field trials (Process Cards, Ogrin 2012). The majority of the teachers were female (83%). In Brazil, all teachers were female, while in Germany, there was a male bias. In each country, very experienced teachers were involved (20-42 years of teaching experience. In Italy, the minimum of teaching experiences reported was 15 years. In half of the countries, novice teachers with a maximum of 3 years of teaching experience participated. These were usually the countries which also involved pre-service teacher students (see Chapter 5.1).

All classes involved in the field trials were mixed. Diversity and Inclusiveness were important features in several ways, albeit not always evaluated (see also Chapters 3.3 and 6):

- Cultural diversity was a frequent context for field trials in Austria, Germany and England. In contrast, field trials in the other countries took place in more homogeneous classes, especially with respect to skills in the language of instruction.
- Another form of heterogeneity in the class room was multi-grade classes (Austria, Switzerland).
- Half of the countries involved special education at various levels: schools for learners with special educational needs (Germany) and special education teachers running classes for high or low achievers or supporting teachers with a number of learners with special educational needs during regular classes (Austria, England, Italy, Spain, Switzerland).

Comparing and contrasting the national and local contexts documented in Ogrin (2012) in more detail will yield interesting findings.

5.4 Problems evaluated

A broad range of aspects was evaluated, reflecting the broad range of IPs implemented and the very diverse contexts. Most frequently, the lack of practical activities especially at pre-school and primary school level was tackled by introducing hands-on activities and IBTL (five countries). Often in relation to these approaches, the interest of learners in S&T – and in one country also of the teachers (Mexico) – should be increased by the field trials.

Another field of problems was the need to manage heterogeneous classes: including learners with special educational needs and/or facing a high number of pupils or students with migration background and consequently low skills in the language of instruction and multi-grade classes (Austria, England, Germany, Italy and Switzerland).

The evaluation of gender differences was reported from two countries, so were achievements in learning outcomes. In Brazil, problems evaluated were also related to social relevance and Nature of Science.

A more in-depth analysis of the problems addressed and evaluated in the frame of the implementations will be carried out at a later stage.

6. THREE IMPORTANT ISSUES IN S&T EDUCATION

The integration of the three issues Diversity and Inclusiveness, Gender and Inquiry Based Teaching and Learning (IBTL) in the field trials and their evaluation varied strongly among the participating countries (see also Chapter 3.3). Here, we summarize the data given in the National Evaluation Reports. Implications of the findings are discussed in Chapter 9.

6.1 Diversity and Inclusiveness

During the course of the project kidsINNscience, the consortium adopted a very broad notion of the terms “diversity” and “inclusiveness”. Cultural diversity due to migration, different national languages or social differences was found not to be equally relevant to individual participating countries. Additional forms of heterogeneity in the classroom were addressed by the IPs described (see Mayer & Torracca 2010) and faced by the teachers involved, such as integrating learners with special educational needs or multi-grade classes. Hence, the consortium broadened the original concept to embrace all aspects of diversity management and inclusiveness in S&T education, labelling it “Diversity and Inclusiveness”.

Diversity and Inclusiveness were often given in the field trials by the composition of the class (see Chapter 5.3). Austria addressed the mixed ethnicity of one school by distributing multilingual letters of information to the parents. In other field trials, cultural aspects were introduced through the content or the resources (see below). In Brazil, none of the adaptations explicitly considering Diversity and Inclusiveness were implemented as teachers were not available anymore at the time of national approval of conducting the field trials. The adaptations related to social roles (e.g. fishermen) and local contexts (e.g. coping with the risks associated to living close to a nuclear power plant).

Table 8. Assessment with respect to Diversity and Inclusiveness as stated in the National Evaluation Reports from the participating countries (data reported in 22 summaries on the level of individual IPs, see Table 5).

Assessment Diversity and Inclusiveness*	Number of statements		
	positive	negative and potential difficulties	unclear assessment
Class room experiences inclusiveness*	13	3	3
Class room experiences mixed ethnicity	7	1	
Introduction of cultural aspects through content or resources used	8		
Flexibility of the original IP	4		
Involvement of the parents	1	2	
Total	33	6	3

* For the definition adopted, see text.

The majority of the assessments with respect to Diversity and Inclusiveness is positive (79% of the statements, see Table 8). Of these, 39% are based on positive experiences with respect to inclusiveness in the class room (e.g. increased participation, involvement and knowledge gain of learners with special educational needs, "silent" students take a more active role in group work, learning on an individual level). Positive experiences with mixed ethnicity include amongst others positive and supportive collaboration among learners and the fact that the innovative practice was effective in the multicultural context (21% of the positive statements). The possibility to introduce cultural aspects through the content or the resources was demonstrated when preparing traditional dishes, addressing historical aspects or using materials from different cultural traditions, e.g. music instruments, pictures from the original IP or using Heritage language (24%). Flexibility of the IP in terms of successful adaptation to several grades or different pedagogic approaches (e.g. Montessori) was mentioned four times (12%).

Six statements report negative experiences or indicate potentially difficult situations (14% of the statements): difficulties involving the parents in experiments performed at home (language problems or pupils abstained from asking their parents, not wanting to hassle them) (2x), abstract activities being too challenging for learners with low skills in the language of instruction or of young age (2x), an increasing gap between interested and deliberately non-interested learners in terms of active participation increased (1x) and learning material that – according to the teachers – did not allow differentiation among learner level (1x).

Three statements describe examples of Diversity and Inclusiveness without indicating the researchers' and/or the teachers' assessment (7%).

6.2 Gender

To many teachers, gender differences were not an issue: This aspect was selected the least for evaluation (18% of the evaluation foci, see Table 2). Even when it was part of the evaluation plan none of the teachers reported on gender issues (Spain). Italy describes that the participating teachers accepted to address gender issues reluctantly because they were convinced that different attitudes towards science and maths are not related to gender but only to personality. In Brazil, none of the adaptations explicitly considering Gender were implemented as teachers were not available anymore at the time of national approval of conducting the field trials.

Assessments with respect to gender can be assigned to three main categories: class room experiences with gender-balanced teaching, approaches for gender-balanced teaching and feedback from female learners (see Table 9). The most frequent assessment of class room experiences claims apparent equal participation and/or performance by girls and boys (37% of the statements). These statements refer to reception, participation or performance of the learners and are mostly based on the teachers' perceptions. However, gender differences are reported, too (12%). They often relate to the learners' behaviour and their roles taken in collaborative work, especially at lower and upper secondary level. The Italian consortium partners describe the gender differences as follows – a view shared by the teachers:

"Males are usually 'allowed' to be divergent, chaotic, but curious and creative; females are more responsible for the group work, methodical, but also shy, fearing to ask questions and be at the centre of attention." (National Evaluation Report Italy, p. 7)

Furthermore, some teachers perceived female learners as more observant, more persevering and accurate when documenting and handling equipment more carefully than male learners (Mexico, Switzerland).

Two statements report an increase in gender awareness. Once, students related traditionally female chores – cooking – to chemistry. Also the male students were involved in this discussion (Mexico). In another trial, the teacher involved became aware of different roles and behaviour of female and male students (Italy). Another IP explicitly involved parents (Science in family). Here, two statements from implementations in different countries report that mainly the mothers participated in experimenting at home or at school, rarely the fathers (Austria and England). Finally, the gender aspects of group dynamics were difficult to manage for one of the teachers in the second cycle (Mexico).

The assessments name several approaches that in the perception of the teachers allowed for gender-balanced teaching and learning (9%), e.g. diverse learning materials to cater for all learning styles, forming single-gender groups or assigning the learners different roles for each collaboration. Suggestions for more gender-balanced teaching comprise e.g. presenting equal numbers of contributions by female and male scientists or keeping to mental discoveries (in opposite to more physical activities) (7%). However, these approaches were not actually put into practice during the field trials.

Furthermore, the English consortium partners *"felt that using drama and mime in some classes helped the girls especially to make vital contributions to the work"* (National Evaluation Report England, p. 4)

Finally, female learners confirmed their motivation for and their interest in learning activities as carried out in the field trials (5%). In another implementation they clearly approve single-gender groups: "*we have worked better together, males are so slow...., we understand each other and are faster and more effective*" (National Evaluation Report Italy, p. 25)

Table 9. Assessment with respect to Gender as stated in the National Evaluation Reports from the participating countries (data reported in 23 summaries on the level of individual IPs (see Table 5).

Assessment Gender	**Number of statements**	**Percentage of statements ***	**Total number of statements**	**Total percentage of statements ***
Class room experiences gender balance			**45**	**79%**
Equal reception and/or performance of girls and boys	21	37%		
Gender differences observed	12	21%		
Gender-independent pattern observed	2	4%		
Gender awareness increased	2	4%		
Mothers could be involved	2	4%		
Interest of female learners increased	1	2%		
Interest of female learners varied	1	2%		
Interest and contribution of females learners poor	1	2%		
Gender not perceived as a problem by the learners	1	2%		
Difficulties with gender management	1	2%		
Approaches for gender-balanced teaching			9	16%
Successfully implemented	5	9%		
Suggested	4	7%		
Feedback from female learners			4	7%
Interested in activities	3	5%		
Single-gender groups approved	1	2%		
Total			57	100%

* Due to the rounding error, the percentages of the subcategories and categories do not sum up to 100%.

6.3 Inquiry Based Teaching and Learning (IBTL)

Inquiry Based Teaching and Learning (IBTL) was integrated in most adaptations, implementations and evaluations of IPs. The National Evaluation Reports give several possible reasons for the predominance of this issue as compared to Diversity and Inclusiveness or Gender. In Austria, IBTL and other learner-centered approaches are fostered by educational policy. Hence, the consortium partners presented only IPs applying these approaches to the teachers. According to the reports, teachers appreciated the possibility to address their insecurity towards this innovative approach and gain (further) experiences with it in the frame of kidsINNscience (Austria, Germany, Mexico). In other cases, teachers saw the direct connection between IBTL and their teaching or S&T teaching in general, in contrast to issues of Diversity and Inclusiveness or Gender (e.g. the Netherlands, Slovenia, Switzerland). As a consequence, the teachers selected this focus for evaluation most frequently (see Table 2).

The information reported in the National Evaluation Reports is very heterogeneous and sometimes too vague as to allow for a sound analysis of the quality of IBTL in the implementations. Therefore, the following assessment is to give only a general impression and pointing to constrains. Taking the aspects of IBTL listed in the final conversation guide as a reference (mainly according to the definition of inquiry by Linn et al. (2004), cited in European Commission (2007)), the majority of assessments is positive in so far the implementation contained one or several activities listed (84% of the summaries where data is reported, see Table 10). While in some cases the assessments are illustrated only with one or two general aspects such as group work or searching for information by the learners, other summaries report and describe a range of inquiry activities. These range from raising and formulating questions to be investigated, making decisions about how to test ideas put forward to supporting one's answers with arguments from different sources of information and communicating the results to classmates in oral or written form.

A number of assessments cannot be linked to the activities of reference (14%) and one denies aspects of IBTL in the implementation, although the teacher considered it to be IBTL (3%). These reports point to an important feature evident from the National Evaluation Reports: both, teachers and consortium partners, hold several meanings and interpretations of IBTL. Sometimes, it is associated with hands-on activities and general learner-centered approaches. Other connections made by teachers include the Nature of Science (NoS), i.e. teaching and learning about scientific inquiry and investigative practices such as emphasising the tentative character of scientific models, and the exploration of Science, Technology & Society (STS) relationships.

Table 10. Assessment with respect to Inquiry Based Teaching and Learning (IBTL). The numbers refer to summaries on the level of individual IPs in the National Evaluation Reports (see Table 5).

Assessment IBTL	Number of assessments
positive	31
unclear	5
negative	1
n/a	5
Total	42

7. CAN INNOVATIVE PRACTICES BE SUCCESSFULLY ADAPTED TO AND IMPLEMENTED IN OTHER COUNTRIES?

7.1 Effectiveness

In the project kidsINNscience, we defined effectiveness of an IP implemented relative to a specific objective set in the beginning of a field trial (see Chapter 3.2). Because it was up to the teachers involved and the respective consortium partners to set the objectives according to the context the following results refer to a broad range of objectives (see Chapter 5.4). Here, we focus on the general picture reported in the National Evaluation Reports.

The majority of the implementations are judged effective (78% of the summaries where data is reported, see Table 11). These assessments are mainly based on the teachers' opinions, sometimes complemented with data from the learners or perceptions of the researchers. In other words, in a high number of implementations the teachers were satisfied with the outcome of the field trial and felt they had achieved the objective(s).

In six summaries (16%), the consortium partners report both, positive and negative or difficult effects observed in the implementations. Usually, several objectives were defined for the implementations. Of these, some were achieved, others not. Two of these summaries – one from Austria and one from Italy – refer to a large number of implementations of an IP involving ten and 21 classes or teaching groups of various ages, respectively. As a consequence, *"Owing to the wide dispersion of ages in this field trial a common conclusion cannot be drawn."* (National Evaluation Report Italy, p. 13) In another case, the positive and negative assessment of effectiveness was due to the fact that one school involved achieved the objective well while another school experienced the opposite and judged the IP's effectiveness as poor (Austria).

Finally, the effectiveness of one IP implemented in Italy changed from unsatisfactory in the 1st cycle to very satisfactory in the 2nd cycle. Based on the experience of the 1st cycle and the context of a new school and new class, the teacher set different objectives for the implementation in the 2nd cycle. Although the difficulties from the 1st implementation still persisted they did not affect the effectiveness, which focussed on another aspect now, in the 2nd year. This example illustrates the importance of the teachers' expectations when assessing an IP's effectiveness.

Table 11. Effectiveness of the IPs implemented relative to a specific objective set in the beginning of the implementation. The numbers refer to summaries on the level of individual IPs in the National Evaluation Reports (see Table 5).

Effectiveness	Number of assessments
positive	29
medium	1
positive and negative/difficult effects	6
negative → positive	1
n/a	5
Total	42

7.2 Main features permitting a successful adaptation and implementation

The National Evaluation Reports indicate a number of features facilitating a successful adaptation and implementation of an IP in another country (see Table 12). They can be grouped into the original IP, process and context on the one hand, and the actors involved and their interaction on the other hand.

The original IP is of major importance leading to a successful adaptation and implementation (24% of the statements, originating from five countries). More specifically, the original IP should match the curriculum or syllabus or be flexible to allow a matching (e.g. by offering a set of activities from which teachers can select or by allowing activities to be added). Furthermore, the original IP should be attractive and close to the learners and teachers. However, the field trials showed that teachers prefer different kinds of IPs and materials, either very defined and well described or very open.

Next, the adaptation of the original IP is seen as crucial (15%, five countries). Teachers appreciate that the original IP did not have to be implemented 1:1 but that they were free to transfer the basic approach – its core – or to adapt the materials to their context. The adaptation then should be close to the learners' knowledge and interest. In addition, it proved successful to connect the IP or field trial with the regular school program and yearly planning. Both approaches, sharing the original IP with the teachers or only its main idea lead to successful adaptations (reported by Spain and England, respectively).

Context features address educational authorities (e.g. the support of the head of school) and the curriculum (e.g. a flexible section where the topic is not predetermined), amongst others (11%, two countries).

Of further importance permitting a successful adaptation and implementation are the actors, the teachers and the researchers. The support of the researchers given to the teachers in multiple forms is widely considered as crucial (18%, eight countries). The support ranged from providing various materials and facilities to methodological guidance as a form of in-service teacher education (in an institutional setting or not) (see also Chapter 5.1). Two statements address support with the specific tasks in the context of kidsINNscience, e.g. the documentation and evaluation of the field trials.

The statements addressing the teachers refer on the one hand to their attitude (e.g. towards dynamic and not predetermined courses of learning such as IBTL or limitations in infrastructure), on the other hand to their competencies. Competencies in the subject matter allow the development of methodological aspects as do prior experiences in the participation in educational research projects (15%, four countries).

Finally, the relationship between the two main categories of actors is seen as decisive, namely good and constant mutual communication between the teachers and the researchers (11%, four countries).

Table 12. Features permitting a successful adaptation and implementation of innovative practices from abroad as stated in the National Evaluation Reports (data reported in nine summaries on the national level, see Table 5).

Features permitting a successful adaptation and implementation	**Examples**	**Number of statements**	**Percentage of statements ***
Original IP	- matches the curriculum/syllabus - attractive to learners and teachers - flexible	16	24%
Researchers/Teacher education	- supported teachers during adaptation and/or implementation	12	18%
Adaptation	- close to learners' knowledge - teacher is free to adapt to his/her context	10	15%
Teachers	- attitude (openness) - competencies (knowledge subject matter, participated in other educ. Research projects)	10	15%
Relationship teachers-researchers	- constant communication	7	11%
Context	- flexible curriculum/syllabus - support from head of school, colleagues, parents	7	11%
Resources	- financial support by kidsINNscience	2	3%
Learners	- used to a variety of learning approaches	1	2%
Parents	- positive attitude towards innovation	1	2%
Total		66	100%

* Due to the rounding error, the percentages of the subcategories and categories do not sum up to 100%.

Looking at features supporting sustainability of innovative change several categories overlap with the ones discussed above in the context of successful adaptation and implementation of IPs. For sustainability, teachers are the key actors (49% of the statements, originating from seven countries, see Table 13). Again, their attitude is seen as crucial: interest in one's professional development with respect to teaching methodologies and disciplinary knowledge, willingness to reflect one's teaching, awareness of diversity management issues in the class room, gender differences and challenges in IBTL. In addition, flexibility is needed to link the original IP to the own teaching context as well as to collaborate within the frame of an educational research project such as kidsINNscience.

Teachers are motivated to continue using the innovative approach when they could notice the learners' motivation and the learning outcomes. With respect to a sustainable adoption of IBTL teachers should be given repeated opportunities to building up their expertise with this approach.

Context features allowing for sustainability of innovative change address most frequently the support and acceptance from the head of school, colleagues and parents (21%, four countries).

Features of professional development of teachers stated are e.g. its duration over a certain amount of time (here six months), the possibility to acquire disciplinary knowledge and to expand or consolidate one's teaching repertoire and the value of an exchange with "critical friends" such as education researchers, teacher educators or other teachers (15%, three countries).

Table 13. Features supporting sustainability of innovative change as stated in the National Evaluation Reports (data reported in nine summaries on the national level, see Table 5).

Features supporting sustainability of innovative change	Examples	Number of statements	Percentage of statements *
Teachers	- attitude (awareness, interest in professional development, flexibility) - motivated to continue if they could notice the learners' motivation and learning outcomes	19	49%
Context	- support from head of school, colleagues, parents - flexible curriculum/syllabus	8	21%
Professional development	- stretches over a certain amount of time - need to acquire disciplinary knowledge - exchange with "critical friends"	6	15%
Learners	- interest	3	8%
Adaptation	- dynamical, addressing each class anew	1	3%
Resources	- financial support to buy material	1	3%
Actors in general	- depends to a large extend on persons	1	3%
Total		39	100%

* Due to the rounding error, the percentages of the subcategories and categories do not sum up to 100%.

7.3 Restrains to a successful adaptation and implementation of innovative practices

Restrains to a successful adaptation and implementation of IPs in another country are complementary to the supporting features discussed above (see Chapter 7.2). Restrains experienced during the field trials address most frequently the context (37% of the statements, originating from seven countries, see Table 14): teachers need to follow a tight content schedule, not allowing them to cover a different topic or trying out a more open-ended learning approach, at certain times, the normal curricular activities are disrupted (e.g. during testing periods and towards the end of the school year) or the infrastructure is lacking (non-existing or limited availability). In addition, the social structure of the school or class influences the success, e.g. the fraction of learners with few competencies in the language of instruction.

The context of kidsINNscience added additional work load to the teachers related to an education research project (e.g. the letters of informed consent, the documentation and reporting of the experiences for the evaluation) (10%, two countries).

The context also affects the teachers, resulting in a high work load already without carrying out a field trial which required additional time to adapt and implement the innovation. In some cases of time shortage during adaptation and implementation, the outcome is considered less successful by the teachers and/or researchers.

Transferability and sustainability are reduced if an IP requires much time and specific knowledge of a teacher (e.g. when writing and staging a play), if the teaching and learning material is not accessible (e.g. non-functional website) or if the activities need to be changed in order to implement it again at the same school (10%, two countries).

Last but not least, the financial resources can be limiting if there is no budget for new material or if the budget cannot be adapted within a useful time frame to cover the needs of the field trial (10%, three countries).

8. THE SAME INNOVATIVE PRACTICE IN DIFFERENT COUNTRIES

About one third of the IPs were adapted, implemented and evaluated in several countries (36%, for the distribution of Cross-Country Clusters, see Table 1). Here, we are briefly illustrating the diversity of contexts and adaptations in the largest cluster.

The IP “Potatoes don’t grow on trees” from Italy was implemented in twelve schools in four countries, involving 21 teachers and 19 classes (see Table 15). The most central content and activity of the original IP – biodiversity and growing potatoes – were taken up in all field trials, albeit in very different forms (see below). In relation to the time it takes from planting to harvesting potatoes, all field trials took at least five months, as the original IP. Also the methodological focus of the original IP – practical experiences – was transferred, such that learner centered approaches, e.g. IBTL, were in the focus of evaluation. In addition, two schools evaluated Diversity and Inclusiveness relating to the composition of the classes with a high proportion of non-native speakers and learners with special educational needs.

Table 14. Restrains to a successful adaptation and implementation of innovative practices from abroad as stated in the National Evaluation Reports (data reported in nine summaries on the national level, see Table 5).

Restrains to a successful adaptation and implementation	Examples	Number of statements	Percentage of statements *
Context	- tight curriculum/syllabus → teachers have no time for innovation - timing during school year - lacking infrastructure	11	37%
Teachers	- high work load already without field trial - no interest in professional development	7	23%
Context kidsINNscience	- time consuming frame (letters of consent, documentation, evaluation)	3	10%
Original IP	- requires much time and specific knowledge of teacher - material not accessible (internet site)	3	10%
Resources	- no budget for new material or too inflexible	3	10%
Relationship teachers-researchers	- long distance	1	3%
Learners	- little knowledge language of instruction	1	3%
Parents	- lack of awareness for IP activities	1	3%
Total		30	100%

* Due to the rounding error, the percentages of the subcategories and categories do not sum up to 100%.

Table 15. Comparison of the original Innovative Practice "Potatoes don't grow on trees" with the contexts and main adaptations of the implementations in four countries.

„Potatoes don't grow on trees"											
Country	**school level[1]**	**number of schools**	**number of teachers**	**number of classes**	**age of learners**	**Duration (months)**	**Language**	**Focus**	**Content (Selection)**		**Remarks**
origin: Italy	pre-primary	1	2	1	3-7	5	Italian	practical experiences	biodiversity	growing potatoes outdoors	
Austria	pre-primary	1	2	1	3-6	10	German	IBTL	yes	indoors and outdoors	Montessori pedagogy
Germany	lower secondary	1	2	2	8-12	5	German	IBTL and Diversity and Inclusiveness	yes	outdoors at a large scale	School for special educational needs; Education for Sustainable Development (ESD)
Spain	pre-primary	5	5	5	3-5	6	Galician	IBTL	yes	indoors in greenhouse and aeroponic	Potatoes may grow on air: Aeroponic cultivation
Switzerland	pre-primary	3	4	4	3-7	5	German, Italian	IBTL (3) and Diversity and Inclusiveness (1 school)	yes	indoors and outdoors	
	primary	2	8	7	6-9	5-6	German, Italian	IBTL	yes	indoors and outdoors	Self-regulated learning (1 school); "Patateto", a construction allowing to observe the development underground

[1] International Standard Classification of Education, ISCED-97 (OECD 1999, pp. 22-23)

Other features of the original IP were adapted to the new context and changed in at least one country: In Switzerland, the IP originating from pre-primary level, was adapted also for the primary level, in Germany even for lower secondary level. This resulted in additional methodological and disciplinary settings. At the primary level, a school connected the IP with their school development in self-regulated learning. At lower secondary level, the concept of Education for Sustainable Development (ESD) was taken as a frame, including large scale cultivation of potatoes and eventually selling the harvest. Another approach to the growing on plants was taken in Spanish kindergartens. There, the IPs title was changed to “Potatoes may grow on air”. The classes experimented with aeroponic cultivation where plants do not grow in soil but in humid air.

Further analyses will allow for interesting and more detailed comparisons, e.g. to what extend the basic idea of the original IP – the core – has been transferred or how much it was changed.

9. DISCUSSION

It is beyond the scope of this evaluation report to analyse the field trials of Innovative Practices (IPs) in science education comprehensively. Here, we will discuss selected points on the basis of the current state of the evaluation and discussions during a recent meeting of the kidsINNscience consortium (meeting 6, Zurich, September 2012). These points address the implementation, the three areas Diversity and Inclusiveness, Gender and Inquiry Based Teaching and Learning (IBTL) and features facilitating a successful adaptation and implementation of IPs. Where appropriate, we will outline possible implications for the innovation of S&T education and indicate questions of interest for further analyses of the field trials.

9.1 Implementation

Finding: Each country implemented a unique set of Innovative Practices (IPs).

Implication: A range of Innovative Practices should be offered.

During the course of the two school years 2010/11 and 2011/12, each of the ten countries participating in kidsINNscience selected and implemented a unique set of IPs. Factors influencing the selection and realization of field trials relate to different levels: First, the educational context such as national priorities in science education and the characteristics of the educational system including teacher education set the frame in which to act. Second, each consortium partner has a different position within and links to the respective educational system and the educational research community. All of this shapes what the consortium partners consider innovative and which emphasises they set for the field trials, e.g. the preselection of IPs presented to the teachers or the determination of the evaluation foci. Furthermore, this influences the networks available for the recruitment of the teachers to participate in kidsINNscience. Third, the teachers were given the leading role in the selection, adaptation and implementation of the IPs. They acted against the backdrop of their national and local educational context, e.g. the curriculum and class composition. At the same time, they acted according to their personal interests, competencies and what they conceive important in their professional situation. This highly individual approach with respect to both, the researchers' and the teachers' situation allowed to embrace the various (educational) cultures represented in kidsINNscience. In this situation, we found that there is not a distinct set of a few IPs that addresses challenges to S&T education in all the participating countries and matches the local contexts of individual class rooms. On the contrary, the diversity of IPs presented in the collection (Mayer & Torracca 2010) was a crucial aspect to allow an adapted strategy to innovating S&T teaching in the participating countries.

Finding: The support by the researchers was helpful to and needed by the teachers.

Implication: Access to persons with the necessary content and pedagogical knowledge should be provided.

However, in many countries and incidents, teachers appreciated a guidance to this broad choice e.g. in form of a preselection of IPs by the researchers. Also for the steps of adaptation, implementation, documentation and evaluation many teachers received and seeked guidance from the researchers: on the one hand with respect to the procedure set by kidsINNscience (e.g. letters of informed consent, what and how to document and evaluate), on the other hand with respect to pedagogic and disciplinary expertise. The data/statements relating to the role and support of the researchers can only rarely be clearly allocated to one of these areas.

kidsINNscience provided a flexible, yet complex context. For the participating teachers, the instruments for documentation and evaluation of the field trial did not necessarily reflect the natural process when adapting and implementing a teaching unit for their regular teaching. In the frame of kidsINNscience, a detailed documentation of the school, class and personal context and of the adaptation and implementation was asked for. For the evaluation, a problem had to be identified, a solution suggested and the (measurable) objectives for the implementation defined. Hence, the context of kidsINNscience was demanding. In two countries the time intensiveness was seen as restrain (see Chapter 7.3).

Analogous, eight National Evaluation Reports indicate the support of the researchers given to the teachers as one of the features for successful field trials (see Chapter 7.2). In addition, the relationship between teachers and researchers is of importance, especially a good and constant communication. This support and collaboration can be situated in a setting of professional development of the teacher. In this case, disciplinary knowledge and a continuous exchange with "critical friends" are seen as supporting sustainability of innovative change, as pointed out by the Italian consortium partners:

"An 'average' Italian teacher, in our opinion, cannot do it on his/her own without the support of other colleagues (from the University or from the School) with the necessary content and pedagogical knowledge." (National Evaluation Report Italy, p. 9)

9.2 Diversity and Inclusiveness, Gender and Inquiry Based Teaching and Learning (IBTL)

Over the course of a field trial, the teachers touched the aspects of Diversity and Inclusiveness, Gender and Inquiry Based Teaching and Learning (IBTL) twice: in relation to the evaluation foci and during the final conversation.

Finding: Teachers have a segmented understanding of the scope of IBTL. Limited content knowledge and practice give rise to insecurity.

Implication: Professional development of teachers should provide disciplinary and pedagogical knowledge in theory and practise.

IBTL was evaluated most frequently (60% of the evaluation foci, see Table 2). Many teachers had heard about IBTL because it is promoted by education policy (e.g. European Commission 2007). According to the teachers, many practiced IBTL occasionally.

There are two aspects to the teachers' perception of IBTL: "What do teachers think is IBTL?" and "Do teachers think they or their learners can do it?" Teachers have been found to have different conceptions of inquiry. They often connect it only with a specific aspect of the pedagogical approach, e.g. learners carry out experiments, come up with questions or search for information. With this segmented view of IBTL, inquiry does not emerge as problematic, as indicated by the high share of positive assessments with respect to this issue (84% of the answers, see Table 10). The teachers appreciated the IPs and the frame of kidsINNscience as an opportunity to learn about IBTL and practicing an example, thus reducing their insecurity towards this approach. Moreover, some teachers of young pupils (pre-primary level and the early years of primary level) considered their pupils too young for doing experiments and inquiries and therefore were not interested in IBTL. As a consequence of the field trials, several teachers changed their opinion on this.

Teacher education or professional development of teachers should address both aspects of the teachers' perception. In addition to broaching IBTL from a theoretical and practical point of view, *"a good content knowledge is essential to design and manage a good IBTL"* (National Evaluation Report Italy, p. 9).

Finding: Teachers rarely perceive gender differences as a major problem in their teaching context.

Implication: Professional development of teachers should make aware of and provide opportunities to reflect on gender differences.

Only every fifth evaluation focus was on gender issues (18%, see Table 2). Teachers rarely perceive gender aspects as a major problem in S&T education. The Brazilian consortium partners comment on this *finding "... the major problems identified by teachers (e.g. lack of interest and motivation) equally affect boys and girls. Also it may indicate that there are issues […] which are considered as more evident, more urgent and more important."* (I. Martins, personal communication). This might apply also to other participating countries.

When assessing the field trials, a considerable fraction of statements claims apparent equal participation and/or performance by female and male learners (37%). However, gender differences in S&T teaching and learning is an issue to which teachers have to – and can – be made aware of, as the experiences in Italy illustrate (see Chapter 6.2): when looked at gender balance in detail, and with an appropriate implementation and evaluation (here single-gender groups and interviews), gender differences became apparent. They often relate to the learners' behaviour and their roles taken in collaborative work and are relevant for the teaching and learning in the classroom, especially at lower and upper secondary level. At a younger age, gender differences seem to be less pronounced. Also in a setting of individualized teaching and learning gender differences are less relevant.

Diversity and Inclusiveness was chosen as evaluation focus about as frequently as Gender (21%). In the cases Diversity and Inclusiveness was evaluated, assessments were mostly positive (79% of the statements, see Chapter 6.1). Gender issues and culture were found to be intermixed, increasing the complexity of these issues further. In some participating countries it was difficult to evaluate Diversity and Inclusiveness because it emerges in relation to the composition of the class. There, introducing cultural aspects through the contents or the resources has been found a possibility to raising awareness of learners towards cultural diversity, e.g. when preparing traditional dishes or using materials from different cultural traditions.

In summary, the three areas of Diversity and Inclusiveness, Gender and Inquiry Based Teaching and Learning (IBTL) are complex and challenging for teachers, as the Mexican consortium partners point out:

"In general we detected that it was not so easy – apart from some cases – for the teachers to focus on these specific aspects. We noticed that they require a major professional background related to these aspects because otherwise they felt insecure or unable to handle them properly and efficiently." (National Evaluation Report Mexico, p. 12)

It is the value of a context like kidsINNscience to make teachers pay attention to these important issues in S&T education. Through repeated opportunities to draw from the disciplinary and pedagogical expertise of the researchers and to reflect their experiences teachers increased their awareness towards Diversity and Inclusiveness, Gender and Inquiry Based Teaching and Learning (IBTL). In the context of S&T education, this is highly desirable – if these aspects are integrated in the learning set-up, learners' motivation was found to increase, even if the learners had not perceived any problem in one of these areas.

9.3 Can innovations be successfully transferred?

Finding: In the majority of the field trials, teachers achieved their objectives.

Implication: To involve teachers in setting adapted and meaningful objectives increases their commitment to innovation.

In a high number of implementations the teachers were satisfied with the outcome of the field trial and felt they had achieved the objective(s) (78% of the answers, sometimes complemented with data from the learners or perceptions of the researchers, see Table 11). In other words, about three quarters of the implementations are judged effective. Here, we remind that we define effectiveness relative to a specific objective. At least one of the objectives had to address one of the three evaluation foci discussed above, Diversity and Inclusiveness, Gender and IBTL. The teachers decided on the objectives for their field trials in collaboration with the researchers. As a consequence, these objectives were adapted to a specific context and integrated the teachers' priorities and experiences, which makes their fulfilment more likely. Involving the teachers in the definition of the objectives allowed them to develop ownership of the field trial. So did the freedom given to the teachers to adapt the IP according to their needs. This frame was highly appreciated and conceived as very feasible, thus increasing the teachers' commitment.

The following citations confirm the importance of (committed) teachers for the successful and sustainable transfer of innovation in S&T education. Also in the frame of kidsINNscience, *"Teachers are key players."* (European Commission 2007, p. 3)

"The possibility of giving a solution to the problems addressed by the IPs [effectiveness, authors' note] seems to depend more on the kind of school/class […] <u>and the teacher</u> than on the IP itself." (National Evaluation Report Italy, p. 10, highlighting in the original)

"Sustainability of innovative change depends to a large extend on persons." (National Evaluation Report Germany, p. 6)

In summary, the features facilitating a successful adaptation and implementation of an IP in another country are manifold (see Chapter 7.2). Ideally,

- the original IP is attractive and close to the learners and the teacher and matches the syllabus or curriculum (or can be matched)
- alternatively, the syllabus or curriculum are flexible, i.e. contain a section where the topic is not predetermined
- the educational authorities, colleagues and parents are supportive towards innovation
- the teachers are free to adapt the IP according to their needs (context and interests)
- the teachers are interested in their professional development with respect to teaching methodologies and disciplinary knowledge and willing to reflect on their teaching and important issues in S&T education, such as Diversity and Inclusiveness, Gender and IBTL
- the professional development stretches over a certain amount of time and allows the exchange with critical friends (experienced colleagues or experts from teacher education and science education research)

9.4 Outlook

Clearly, this report presents the rich data collected during the two years of field trials only in a highly aggregated form. In face of the many possible comparisons at various levels of the project kidsINNscience further analyses are needed to embrace the full scope of the adaptations, implementations and evaluations of the innovative practices. Interesting issues worth to be looked at in more depth are amongst others

- Which features of the individual school levels are of importance for innovating S&T teaching and learning?
- Is there any pattern about the problems addressed by the field trials in different countries or at different school levels? Here, the IPs implemented in several countries are of special interest.
- Does the composition of the class, e.g. related to migration background, affect the teachers' aims of the field trials?
- What differences are there between teachers' and researchers' opinions about success of the field trials?
- Can we characterize reasons for negative results in effectiveness or for other less successful features?

Findings yielded and implications derived from kidsINNscience will be disseminated as "Strategies to facilitate innovative education in Science & Technology" (deliverable D5.2, February 2013) and a series of publications and events sharing the experiences with key change agents such as teachers, teacher educators, educational authorities and the scientific community of science education research.

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ANNEX

Table A1. Basic data of the field trials of Innovative Practices (IPs) in the ten participating countries.

original IP: the original IPs are described in Mayer & Torracca (2010)

school level: International Standard Classification of Education, ISCED-97 (OECD 1999, pp. 22-23)

number of classes: refers also to teaching groups or multi-grade classes

1st cycle: school year 2010/11

2nd cycle: school year 2011/12

learners/number of females: In Spain, the data on the sex ratio of the learners is not available for one class (School I), therefore, the numbers of female and male learners do not add up to the total number of learners.

numeric total: reflects the full data base of the field trials in a given country

multiple participation: number of schools, teachers and learners, which participated in several field trials, often addressing different topics during the 1st and the 2nd cycle

absolute total, i.e. number reached: number of schools, teachers and learners actually involved in a given country

country	school	original IP	school level	number of teachers	number of classes			learners				evaluation focus		
					total	1st cycle	2nd cycle	age	total	number of females	number of males	Diversity and Inclusiveness	Gender	IBTL
Austria	1A	Science in family	primary	1	1	1		6 - 9	13	7	6	field trial broken up without defining focus		
Austria	1B	Science in family	primary	1	1	1		9	13	8	5	field trial broken up without defining focus		
Austria	A	Science in family	primary	1	1		1	7	15	3	12	*		*
Austria	B	Science in family	primary	1	1		1	6 - 7	24	9	15	*		*
Austria	C	Science in family	primary	1	1		1	8	19	10	9	*		*
Austria	D	Science in family	primary	1	1		1	6 - 9	20	8	12	*		*
Austria	E	Science in family	primary	1	1		1	6 - 10	23	8	15	*		*
Austria	F	Science in family	lower secondary	1	1		1	13 - 15	17	7	10	*		*
Austria	G	Science in family	lower secondary	1	1		1	9 - 12	20	14	6	*		*
Austria	H	Science in family	lower secondary	1	2		2	10 - 15	30	11	19		*	*
Austria	I	Explore-it – grasping technology	primary	2	1		1	6 - 9	22	11	11	*		*
Austria	J	Explore-it – grasping technology	primary	2	1		1	7 - 8	18	6	12	*		*
Austria	K	Walk about through the body in 80 pulsation: the circulatory system	primary	2	1		1	9 - 10	19	11	8	*		*
Austria	L	“Water” – research on the “wet” element	primary	2	1		1	8 - 9	21	11	10			*
Austria	M	Modelling of invisibles structures	preprimary	3	1		1	3 - 6	27	12	15			*
Austria	N	Cooking with the sun	lower secondary	1	2		2	14 - 15	38	19	19		*	*
Austria	O	Science in family	preprimary	6	2		2	1,5 - 6	39	22	17			*
Austria	P	Potatoes don’t grow on trees	preprimary	2	1		1	3 - 6	23	12	11			*
Austria	Q	“The principle of Le Châtelier” – a different way: experimenting along the national education standards	lower secondary	1	2	2		14 - 15	32	8	24		*	*

numeric total Austria	19	8		31	23	4	19	1,5 - 15	433	197	236	10	3	17
multiple participation Austria														
absolute total, i.e. numbers reached Austria	19	8		31	23	4	19		433	197	236			

country	school	original IP	school level	number of teachers	number of classes			learners				evaluation focus		
					total	1st cycle	2nd cycle	age	total	number of females	number of males	Diversity and Inclusiveness	Gender	IBTL
Brazil	A	Air to breathe – asthma and air pollutants	Lower secondary	1	1		1	12	22	9	13			*
Brazil	B	The "parallel globe": perceiving ourselves on a spherical Earth	Primary	1	1		1	10 - 11	19	11	8			*
Brazil	C	The weekly "5 minutes of science news"	Upper secondary	1	1		1	16 - 18	40	28	12			*
Brazil	D	Developing Analogical Thinking: Atom Model	Lower secondary	1	1		1	13 - 15	45	25	20			*
Brazil	D	Walk about through the body in 80 pulsation: the circulatory system	Lower secondary	1	1		1	13 - 15	43	20	23			*
numeric total Brazil	5	5		5	5		5	10 - 18	169	93	76	0	0	5
multiple participation Brazil	1			1										
absolute total, i.e. numbers reached Brazil	4	5		4	5		5		169	93	76			

country	school	original IP	school level	number of teachers	number of classes			learners				evaluation focus		
					total	1st cycle	2nd cycle	age	total	number of females	number of males	Diversity and Inclusiveness	Gender	IBTL
England	A	Science in family	Pre-primary	1	1	1		3 - 5	25	10	15	*		*
England	B	Science in family	Pre-primary	2	2	2		3 - 5	60	30	30	*	*	*
England	C	Modelling of invisibles structures	Primary	1	1	1		6	23	11	12			*
England	D	Modelling of invisibles structures	Primary	4	4		4	9	110	50	60	*		*
England	E	Modelling of invisibles structures	Primary	2	2		2	9	21	13	8		*	*
England	F	Physics and toys	Primary	2	2		2	8	45	18	27	*	*	*
England	G	Modelling of invisibles structures	First stage tertiary education (teacher education)	2	2		2	22plus	45	35	10	*		*
England	H	Sunny side up	Primary	1	1		1	11	25	12	13	*	*	*
England	I	Sunny side up	Primary	1	1		1	10	30	14	16			*
England	J	Sunny side up	Primary	1	1		1	5	25	13	12	*		*
England	K	Sunny side up	Pre-primary	2	2		2	3 - 5	60	29	31	*		*
England	L	Science in family	Primary	1	1		1	6	24	13	11		*	*
England	M	Physics and toys	Primary	2	2		2	6	50	26	24		*	*
England	N	Modelling of invisibles structures	Pre-primary	2	2		2	6	58	28	30	*		*
numeric total England	14	4		24	24	4	20	3 - 6, 8 - 11, and 22plus	601	302	299	9	6	14
multiple participation England	8													
absolute Total, i.e. numbers reached England	6	4		24	24	4	20		601	302	299			

country	school	original IP	school level	number of teachers	number of classes			learners				evaluation focus		
					total	1st cycle	2nd cycle	age	total	number of females	number of males	Diversity and Inclusiveness	Gender	IBTL
Germany	A	Physics and toys	primary	1	1	1		7 - 9	13	7	6	*		
Germany	B	Physics and toys	primary	1	1	1		8 - 9	19	9	10			*
Germany	C	Explore-it – grasping technology	primary	1	1		1	10 - 11	25	13	12	*	*	*
Germany	D	Physics and toys	primary	1	1		1	8 - 9	15	8	7	*		
Germany	E	Physics and toys	primary	1	1		1	9 - 10	19	9	10			*
Germany	F	Potatoes don’t grow on trees	lower secondary	2	2		2	8 - 12	35	13	22	*		*
Germany	G	The mobiLLab	upper secondary	1	1		1	14 - 15	19	11	8			*
Germany	H	The mobiLLab	upper secondary	1	1		1	16 - 17	26	16	10			*
Germany	I	The mobiLLab	upper secondary	1	4		4	15 - 19	80	40	40			*
Germany	J	The mobiLLab	upper secondary	1	1		1	18 - 19	23	8	15			*
numeric total Germany	10	4		11	14	2	12	7 - 12 and 14 - 19	274	134	140	4	1	8
nultiple participation Germany	2			2	2		2		32	16	16			
absolute total, i.e. numbers reached Germany	8	4		9	12	2	10		242	118	124			

country	school	original IP	school level	number of teachers	number of classes			learners				evaluation focus		
					total	1st cycle	2nd cycle	age	total	number of females	number of males	Diversity and Inclusiveness	Gender	IBTL
Italy	A	Posing the question “why” to reach comprehension. Science learning and language in primary school	primary	18	18	6	12	6 - 11	370	173	197	*	*	*
Italy	B	Posing the question “why” to reach comprehension. Science learning and language in primary school	primary	1	2	1	1	7 - 9	46	24	22	*	*	*
Italy	C	Posing the question “why” to reach comprehension. Science learning and language in primary school	primary	1	1		1	6 -7	25	12	13	*	*	*
Italy	D	Cooking with the sun	lower secondary	1	1	1		13 - 14	17	7	10	*	*	*
Italy	E	Cooking with the sun	lower secondary	1	1		1	13 - 14	18	7	11	*	*	*
Italy	F	Drama and Science	lower secondary	2	2	1	1	13 - 14	45	34	11	*	*	*
Italy	G	Renewable Energy	lower secondary	1	2	1	1	12 - 13	43	24	19	*	*	*
Italy	H	Secrets of culinary art in science experiments	upper secondary	1	2	1	1	17 - 18	42	17	25	*	*	*
Italy	I	Secrets of culinary art in science experiments	upper secondary	1	1		1	14 - 15	20	3	17	*	*	*
numeric total Italy	9	5		27	30	11	19	6 - 15 and 17 - 18	626	301	325	9	9	9
multiple participation Italy				7	7				155	76	79			
absolute total, i.e. numbers reached Italy	9	5		20	23	11	19		471	225	246			

country	school	original IP	school level	number of teachers	number of classes			learners				evaluation focus		
					total	1st cycle	2nd cycle	age	total	number of females	number of males	Diversity and Inclusiveness	Gender	IBTL
Mexico	1.Corn.2ABP	Apple, apple, apple	pre-primary	4	4	4		4 - 5	85	42	43	*	*	*
Mexico	4.Aquarium.5CM	A minimum aquarium	primary	1	1	1		10 - 11	39	18	21			*
Mexico	7.Circulatory.6CM	Walk about through the body in 80 pulsation: the circulatory system	primary	1	1	1		11 - 12	36	18	18			*
Mexico	8.KitChe.M3.T82	Kitchen Chemistry: a teaching sequence for introducing scientific knowledge of women	lower secondary	1	1	1		13 - 14	37	14	23		*	
Mexico	9.ScBlogs.V2.T82	Science Blogs	lower secondary	1	1	1		14 - 15	34	24	10		*	*
Sub-total	3	5		8	8	8			231	116	115			
Mexico	1.Corn.2ABP	Apple, apple, apple	pre-primary	4	4		4	4 - 5	118	53	65	*	*	*
Mexico	2.Corn.2VC	Apple, apple, apple	pre-primary	2	2		2	6 - 7	47	23	24	*	*	*
Mexico	3.Corn.2LP	Apple, apple, apple	pre-primary	1	1		1	4 - 5	24	11	13	*	*	*
Mexico	4.Aquarium.5CM	A minimum aquarium	primary	3	3		3	10 - 11	123	56	67			*
Mexico	5.Aquarium.6Erz	A minimum aquarium	primary	1	1		1	10 - 11	15	8	7			*
Mexico	6.Aquarium.5St.J	A minimum aquarium	primary	1	1		1	11 - 12	42	22	20			*
Mexico	7.Circulatory.6CM	Walk about through the body in 80 pulsation: the circulatory system	primary	2	2		2	11 - 12	75	38	37			*
Mexico	8.KitChe.M3.T82	Kitchen Chemistry: a teaching sequence for introducing scientific knowledge of women	lower secondary	2	2		2	13 - 14	74	29	45		*	
Mexico	9.ScBlogs.V2.T82	Science Blogs	lower secondary	1	1		1	14 - 15	38	13	25		*	*
Sub-total CIN	7	5		17	17		17		556	253	303			
numeric total Mexico	10	5		25	25	8	17	4 - 7 and 10 - 15	787	369	418	4	8	12
multiple participation Mexico	3			6										
absolute total, i.e. numbers reached Mexico	7	5		19	25	8	17		787	369	418			

country	school	original IP	school level	number of teachers	number of classes			learners				evaluation focus		
					total	1st cycle	2nd cycle	age	total	number of females	number of males	Diversity and Inclusiveness	Gender	IBTL
the Netherlands	A	Physics and Sports	upper secondary	1	1		1	18	16	8	8	*	*	*
numeric total the Netherlands	1	1		1	1		1	18	16	8	8	1	1	1
multiple participation the Netherlands														
absolute total, i.e. numbers reached the Netherlands	1	1		1	1		1		16	8	8			

country	school	original IP	school level	number of teachers	number of classes			learners				evaluation focus		
					total	1st cycle	2nd cycle	age	total	number of females	number of males	Diversity and Inclusiveness	Gender	IBTL
Slovenia	A	“Natlab”-Mitmach & Experimentierlabor – Laboratory for experimentation and “do it yourself” activities	upper secondary	1	1		1	15	6	3	3			*
Slovenia	B	“Natlab”-Mitmach & Experimentierlabor – Laboratory for experimentation and “do it yourself” activities	upper secondary	1	1		1	15 - 16	20	8	12			*
Slovenia	C	“Natlab”-Mitmach & Experimentierlabor – Laboratory for experimentation and “do it yourself” activities	lower secondary	2	2		2	13	38	18	20			*
Slovenia	D	“Natlab”-Mitmach & Experimentierlabor – Laboratory for experimentation and “do it yourself” activities	upper secondary	3	3		3	18	45	26	19			*
Slovenia	E	“Natlab”-Mitmach & Experimentierlabor – Laboratory for experimentation and “do it yourself” activities	lower secondary	2	1		1	14	27	15	12			*
Slovenia	F	“Natlab”-Mitmach & Experimentierlabor – Laboratory for experimentation and “do it yourself” activities	lower secondary	5	3		3	13	71	42	29			*
Slovenia	G	“Natlab”-Mitmach & Experimentierlabor – Laboratory for experimentation and “do it yourself” activities	lower secondary	1	1		1	13	13	6	7			*
Slovenia	H	“Natlab”-Mitmach & Experimentierlabor – Laboratory for experimentation and “do it yourself” activities	lower secondary	2	1		1	13	18	11	7			*
Slovenia	I	“Natlab”-Mitmach & Experimentierlabor – Laboratory for experimentation and “do it yourself” activities	lower secondary	1	1		1	13	18	10	8			*
Slovenia	J	“Natlab”-Mitmach & Experimentierlabor – Laboratory for experimentation and “do it yourself” activities	lower secondary	2	2		2	14	20	10	10			*
Slovenia	K	“Natlab”-Mitmach & Experimentierlabor – Laboratory for experimentation and “do it yourself” activities	primary	2	2		2	7	28	15	13			*
Slovenia	L	“Natlab”-Mitmach & Experimentierlabor – Laboratory for experimentation and “do it yourself” activities	lower secondary	1	1		1	14	15	8	7			*
Slovenia	M	“Natlab”-Mitmach & Experimentierlabor – Laboratory for experimentation and “do it yourself” activities	lower secondary	2	1		1	13	25	12	13			*
Slovenia	N	“Natlab”-Mitmach & Experimentierlabor – Laboratory for experimentation and “do it yourself” activities	primary	3	4		4	6 - 9	25	13	12			*
Slovenia	A	Mobile education project – “Science on Tour” to schools in the state of Brandenburg/Germany	lower secondary	2	1		1	13 - 14	32	15	17			*
Slovenia	B	Mobile education project – “Science on Tour” to schools in the state of Brandenburg/Germany	lower secondary	1	1		1	13	26	14	12			*

Slovenia	C	Mobile education project – “Science on Tour” to schools in the state of Brandenburg/Germany	upper secondary	2	1		1	18	43	24	19			*
Slovenia	D	Mobile education project – “Science on Tour” to schools in the state of Brandenburg/Germany	lower secondary	2	1		1	13 - 14	39	16	23			*
Slovenia	E	Mobile education project – “Science on Tour” to schools in the state of Brandenburg/Germany	lower secondary	3	1		1	12 - 14	140	80	60			*
Slovenia	F	Mobile education project – “Science on Tour” to schools in the state of Brandenburg/Germany	lower secondary	2	1		1	13	27	15	12			*
Slovenia	G	Mobile education project – “Science on Tour” to schools in the state of Brandenburg/Germany	pre-primary	2	1		1	5 - 6	18	9	9			*
Slovenia	H	Mobile education project – “Science on Tour” to schools in the state of Brandenburg/Germany	lower secondary	1	1		1	13	31	18	13			*
Slovenia	A	Mobile education project – “Science on Tour” to schools in the state of Brandenburg/Germany	upper secondary	2	1	1		16	32	20	12			*
Slovenia	B	Cooking with the sun	upper secondary	1	1	1		16	25	11	14			*
Slovenia	B	Cooking with the sun	upper secondary	1	1		1	16	27	8	19			*
Slovenia	A	Science in family	lower secondary	1	1		1	13	17	9	8		*	*
Slovenia	A	Science in family	lower secondary	1	1		1	13	15	8	7		*	*
Slovenia	A	Science in family	lower secondary	1	1		1	14	19	9	10		*	*
Slovenia	A	Science in family	lower secondary	1	1		1	14	12	7	5		*	*

numeric total Slowenia	29	4		51	39	2	37	5 - 9 and 12 - 16 and 18	872	460	412	0	4	29
multiple participation Slowenia	4													
absolute total, i.e. numbers reached Slowenia	25	4		51	39	2	37		872	460	412			

country	school	original IP	school level	number of teachers	number of classes			learners				evaluation focus		
					total	1st cycle	2nd cycle	age	total	number of females	number of males	Diversity and Inclusiveness	Gender	IBTL
Spain	A	Potatoes don't grow on trees	pre-primary	1	1	1		4 - 5	25	13	12			*
Spain	1B	Potatoes don't grow on trees	pre-primary	1	1	1		4 - 5	20	11	9			*
Spain	2B	Potatoes don't grow on trees	pre-primary	1	1		1	4 - 5	14	8	6			*
Spain	C	Potatoes don't grow on trees	pre-primary	1	1		1	3 - 4	23	14	9			*
Spain	D	Potatoes don't grow on trees	pre-primary	1	1		1	3 - 4	10	4	6			*
Spain	E	X-rays a combination of physics and human biology/medicine	lower secondary	1	1	1		16 - 17	6	4	2			*
Spain	E	X-rays a combination of physics and human biology/medicine	lower secondary	1	1		1	16 - 17	6	2	4			*
Spain	F	X-rays a combination of physics and human biology/medicine	lower secondary	1	1		1	15 - 16	8	2	6			*
Spain	G	The weekly "5 minutes of science news"	lower secondary	3	1		1	14 - 15	20	12	8			*
Spain	H	Science Blogs	lower secondary	1	2		2	16 - 17	58	34	24			*
Spain	I	Science Blogs	lower secondary	1	1		1	14 - 15	22	n.a.	n.a.			*
numeric total Spain	11	4		13	12	3	9	3 - 5 and 14 - 17	212	104	86	0	0	11
multiple participation Spain	1			2										
absolute total, i.e. numbers reached Spain	10	4		11	12	3	9		213	104	86			

country	school	original IP	school level	number of teachers	number of classes			learners				evaluation focus		
					total	1st cycle	2nd cycle	age	total	number of females	number of males	Diversity and Inclusiveness	Gender	IBTL
Switzerland	A	Potatoes don’t grow on trees	pre-primary	1	1	1		4 - 7	20	10	10			*
Switzerland	B	Potatoes don’t grow on trees	primary	3	3	3		6 - 8	45	26	19			*
Switzerland	C	Multimodal explanation on nervous system in Childhood Education	primary	1	3		3	8 - 13	10	6	4		*	
Switzerland	D	Potatoes don’t grow on trees	pre-primary	1	1		1	3 - 6	21	9	12			*
Switzerland	E	Potatoes don’t grow on trees	primary	5	4		4	7 - 9	75	36	39			*
Switzerland	F	Potatoes don’t grow on trees	pre-primary	2	2		2	4 - 7	46	29	17	*		*
Switzerland	G	Multimodal explanation on nervous system in Childhood Education	primary	1	1		1	6 - 11	21	10	11	*		
Switzerland	H	Multimodal explanation on nervous system in Childhood Education	primary	1	1		1	8 - 13	9	6	3			*
Switzerland	I	Physics and Sports	upper secondary	2	1		1	16 - 17	22	9	13		*	
Switzerland	B*	Multimodal explanation on nervous system in Childhood Education	primary	2	1		1	7 - 9	11	8	3	*		*
numeric total Switzerland	10	3		19	18	4	14	3 - 13 and 16 - 17	280	149	131	3	2	7
multiple participation Switzerland	1			1	1				11	8	3			
absolute total, i.e. numbers reached Switzerland	9	3		18	17	4	14		269	141	128			