



TEACHING ENQUIRY
with MYSTERIES INCORPORATED

Local stakeholder groups formed, with membership and terms of reference

Deliverable report (D2.1)

Lead partner organisation: Università degli Studi di Milano

Authors: Marina Carpineti and Marco Giliberti

With the contribution of:

Sterrenlab; Queen Mary and Westfield College, University of London; Universitaet Bremen;
University of Leiden; University of Limerick; Sheffield Hallam University; Hogskolen i Vestfold;
Universitaet Wien; Weizmann Institute of Science; Univerzita Karlova V Praze.

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Contents

1. Identification sheet.....	3
2. Introduction	4
3. Stakeholders: Why to involve them?	6
4. Stakeholders: What do we need? functions.....	8
5. Local stakeholders groups and term of reference	11
5.1 Italy.....	11
5.2 Austria	13
5.3. Czech Republic.....	14
5.4 Germany	14
5.5 Ireland	15
5.6 Israel	16
5.7. The Netherland	18
5.7 Norway	19
5.8 United Kingdom.....	20
6. Stakeholders: How to recruit them?	22
7. References.....	25

1. Identification sheet

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Author(s) (alphabetically)	M Carpineti & M Giliberti with the contribution of: Sterrenlab; Queen Mary and Westfield college, University of London; Universitaet Bremen; University of Leiden; University of Limerick; Sheffield Hallam University; Hogskolen i Vestfold; Universitaet Wien; Weizmann Institute of Science; Univerzita Karlova V Praze.
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Abstract (for dissemination)	We present here the local stakeholder groups, the general idea for their recruitment, on the basis of the needs of the projects, and the term of references.

2. Introduction

The aim of TEMI project is “to help transform science and mathematics teaching practice across Europe by giving teachers new skills to engage with their students, exciting new resources and the extended support needed to effectively introduce enquiry based learning into their classrooms.” [1]

To do so we will implement innovative training programmes (‘enquiry labs’) in which we will use “scientists and communication professionals (e.g. actors, communication experts, etc.) to mentor teachers through the transition to use enquiry to teach science” [1].

In other word, in this project we aim to transform teacher training practices by developing and implementing a best practice pedagogy teacher training strategy across Europe. This programme will extend the collected use of enquiry based learning in the European classrooms.

The goal we want to achieve is a real challenge for many reasons. To cite some of them: there is a natural diffidence of teachers about new teaching practices, and whenever they decide to trust and therefore adopt them, they need help for their implementation; the number of teachers that can be reached is limited; the new teaching method needs the appreciation of parents, schools’ headmasters, and policy makers in order to be spread around Europe; local country needs must be taken into account, while maintaining an overall EU wide sharing of best practices and reporting...

Some of these challenges can be partly overcome through a specific approach. For example, to enable the achievement of project impact, i.e. to increase the number of teachers reached by the project, we will implement a cascade dimension of the training. The target for each directly trained teacher will be to influence 2 further colleagues in their department to adopt TEMI inquiries, and participate in the learning community.

This has a double effect. On one side it allows us to multiply the reach of the project. On the other side, involving other teachers in their schools, it will be more likely for teachers that their own innovations are sustained. Too often a single teacher’s attempted change in practice can falter, because of the power of the school culture to cause reversion to the status quo.

However, our approach, in order to be effective, requires that the schools’ headmasters support the project and share its objectives. [2]

Furthermore, to allow the new method to diffuse more and more, it is important that the local institutions have the means to continue to train teachers. This could imply the necessity of sponsorships from industry, as many pan European companies have a wish to support science education through their corporate responsibility wing.



D2.1 Local stakeholder groups formed, with membership and terms of reference

Finally, as already pointed out in the beginning, the strategy that we have developed will support teachers with the new skills, the appropriate lesson content, and extended mentor support to help transform their classroom practice. Therefore the support of experts is necessary, both for planning the lessons and to give teachers new tools to teach through an inquiry based approach.

It clearly emerges that the success of the project strongly depends on the joint work of many different stakeholders with precise terms of reference.

In this Report we will try to identify the reasons for involving stakeholders, the specific functions that they are expected to cover, the strategies to involve them, and finally, the local choices made by the partners of the TEMI project.

3. Stakeholders: Why to involve them?

A very common mistake while programming teaching activities, in particular when they are addressed to teachers, is to underestimate the role of stakeholders.

Their identification and their involvement can be seen as marginal problems, with respect to planning the training, and to recruiting the teachers, but actually, without a correct choice of stakeholders, and without clear requests addressed to each of them, a project risks being neglected, to fail its basic purpose that is to influence the teaching practices across Europe.

This is why in the TEMI project we have planned to devote special attention to this point.

In order to properly choose the stakeholders, we need to be convinced of the real necessity to involve any of them.

As a first point we must realize that teachers are continuously reached by requests, suggestions, proposals, all requiring them to work more than they already do. Why should they decide to follow our program? What could convince them? We need arguments, and, as we will explain in Report D2.3, we will develop and implement a recruitment strategy. The programme will be well explained because teachers need to appreciate clearly the benefits that it offers, complementing the schools' objectives. For that we will plan a communication strategy, and we will need the aid of experts who will ensure that the programme description is easy to understand, as teachers have little time to absorb complex marketing. For that it could be also important to work through existing teachers networks and CPD structures, wherever possible, to add credibility to the programme.

However, appreciating the benefits might not be enough, as teachers also need the support of their school's headmaster and of their colleagues. In fact, they need to share with others their new ideas, to check their new skills, and to compare with others their results. Therefore, it could be very important for the inquiry labs to create groups of teachers coming from the same school and having a strong headmaster support [2 and 3]. That can also help to get over the barriers given by national standards curricula and by final examinations.

As a further point we need to remember that our long-term goal is the implementation of IBSE in school. Therefore, teachers should be followed continuously in their work. For that, it could be useful to create local and European support communities, both face-to-face and online, where trainee teachers, teachers' networks, scientists, but also science centres, communication experts and so on, can exchange experiences and best practices around the IBSE activities, providing continuous support to facilitate transformational change in classroom practice.



D2.1 Local stakeholder groups formed, with membership and terms of reference

Moreover, changing teaching habits across Europe can occur only if the new teaching approach has impact on policy makers, building an evidence based consensus to affect future change. In this direction it is important to have in mind that also parents are a substantial pressure group for changes in education across Europe, as they want their children to have the best available. Spreading of best practices through changes in teacher training will therefore be required, and for that, each partner will highlight best practice to their Ministries of Education, and relevant industry organisation e.g. European School Heads Association, Curricula developers, publishing houses and also evaluators have to be strongly coupled in inquiry teachers' formation in long-term activities, to seek accreditation of the training programme from the relevant Ministry of Education agency, so that the teachers gain credit points. This would also ensure sustainability of the project outcomes. [1]

This list of points, although only partial, can probably give a definite evidence of why stakeholders are fundamental: because the image of IBSE as a fundamental didactic strategy should be strongly advertised to foster the required changes in the teachers' role.

4. Stakeholders: what do we need? Functions

We will work to disseminate our proven CPD model to school science education organisations, science centres, science museums, and associations for the promotion of sciences. Each local partner will link with these organisations to identify communication experts and exchange ideas on content of IBSE student training modules. With regard to policy organisations each partner will interact with their national department of education and invite key members to come and view the teacher training in practice and raise the general profile. Partners will disseminate the results of the project by making their policy organisation aware of our website and the results available to them [1].

However, the definite choice of stakeholders strongly depends on the local characteristics of the educational systems. Therefore, it is highly probable that the actual stakeholders chosen in the various countries are going to be extremely different. In other words, it is difficult to find out a group of stakeholders, which is common to all the partners.

By contrast, we can try to identify a group of functions that stakeholders are required to cover. These functions are expected to be shared by all the partners, whose task will then be to find out the most suitable stakeholders for each of them.

These functions have been discussed in the Leiden meeting between all the partners and the more important are reported and commented on below.

1) Creation of a methodology for training teachers in the mindset and practices of fostering student enquiry skills;

In order to promote the more widespread use of problem and enquiry based science teaching techniques, we will project laboratories that need to roll out a best practice multidisciplinary teaching strategy and a proven implemented model for enquiry-based learning. This task requires the provision of scientists, and communication experts, but also people who know very well the school situation in the country, as each country manages its own school curriculum and will have specific IBSE requirements at a local level.

2) Development of the enquiry contents;

These will be done with the help of properly chosen stakeholders, as institutions involved in education, but also teachers, teachers' association, scientists and scientific associations. These stakeholders will be different in each country, in accordance with the educational system.



3) Identify and solve local constraints to deliver the training (period required, accreditation sought, local cultural issues);

These are practical problems whose solution can be crucial for teachers' recruitment. The appeal of the project will never be enough for convincing the teachers to participate to in the courses, if practical problems are not solved. Depending on the local issues, it will be important to define which the proper stakeholders to be involved are.

4) Creation of materials;

In order to implement IBSE in their classrooms, teachers need materials. We will project texts, questionnaire, forms, but we will also project and develop activities to be suggested to the teachers. It will be important to have the help of people with the required skills, and with a deep knowledge of the school context.

5) Promote knowledge exchange between teachers, science educators, scientists, and communication experts;

Good practice cannot be cloned, but exchange of experiences on a personal level supports learning and innovations [3]. This needs effort from TEMI project in the direction of promoting knowledge and experience exchange between teachers and all the subjects responsible of disseminating scientific culture.

6) Have appropriate support to help teachers enhance the way IBSE is locally delivered in the classroom;

This point is strongly related with the problem of local barriers against IBSE discussed in Report D2.2 [3]. In fact it has been pointed out that teachers pose a certain degree of resistance to the introduction of IBSE in their classrooms [see for example 5, 6]. The reasons for the resistance can be extremely different and have turned out to be strongly sensitive of the environment. Therefore, any country, starting from the results of its analysis of the local barriers against IBSE, should individuate the more suitable stakeholders to contact in order to have proper help in supporting teachers.

7) Help a cascade mechanism to spread transformation locally;

As already explained, in order to have an actual spreading of IBSE towards Europe, a cascade effect is necessary. This needs the effort from TEMI project in the direction of promoting knowledge and experience exchange between teachers and all the subjects responsible of disseminating scientific culture.

8) Allow the exchange of project knowledge at EU level, across countries.

D2.1 Local stakeholder groups formed, with memberships and term of reference

We would like to work towards an EU accreditation system to validate these CPD training modules ensuring they are recognised as the gold standard in IBSE teacher training throughout the EU. Continuous contacts and exchanges with other EU projects will help in this direction, but other stakeholders should be involved.

In the Leiden meeting we have also discussed the possibility of involving some stakeholders (as for example publishing houses) able to influence textbooks with the findings of the project.

This idea has been discarded for the following reasons:

First of all, we have the shared opinion that publishing houses are not really interested in taking risks, but they prefer to make already tested choices. The editorial pressure forces them to be unable to support the costs of a person devoted to follow new projects.

As a second point, IBSE by its own nature is probably not suitable to be presented in a textbook. IBSE is a way of teaching in which students are central in the learning process, and teachers have the task of driving them in asking questions.

It is possible that teachers will need help in projecting this kind of lessons, but it is quite unlikely that they will look for answers in textbooks.

5. Local stakeholders groups and terms of reference

In the following, the case of each partner is described. Stakeholders and term of reference are listed, and they are related to the list of functions determined in Leiden

5.1. Italy

The group of the University of Milan (UMIL) will explore the direct use of theatre as a tool to introduce teachers to IBSE.

We are projecting face teachers' training starting with a theatre show. We have ten years of experience in this field, with five theatre shows addressed to students of various ages, teachers, but also general public, in which mysteries caused by not understood or misunderstood scientific phenomena are introduced [7,8]. We will transfer the show, after translating it in different languages, to theatre companies of some of the project countries. We will share the know-how with them, and organize performances, so that partners can attend the show and verify its utility as a vehicle to produce emotional involvement. Teachers/school experts from a number of the cohort sessions will attend and study the show in the enquiry labs/teacher training seminar series (e.g how the attention of the audience is caught by the mysteries and scenario). They would then work on it in subsequent sessions in the enquiry labs.

In order to carry out this program we need a number of stakeholders which are probably different by those of the other partners, although some of them are coincidental.

In the following, we list the stakeholders that we have contacted, and the ones that we plan to contact, with their term of reference, and their role with respect to the functions that we have identified and described in paragraph 4.

A first fundamental group of people that are indispensable for the success of the project are **experienced teachers**. They will be involved in all the functions from 1 to 7, thanks to their deep knowledge of school, teachers and related mechanisms and issues.

We have contacted a group of teachers working with our Physics Department since a long time in various reasons, as for example as course exercisers. We have involved them since the very beginning, in the planning and exploratory phase. In the following they will help us in the development of the enquiry context, in the creation of materials, but also in promoting a cascade mechanism. Their role of teachers will be fundamental to help other teachers to overcome their natural resistance to IBSE and to identify external challenges in the introduction of IBSE in the classrooms.

They will also be important to encourage processes of experience exchange between teachers and other stakeholders.

D2.1 Local stakeholder groups formed, with memberships and term of reference

A second group of stakeholders are **trainee teachers**. We will involve teachers attending the preparatory course for becoming teachers in the various phases of the project. They will help experienced teachers for all the aspects described from functions from 1 to 7.

Actually, in Italy, the teachers' certification course is just changing, and present scholar year is going to be the pilot year of the new course. We therefore have to identify the best modality of trainee teachers' involvement, as until now we have worked on the previous course, named TFA (Formative Active Training).

It will also be important to involve **teachers' networks and scientific associations**. In Italy we have contacted **AIF**, the Association of Italian Physics Teachers. We will involve them for promoting the knowledge exchange between teachers, science educators, scientists, and communication experts, thanks to their spread around the country. We will participate to the events that they organize for teachers, for presenting our program.

We have also contacted **SIF**, the Italian Physical Society. Its involvement will be double. On one side, SIF will help us in advertising the project in academic environments. We expect that this action will help in creating discussion about didactic approaches and will bring life to the project, while keeping it on the wave front of research. On the other side, SIF will help the project to be known all over Italy, but also to make the policy makers aware of it.

The point of **policy makers** is extremely important, as they have, at various levels, a role in orienting teachers' choices. As an example, in the last years Italian students of any ages are requested to answer questionnaires prepared by INVALSI [9] (Istituto Nazionale per la Valutazione del Sistema educativo e di formazione), a National research centre in charge for the evaluation of students' education level. Some teachers are hostile against IBSE, because an enquiry approach does not favour the ability of answering a multiple choice questionnaire. Therefore, they prefer to abandon IBSE and to train their students to answer multiple choices tests. This is an extreme example, but demonstrates quite clearly how much is important to work together with policy makers. Otherwise we risks going in opposite directions. We have contacted both the **Regional School Superintendence of Lombardia**, namely a branch office of the Italian Ministry of Education, University and Research. A person has been appointed as a reference person. We will share with her our progresses and our findings. In particular, we hope to have a partner who can intervene on political choices on school.

Create a methodology for training teachers and develop enquiry contents, will require the contribution of **scientists**, experts in the subjects to be taught. We are physicists and we will do not have all the competences necessary to cover all the scientific subjects. We will evaluate whether to involve colleagues coming from other Departments of our University for specific presentations on particular topics. Probably, following the conclusions of a discussion in Leiden with all the partners, we



D2.1 Local stakeholder groups formed, with membership and terms of reference

will probably decide to put our personal experience for the examples that we will propose in the course, while creating a kit of mysteries, with the help of the other TEMI partners.

With respect to the Italian project, we need contacts with **theatres, actors, and theatre directors**, in order to have space, competencies, equipment and facilities. We already have collaborations with all these stakeholders, which can also have a role in the dissemination.

As a final point, we think that to allow the exchange of project knowledge at EU level, across countries, the first step to do is to stay in touch with other European projects. We have direct contacts with the Italian staff of the projects Pathway, Profile and Establish.

5.2. Austria

In Austria PD courses have to be announced at a Teacher Education College which are in charge of in-service education. Thus, **Teacher Education Colleges** in every state of Austria are very important stakeholders for us. We cooperate with several **teacher educators** working at teacher education colleges who organize the regional PD courses with us. Every September there is a meeting of teacher educators where we promoted and will promote the TEMI idea and further the cascade mechanism.

At our institute, the Austrian Educational Competence Centre, work several **experienced chemistry, physics and biology teachers** who will contribute to function 1 to 7. Especially the development and trial of mysteries will be supported by the teachers. Especially Denise Mader, an experienced teacher and external PhD student at our institute, supports the Austrian TEMI team in the functions 1 to 7. Furthermore, we cooperate with two long-term PD programmes in Austria, called PFL and IMST. We will contact the graduates of the programmes who can be considered as experienced teachers as well.

The **trainee teachers** who study at our institute will be included in the project as well to give feedback on and support the development of the classroom materials.

Scientists of the other science departments than chemistry at the University of Vienna will be asked to provide their subject matter expertise for the development of classroom materials.

It is also important to contact **teachers' networks and scientific associations**. In Austria we work closely with the Science Network Vienna (ARGE), the Society for Promotion of Physics and Chemistry Education (VFPC) and the Association of Austrian Chemistry Teachers (VCÖ). The president of the VCÖ is an associated member of our institute.

D2.1 Local stakeholder groups formed, with memberships and term of reference

We have contacts to the **Technical Museum** of Vienna which is interested in collaboration to disseminate scientific culture.

To facilitate teachers getting out of school we will ask the **Federal Ministry of Education, Arts and Culture (BMUKK)** and the **Education Authorities in the Austrian States** (Stadtschulrat or Landesschulrat) for support and promotion of the TEMI project.

The recruitment of **communication experts** is running to help teachers develop motivational strategies in presenting the mysteries.

Additionally, we have direct contacts to the **European projects PROFILES** and **INSTEM** to exchange knowledge and experiences on inquiry-based learning.

5.3. Czech Republic

In the Czech Republic, the Faculty of Science of the Charles University is participating in the TEMI project. This faculty has a tradition of many years in preparing science teachers for teaching practice and in cooperating with these teachers, especially chemistry and biology teachers.

We also have a long-term cooperation with many science education institutions which will be the stakeholders of the TEMI project.

The most important stakeholders in the TEMI project in the Czech Republic include:

- The Ministry of Education which is represented by the National Institute for Education. In this institute, there works a work group for chemistry, biology and physics education for primary and secondary school, with which we closely cooperate. In here the curricular documents are formed along with other obligatory documents for science education at these schools. At this time, we are writing a document about the teaching of didactics of science at all universities in the CR for this institution. This document will be also important for the TEMI project.
- Expert societies, especially the Czech Chemical Society, which support the improvement and popularization of science education in the CR.
- Pedagogical societies and the special didactics accreditation group, which directly influences the means of preparing future science teachers at universities.
- Science centres – we cooperate with the science centre in Liberec (northern Bohemia) when we need to contact teachers and pupils from primary and secondary schools.
- Companies connected with science education – Conatex (distribution of didactic tools), Silon (processing of plastic), Madeta (processing of milk), Bayer etc....



D2.1 Local stakeholder groups formed, with membership and terms of reference

- Primary and secondary schools in the CR, the boards of these schools and science teachers. Thanks to the small area of the CR and good contacts with other universities preparing science teachers (a total of 11 faculties at 9 universities), we have the means of contacting schools in every part of the CR.

5.4. German

The TEMI project in Bremen involves a lot of different stakeholders from the science education arena and beyond.

TEMI-Bremen is led by science educators from the fields of chemistry and biology education at the University of Bremen. All the participating project staff is also involved in pre-service teacher education (BSc and MEd level). Based on this double-function, student teachers of chemistry and biology will be involved in the project. Some of them will do their MEd-thesis within the TEMI-project; many others will receive a TEMI workshop connected to a 3-month school internship within the MEd-program.

The TEMI-Bremen team is also acting as in-service teacher educators. The TEMI-Bremen team with its partners is in charge for the Bremen-Oldenburg-center of science and chemistry in-service teacher training funded by the German chemical society (GDCh) and many sponsors. TEMI activities will become part of the trainings offered by the center and officially acknowledged by the ministries of education of the German states of Bremen, Lower-Saxony and Schleswig-Holstein. The chemistry education group of the University of Bremen is also driving a non-formal laboratory for visits of secondary school classes to the university. On request the staff from the non-formal laboratory will offer special TEMI-events for teachers and their secondary science school students.

TEMI is working in the piloting phase with a group of leading teachers to structure and pre-test the course materials. The group is made up of teachers being involved in action research triggered innovation of science education for up to 15 years. Part of the team became in the last 15 years headmasters, textbook authors, in-service trainers, and educators in the German compulsory post-university trainee program for science teachers. From this action research network, three of the educators from the compulsory post-university trainee program for science teachers agreed to engage with their trainees in the TEMI-program.

In the main implementation part, TEMI Bremen will work with TEMI-partner-schools (see deliverable 2.3). Within the partner-schools groups of teachers from different science disciplines will participate in the TEMI program. The teachers from the partner-schools will participate in TEMI in cooperation with teachers from neighbor-schools in the local environment to form networks of teachers. With letters of intent the headmasters of the partner-schools will be informed and involved. With the offer to TEMI-partner-schools to help structuring a public presentation by students for open school events, parents and the public around the school will become informed about and involved in TEMI. Several of these co-operations are already initiated. Part of the

D2.1 Local stakeholder groups formed, with memberships and term of reference

teachers in the partner-schools is also involved in teacher in-service and trainee teacher education in science.

Aside from the stakeholders in science education, experts in drama and rhetoric shall be involved in the project. The project is officially acknowledged by the Bremen ministry of education and the Bremen-Oldenburg-Centre of science and chemistry teacher in-service training. Dissemination will be done regularly via the regional annual conference of the German science teachers association in Bremerhaven every November as well as with other professional science teacher bodies on other regional and national events

5.5. Ireland

In Ireland, like in the other TEMI partner countries there are a combination of different stakeholders. Many of the stakeholders have different roles and functions in their involvement in the TEMI project. The Irish stakeholders can be divided into 5 groups as follows:

Science Educators:

There are three levels of Science Educators involved in the TEMI project. These include Science Teacher trainers (Science Pedagogy lecturers) in the University of Limerick, pre-service Science teachers in the University of Limerick and in-service Science teachers from around Ireland.

The Science pedagogy lecturers can inform pre-service Science teachers about the 'TEMI approach' to teaching Science; using a mystery to engage pupils. Currently (Nov 2013) there are four pre-service Science teachers working on the development and trial implementation of TEMI lesson ideas. 6 cohorts of in-service Science teachers will be involved in the TEMI project Teacher Training and in-school delivery. By involving more than one teacher from each participating school (through the 6 cohorts), this will facilitate the cascade mechanism and sustainability of the TEMI teaching approach. E.g. Teacher 1 from School A participates in cohort 1, Teacher 2 from School A participates in cohort 2. Both teachers can support each other to sustain their implementation of the TEMI teaching approach.

Policy Makers:

The National Council for Curriculum and Assessment (NCCA) is a national body that oversees the curriculum development in Ireland. This body can support the teaching of the Irish curriculum content in an engaging manner for pupils.

The teaching approaches that will be used in this project (e.g. 5E's) will help to prepare teachers for the current changes in the Irish Science curricula and assessment.

The Inspectorate in the governmental Department of Education and Skills is responsible for the evaluation of primary and post-primary schools and centres for education. Inspectors also provide advice on a range of educational issues to school communities, policy makers in the Department and to the wider educational system. They provide an assurance of quality and public accountability in the education



D2.1 Local stakeholder groups formed, with membership and terms of reference

system. The Inspectorate is interested in using the findings and progress of the TEMI project to inform their decisions and policy.

Professional Development Associations:

The Irish Science Teachers' Association (ISTA) is the professional association for Irish Science teachers. The Professional Development Service for Teachers (PDST) is responsible for the delivery of continued professional development to Second-Level teachers in Ireland. Both of these associations will be able to be involved in informing and recruiting teachers (e.g. at the ISTA National conference) and in the dissemination of TEMI resources (towards the end of the project).

Researchers:

The National Centre for Excellence in Mathematics and Science Teaching and Learning (NCE-MSTL) is based in the University of Limerick. This centre is committed to the promotion of best practice in Science Education that is informed by literature. Researchers in this centre are involved in the TEMI project management and working group in the University of Limerick.

Industrial partners:

It is envisaged that some chemical and pharmaceutical companies will have a role as stakeholders in the TEMI project in Ireland. Companies such as Pharmaceutical Ireland have supported previous Science Education research projects with the University of Limerick. Good working relationships have been developed from previous collaborations.

To date (Nov 2013), some of these stakeholders have confirmed their involvement in the TEMI project. However, others have yet to be confirmed.

5.6. Israel

In the Israeli context, the group at the Weizmann Institute has experience in Inquiry-type activities. It is an integral part of the Israeli high-school science curriculum. Therefore, the Weizmann group will explore new teaching methods that stimulate student motivation in general and motivation towards enquiry in particular, by employing storytelling and other dramatic resources. This will be done by the "Engage" stage out of the 5Es: Exploring and producing scenarios that introduce an enquiry activity through an introductory mystery story.

The main stakeholders in the Israeli context will be:

The superintendents and of the science disciplines, in order to involve them in the project and promote its rationale and activities.

D2.1 Local stakeholder groups formed, with memberships and term of reference

- The National Centre of Science (Chemistry, Physics...) Teachers, which provides continuous professional development for science leading teachers.
- High school headmasters, in order to promote science learning in their schools.
- Science coordinators in schools, who are in charge in encouraging the professional development of the science teachers.
- In-service teachers, who participate in the training workshops. These teachers will be an integral part of the writing and design process of the mystery story activities. The group at the Weizmann Institute is based in the Department of Science Teaching which has an extensive tradition of holding continuing professional development workshops for science teachers from across the country. Many teachers participate in more than one training workshop and are in constant communication with the Department. These links will be utilized to recruit teachers for the TEMI professional development workshops. The activities prepared by the Weizmann team in cooperation with the teachers will include an appropriate mysterious experiment/phenomenon - something unexpected, that is counterintuitive and goes against the concepts which students learned. Teachers have to be aware of what students will expect based on their prior knowledge. They should collect, ask, observe and analyse students' ideas in order to adapt the level of the scenario. The story then leads to the high level of enquiry. The activities prepared by the Weizmann TEMI team as well as those prepared by the teachers will be shared in an internet site.
- A second group of stakeholders recruited by the Weizmann team are experts in storytelling and experts in education through drama. In order to be able effectively convey the mystery stories, we believe that the teachers should acquire some skills from the world of drama such as good storytelling. If teachers learn how to tell a story in an effective way, their students will be more engaged and should show higher motivation to learn. The purpose is not to train the teachers to be actors, but rather to use the 'teacher as an actor' metaphor in order to equip teachers with tools from the world of drama that may help them in their teaching.
- Graduate students at the Weizmann Institute who are involved in TEMI workshops.

5.7. The Netherlands

The Leiden team has experience with organising teacher trainings in collaboration with Pabo's (Teacher in Training Institutes). These institutes proved to have a large network which they can address with success. For TEMI we therefore also make use of teacher training institutes. To start with, we give workshops at a conference organised by the Werkgroep Natuurkunde-Didactiek; the Woudschoten conference for physics teachers in December 2013. Below we present a list of other stakeholders that are involved.



D2.1 Local stakeholder groups formed, with membership and terms of reference

- **ICLON** supports the educational part of Leiden University and is the link between secondary school and university. It has experience in giving workshops to university teachers and has a broad network of secondary schools, at which they help school students bridge the gap between school and university.
- Every university in the Netherlands has a **Wetenschapsknooppunt** – an office that brings scientific research results back into the educational loop, including the curricula of the first years of secondary school. Each Wetenschapsknooppunt has many contacts with schools.
- **NOVA** is the Dutch Research School for Astronomy and is the umbrella organisation of all (four) university astronomy departments in the Netherlands. They have experience with developing educational astronomy resources for secondary schools and links to many schools.
- **The Lorentz Centre** is situated at the science faculty of Leiden University and its mission is to coordinate and host science workshop.
- **Platform Beta Techniek** is a national organisation that aims to have more students choose a science education.
- We cannot forget **secondary schools** themselves. Since TEMI reimburses schools for the time their teachers are attending our trainings, especially school directors will be interested in our program. They will gain a better skilled teacher, without any costs. We plan to contact teachers indirectly, through the school board, instead of directly contacting teachers individually. This also means we reach more teachers per contact attempt.
- As part of the teacher trainings, we either hire a **storytelling expert** to teach this skill during the training, or make a video with a storytelling expert which we show during the training.

5.8. Norway

The Norwegian TEMI-group on HiVe works both with teachers, teacher students and practicing teachers (mentors) in our area of the country, and with teacher educators in science and policymakers at the national level. We have already held a plenary lecture followed by discussion at The National conference of educators in science in November 2013. The aim was to inform about TEMI and inquiry education, exchange experiences with colleagues and get ideas and contacts to ensure the implementation and dissemination of the key elements in TEMI. At the conference all key players in the science teacher education community were present, both professionals and organizations that are in close contact with politicians and the ministry. Organizer of the conference was The Norwegian Center for Science Education. The National Network for Teacher Education in Science also participated in the preparation and drafting of the program. These are two key institutions in relation to contact with the Ministry of Education and other policy makers. They are also the most important organizations in Norway in relation to the development of science education-resources for teachers and as leaders of the network for teacher educators in science.

D2.1 Local stakeholder groups formed, with memberships and term of reference

At this conference it was already decided that the work of TEMI or the central elements of inquiry education, will get a place at next year's conference. We will continue to work with both of these organizations.

We also have aim that the different cohorts will form the basis for the formation of networks between teachers of science in schools in the different municipalities we involve. We therefore wish to work with local resource center, resource persons and scientists. Horten nature center is a centrally located center in our area frequented by many schools every year. It is important to get this center and other contributors to take lessons from TEMI and implement our methods in their work. This way we may cooperate and have a dissemination of the methods in TEMI after our courses and the project are completed.

We must also seek cooperation with experts for input of theory and to the development of our courses. Some we have made an agreement with but we think it is best that we and our partner teachers, students, and training teachers, may jointly define the varying needs as TEMI develops. Therefore we may add new resource persons as the project progresses and new needs and desires arise.

Hopefully, also the development of TEMI by our cooperation partners in other countries will provide ideas and input to scientific and didactic elements that will be useful for us.

To disseminate knowledge and information, we want to increase focus on knowledge of the publishing of science and inquiry education. For this purpose we will use a very experienced journalist who also has received an award for good writing and effective dissemination of science. He has for many years worked in the Norwegian Broadcasting Corporation and as editor of "forskning.no" (research.no) an online science journal.

Telling a story is no easy matter. There is a reason why some actors are preferred more than others for these tasks. A teacher should engage their students. That's the key dissemination in the context of TEMI and inquiry teaching. A teacher stands at the scene in the classroom every day, but as we all know, not all teachers master this role as well as we could wish. Most of us have something to learn. We want to bring in one or various skilled and professional actors from the theater world. Professionals that can teach the basics in how to tell a story so it engages the pupils. The teachers shall learn to tell a story in a way so the pupils get engaged and want to find out how the story continues. Learning to tell a story so that it arouses curiosity. For this work we need the help of professional instructor.

Finally, we believe it is very important to get long-term effects that we do not only involve teachers, but also the rector of the schools. Principals must feel a responsibility and obligation to continue our work, providing time for teachers so that they can continue their development and involving new colleagues.

The Rector is also in direct contact with the administration and politicians, and may thus influence the development, for example in the selection of continuing education



D2.1 Local stakeholder groups formed, with membership and terms of reference

courses for teachers. Therefore, the principals are important resource we want to involve.

5.9. United Kingdom

In England, TEMI is operating within a well-established and national infrastructure to support and enhance the quality and impact of science teachers' professional development. Therefore, apart from the science subject leaders and classroom teachers who are participating in the TEMI initiative, our most important stakeholders are MyScience (the National Science Learning Centre) and the five regional Science Learning Centre Consortia. This network currently offers high quality science continuing professional development (CPD) for teachers and technicians working with pupils aged 5 to 19. One of these regional consortia (DHYNE) is co-located within the Centre for Science Education at Sheffield Hallam University. Through the national and regional networks, there is potential to promote and recruit to TEMI. Therefore, we are currently working directly with this stakeholder to implement TEMI in several locations across the country over the 3 years of the project.

However, the CPD programme offered by this network is already extremely comprehensive, flexible and accessible. Teacher participation is often supported with financial incentives to release teachers from the classroom. As such, to ensure long-term engagement in TEMI, our CPD programme needs to be appropriately positioned and unique. This will be achieved by profiling the four TEMI innovations, highlighting the added value of combining quality CPD with effective contemporary curriculum materials and by keeping abreast of the relevant needs of the UK science curriculum and science education community. Furthermore, in the pilot phase, we have attempted to position TEMI, as one of the innovative ways towards becoming an 'outstanding teacher' – a requirement of the UK school inspection system.

The Centre for Science Education, is now based within the new Sheffield Institute of Education (SIOE) and works closely with other CPD providers, including learned societies (such as the Royal Society of Chemistry and the Institute of Physics), Examination Boards and Charitable Trusts – many of which are also providers of science CPD. We will endeavour to systematically introduce TEMI into these stakeholders groups and consult as necessary. For the development of the prototype workshop, we engaged with research scientists from the Department of Astronomy at the University of Sheffield, a science communication expert, and a programme leader in Science Initial Teacher Training. The research scientist developed and delivered an 'expert scientist' input on day 1, which enabled us to emphasise how the TEMI enquiry approach is reflected and practiced in authentic contemporary scientific research.

In 2014, we will formally establish this wider group of stakeholders, in order to further inform and evaluate the TEMI programme as it is rolled out, developed and evaluated. The intention is to ensure that TEMI builds on established good practice and becomes embedded within the UK science education community. In addition to the stakeholder members already engaged, this group could potentially include: representatives from:

- science subject leaders networks (Heads of Science from secondary schools)

D2.1 Local stakeholder groups formed, with memberships and term of reference

- subject associations (Association of Science Education, ASE)
- learned societies (IOP, RSC, Society of Biology)
- Higher Education Initial Teacher Trainer providers (e.g. University of Leeds, London Institute of Education)
- Teaching Schools/Academy Chains (key influencers in recent CPD policy changes towards school-led teacher training and CPD)
- Teacher practitioners (TEMI innovators and ambassadors)

6. Stakeholders: how to recruit them?

TEMI communication strategy shall stress the clear benefits that TEMI will bring in everyday science teaching practice in order to engage relevant stakeholders.

Taking into account what has been indicated by the various partners, it can be noted that our primary stakeholders are teachers. TEMI key messages should stress that TEMI trainings will be able to answer teachers' concrete needs and objectives; we need to make teachers aware that our results are validated practices, easy to use and that can bring an improvement in students' knowledge. We need to be perceived as competent, experienced and trustworthy trainers who are able to provide support to teachers to overcome local barriers to IBSE, to provide lessons examples and educational material.

Our secondary stakeholders are:

- Science educators;
- Science education researchers;
- Project managers in science education;
- EC Project officers and advisors of policy makers;
- Educators;
- Science communicators and professionals from science museums;
- Students;
- Students families;
- Media and publishers.

Secondary stakeholders will amplify the consortium effort to reach teachers and facilitate the introduction of IBSE methodology and in particular our mystery approach in teaching practices.

TEMI aims at implementing a dissemination model which involves the target audience which in its turn will play an active role in dissemination actions. Every single stakeholder has to be engaged with different tools and actions and in different contexts. It is therefore important to identify our main stakeholders in order to maximize the dissemination effort. To facilitate the implementation of a communication strategy, we grouped TEMI stakeholders according to 2 criteria: power and interest. With "power" we refer to the actual possibility to implement IBSE; with "interest" we refer to the direct interest of a stakeholder to support a change in the science teaching methodologies.

D2.1 Local stakeholder groups formed, with memberships and term of reference

- High powered, high interested stakeholders: to support and follow closely

Science educators, Science education researchers, Educators, Project managers in science education

- High powered, low interested stakeholders: to keep informed

EC Project officers, Advisors of policy makers, Media and publishers

- High interested, low powered stakeholders: to establish a dialogue

Students, Science Communicators and professionals from science museums

- Low powered, low interested stakeholders: to monitor

Students families

As mentioned, each stakeholder or group of stakeholders has to be reached and engaged with adequate and relevant tools.

Stakeholder(s)	Tool/activity
Teachers (primary stakeholder), Science educators	Teacher's journals, magazines and websites (i.e. Scientix, Science in school, Teacher online), Repositories (i.e. Merlot, Thinkfinity, Changetheequation), Teachers conferences, seminaried and workshops organised by TEMI and other actors, existing teacher's networks (i.e. Comenius, local science teachers associations), social media and virtual learning environments, TEMI website, brochures and flyers
Science education researchers	Science education conferences (eg. ESERA), science education journals, books
Educators	General education conferences (i.e. ECE)
EC Project officers, Advisors of policy makers	Professional meetings, professional networks, dedicated conferences, face-to-face events
Project managers in science education	Professionals IBSE networks and conferences (i.e. PROFILES project), TEMI website, reports, word of mouth



D2.1 Local stakeholder groups formed, with membership and terms of reference

Stakeholder(s)	Tool/activity
Media and publishers	Press releases, reports, media products, interaction with local press offices
Students	Viral communication initiatives, Social networks, science fairs and festivals, Open days, Focus groups at school
Science communicators and professionals from science museums	Science communication conferences and meetings (i.e. ECSITE, JIES), science communication journals (i.e. JCOM, PUS - Public Understanding of Science)
Students families	Science fairs and festivals, Parents associations

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