



**Project No.:** 244749

**Project Acronym:** ESTABLISH

**Project Title:** European Science and Technology in Action:  
Building Links with Industry, Schools and Home

## Work Package 8 | Deliverable 1

### D8.1 Final Report presenting the nature and success of the dissemination strategy

**Dissemination Level:** Public

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**Name of Coordinator:** Dr. Eilish McLoughlin

**Name of lead partner for this deliverable:** JU

**A. Background to this report**

This report is a deliverable of Work Package 8 (WP8) of the European FP7-funded project “European Science and Technology in Action: Building Links with Industry, Schools and Home” (ESTABLISH; 244749, 2010-2013). It meets the requirements of this deliverable by presenting through a series of case-studies the nature of the dissemination adopted and implemented by ESTABLISH beneficiaries (Table 1) in the participating countries.

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**Table 1: The ESTABLISH consortium**

<b>Beneficiary short name</b>	<b>Beneficiary name</b>	<b>Country</b>	<b>Abbreviation</b>
DCU	DUBLIN CITY UNIVERSITY	Ireland	IE
AGES	AG EDUCATION SERVICES	Ireland	IE
UmU	UMEÅ UNIVERSITET	Sweden	SE
JU	UNIWERSYTET JAGIELLOŃSKI	Poland	PL
CUNI	UNIVERZITA KARLOVA V PRAZE	Czech Republic	CZ
AL	ACROSSLIMITS LIMITED	Malta	MT
UPJS	UNIVERZITA PAVLA JOZEFA ŠAFÁRIKA V KOŠICIACH	Slovakia	SK
UTARTU	TARTU ULIKOOL	Estonia	EE
UNIPA	UNIVERSITA DEGLI STUDI DI PALERMO	Italy	IT
MaH	MALMÖ UNIVERSITY	Sweden	SE
IPN	LEIBNIZ-INSTITUT FÜR DIE PÄDAGOGIK DER NATURWISSENSCHAFTEN UND MATHEMATIK AN DER UNIVERSITÄT KIEL	Germany	DE
CMA	CENTRE FOR MICROCOMPUTER APPLICATIONS	Netherlands	NL
MLU	MARTIN LUTHER UNIVERSITÄT HALLE-WITTENBERG	Germany	DE
FU	FREDERICK UNIVERSITY	Cyprus	CY

# Table of Contents

Executive Summary .....	2
Introduction.....	3
ESTABLISH's Dissemination Strategy .....	3
Strategies for communicating at local level .....	5
Strategies for communicating at international level.....	6
Evidence of Dissemination .....	7
Range of Dissemination Activities .....	7
Quantity of Dissemination Activities .....	8
Formats of Dissemination Activities.....	14
Case-studies.....	17
Impact.....	38
Success breeds success .....	39
Conclusion .....	40
Appendix.....	42

## Executive Summary

The overall objective of the ESTABLISH project has been to facilitate and implement an **inquiry-based** approach to **science education** (IBSE) for second level students (age 12-18 years) on a widespread scale across Europe bringing together, within a collaborative environment, the stakeholder in science education. It has heavily focused on dissemination to, not only, generate an increased awareness but, also to engage audiences so as to bring about a change (increased implementation of IBSE) in the way that science is taught in school throughout Europe.

The variety of levels of dissemination as well as the multiple tools or channels available to conduct this dissemination required planning at both project level and at national level to maximise the impact of ESTABLISH.

ESTABLISH has focused primarily on teacher education and so the initial level of dissemination (and recruitment) has been at the national teacher level. ESTABLISH, however, has sought to look beyond the classroom, to inform and engage all the stakeholders in science education, so as to create a supportive environment for bringing change in the way that science is taught in schools. Thus there have been overlaps with other work-packages which have focused and reported on the engagement of stakeholders (D2.3).

Different dissemination channels have been used throughout the project depending on particular audiences and contexts. For example many ESTABLISH beneficiaries have conducted workshops to engage teachers, with the result that ESTABLISH beneficiaries have conducted over 100 workshops and reached an audience of over 4000 participants. These workshops have been significant for the recruitment of teachers to participate in the ESTABLISH Teacher Education Programme. Also ESTABLISH beneficiaries have participated in 253 oral contributions or workshops at national and international conferences. The quality of these contributions has been recognised by conference organisers with invitations issued for ESTABLISH representation at future conferences, such as GIREP 2014, ECRICE 2014 and NARST. Thus the impact of ESTABLISH will continue to grow beyond the life-time of the project.

ESTABLISH has sought to enhance its dissemination efforts and activities when possible. Again as an example, the teachers who were engaged at national level were invited and facilitated to attend the international Science and Mathematics Education Conference hosted in conjunction with ESTABLISH. Here they were given the opportunity to learn and also to inform the science education community as well as one another of their experiences of implementing IBSE in the classroom. This has been a very positive outcome of the project, enabling teachers to see their value and position in increasing scientific awareness and knowledge in younger generations.

This report presents a summary of the project's dissemination objectives, targets, and approaches as used during the lifetime of the project. Additionally a number of case-studies are included to describe in detail particular approaches which beneficiaries found successful and useful in promoting the project's objectives.

Overall, the core concept for success in bringing a change to promote and facilitate the implementation of IBSE has been the continuous engagement with and between the key stakeholders in STEM education, at regional, national or international level.

## Introduction

### Role of dissemination activities in the ESTABLISH Project

The overall objective of the ESTABLISH projects is to facilitate and implement an inquiry-based approach to science education for second level students (age 12-18 years) on a widespread scale across Europe bringing together, within a collaborative environment, the stakeholder in science education. To achieve this objective requires communication and engagement with many different groups and using varied means. Specifically the objectives of this work-package focus on:

- **O8.1** Reaching a wide audience of stakeholders/special interest groups for the maximum propagation of the conduct, implementation and outcomes of this project.
- **O8.2** Engaging in presentations/workshops/conferences at national, European and international level to share project process/outcomes and examples of best practice.
- **O8.3** Publishing articles/reports in journals, newsletters, newspapers, at national, European and international level to share project process/outcomes and examples of best practice.

To disseminate literally means to ‘send out’ or broadcast information (Latin *disseminare* to sow, to spread abroad<sup>1</sup>) To disseminate information on ESTABLISH is an attempt to raise awareness about the project among the audiences or stakeholders targeted by the project – teachers, policy makers, parents etc.

This dissemination is central to the project, with all work packages contributing towards and also benefiting from these efforts. The regular dissemination of progress and know-how to special interest groups across Europe on the use of inquiry based teaching methods, as mentioned is one of the main goals of that project.

The purpose of this report is to offer a systematic description of the planning and execution of the dissemination strategies adopted by the ESTABLISH consortium partners, together with the presentation, through a series of case-studies to illustrate the outcomes of these activities.

## ESTABLISH’s Dissemination Strategy

Dissemination activities have been a central part of the ESTABLISH project. To maximise the impact of the dissemination a plan was proposed, whereby efforts and implementation would take firstly at a local (national) scale and secondly a larger (European and international) scale so as to enable the knowledge to be shared in a constructive and engaging manner beyond the boundaries of the consortium partners.

A convincing plan for the regular dissemination of progress and know-how to special interest groups (e.g. parents' associations, teachers' networks, curricula developers, and policymakers) has been developed. Various group of stakeholder communities were involved at all stages of the Project (see D2.3).

The Project dissemination strategy was to be realised by following activities and action (Fig.1):

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<sup>1</sup> <http://www.merriam-webster.com/dictionary/disseminate>

- generating links with strategic groups within a country, and internationally where applicable.
- agreeing to adhere to a strategy for promoting best teaching practice of IBSE through the local dissemination links.
- designing a plan for dissemination involving the stakeholders which take into account the national circumstances and local industry. The national dissemination plans for the participating countries identified the relevant national stakeholders/strategic partners that were targeted for this project and the journals/publications and conferences/workshops that partners were contributed to for the dissemination and promotion of this project.
- utilisation of the networking strengths in order to maximise the dissemination and publicity of this project. Such linkages include international bodies, national programme boards and national associations of teachers, parents, students, researchers e.g. Czech & Polish Chemical Societies,.
- developing an e-platform to facilitate communication between all stakeholders, developed by partner Across Limits (AL)
- dissemination of ESTABLISH in national and international journals, newspapers, magazines as described in the National Dissemination Plans
- dissemination of ESTABLISH at local/national workshops/summer schools for in-service and pre-service teachers.
- dissemination of ESTABLISH to the Ministries for Education and Science in each country through forums with both industry and policy makers present to discuss and debate ISBE and to contribute to its wider implementation.
- organising a large-scale European conference for in-service and pre-service teachers,
- dissemination findings at international teacher/science education conferences.

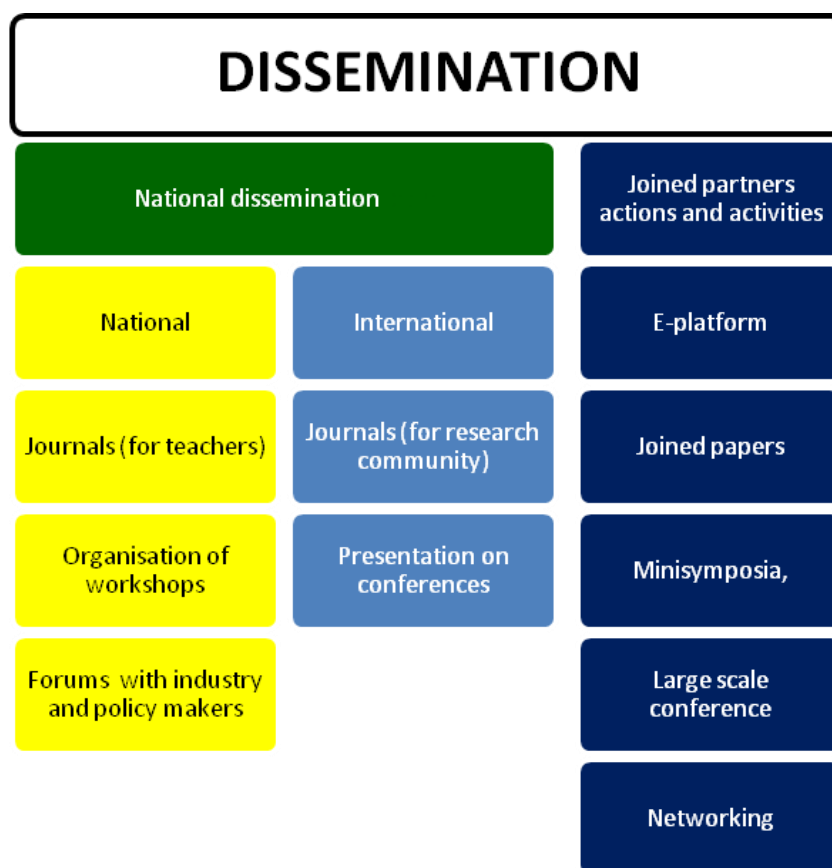


Fig 1. Dissemination strategy

### Strategies for communicating at local level

Local strategies depend heavily on the situation in the particular country: the identified groups of stakeholders who have a special impact on the system and methods of education, traditional contacts and opportunities to develop new dissemination channels etc. However, it can be said that the main channels were: magazines, newsletters and conferences of science teachers associations and teachers training centres.

For example:

- In Sweden Nordic conference on Science education, national network for technology teachers and teacher educators as well as national resource centres for Biology and Biotechnology, Chemistry and Physics were targeted.
- In Poland a journal for chemistry teachers “Niedziałki” edited/published by a partner institution was planned to be use in dissemination process. Also, partner’s and one of publishing school textbook for chemistry teachers houses were used to promote and present project’s materials. Community of chemistry researchers and educators were informed about the project through presentations on annual meetings of Polish Chemical Society and its journal Orbital.
- In Czech Republic policy makers and science education experts were planned to be influenced by direct contacts by participation in common expert teams.



- In Malta the partner planned to organise dissemination via partner's website and monthly newsletter as well as the NGO "the Foundation for Women Entrepreneurs (Malta)" of which they were founder-members.
- In Slovakia regional school centres and science teachers festivals we planned to be involved in dissemination process.

The network of context-based learning was planned to support dissemination and testing units developed in the framework of the project in Germany.

Other considerations are the various levels of influencing power held by the different categories of stakeholder and the timescale necessary to exert such influence. For example, policy makers can exert great influence but it usually takes a long time to change policy and produce new syllabi or regulations. Parents can also exert influence but probably on their children's choice of school subjects rather than on teaching methods. It is difficult to avoid the conclusion that teachers and school management should be targeted as the main immediate stakeholders.

### Strategies for communicating at international level

All ESTABLISH partners were dedicated to the development, dissemination and use of project results internationally to a wider community and will contribute to relevant international journals, conferences and symposia, during the duration of the project such as:

#### 1. International Journals:

- Science Education International (ICASE)
- International Journal of Science Education
- Research in Science Education.
- European Journal of Physics
- The Physics Teacher
- Physics Education
- Chemistry Education
- The Physics Teacher,
- School Science Review

#### 2. International Conferences and websites:

- Groupe International de Recherche sur l'Enseignement de la Physique (GIREP) – August 2010; August 2011; July 2012
- European Conference on Research in Chemical Education (ECRICE) – August 2010
- European Conference on Educational Research (ECER) - September 2010; September 2011; September 2012
- International Organization for Science and Technology Education (IOSTE) - September 2010; September 2012
- Science and Mathematics Education Conference by CASTeL at DCU - September 2010
- European Science Education Research Association (ESERA) - August 2011; August 2012; September 2013
- Science and Mathematics Education Conference by CASTeL at DCU - September 2012

## Evidence of Dissemination

In this section we present evidence that the specific objectives of this work-package have been addressed and describe the outcomes of these actions. Following an overview of the range, quantity and formats of the ESTABLISH dissemination activities, we present a number of descriptive case-studies showcasing the variety of dissemination activities used during the lifetime of the project.

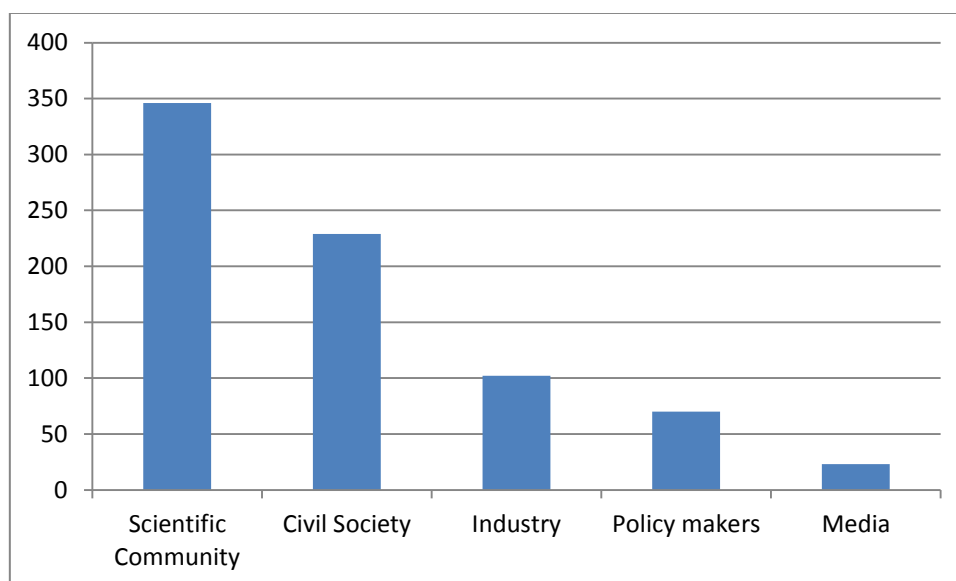
### Range of Dissemination Activities

**Reaching a wide audience of stakeholders/special interest groups for the maximum propagation of the conduct, implementation and outcomes of this project.(O8.1)**

In each partner's country consortium members reached a wide audience of stakeholders for the maximum propagation of the conduct, implementation and outcomes of this project. According to the SESAM platform following categories of stakeholders have been approached: scientific community (higher education, research), industry, civil society, policy makers and medias.

In the case of ESTABLISH Project 'civil society' includes: teachers, teachers educators, school management, parents, curricula developers and assessment agencies. Scientific community consists of two different groups: science education researchers and those dealing with natural sciences: biologists, physicist, chemists.

Generally speaking all partners directed their activities to all stakeholders with many activities appropriate for mixed audiences. These include: 346 dissemination activities for scientific community (the most active partners - CUNI, CMA, IPN and UNIPA), 229 towards civil society, especially JU and UMEA, 102 for industry, 70 - policy makers as represented in Fig.2. Beneficiaries often used those channels that were most familiar to them. As many of these were sourced from the science research community, it was expected that many of the activities were also appropriate for the scientific community.



*Fig. 2 Distribution of dissemination approaches towards various target group*

In other cases the SME's have been prominent in conducting more of the industry-type activities, for example AGES hosting 51 meetings with various industrial partners such as Bord Gais Networks, Boston Scientific, Cordis, CRH, Novartis, Leo Pharma, Pfizer, TEVA. Recommendations for cooperation with industry are described in the case-study No 1.

The networking activities during the ESTABLISH project have enabled the development of fruitful collaborations between education and industry. As an example, due to their activities in the project, MLU have begun a collaboration with the largest German publisher of schoolbooks (Klett-Verlag, Stuttgart). This collaboration has led to further national and international invitations to participate in promotion and research of STEM education with further details available in case-study no. 7.

Several national and international networks have supported the dissemination of ESTABLISH ideas and outcomes European Chemistry Thematic Network Association (ECTNA), International Council of Associations for Science Education (ICASE), The International Organization for Science and Technology Education (IOSTE), European Science Research Association (ESERA),– via their web pages, Newsletters, mailing lists etc. Also national programme boards and national associations of teachers, parents, students, researchers e.g. Czech & Polish Chemical Societies were involved. The way of involvement of NGOs in dissemination among particular group of stakeholders is described in Case 2.

### Quantity of Dissemination Activities

**Engaging in presentations/workshops/conferences at national, European and international level to share project process/outcomes and examples of best practice. (O8.2)**

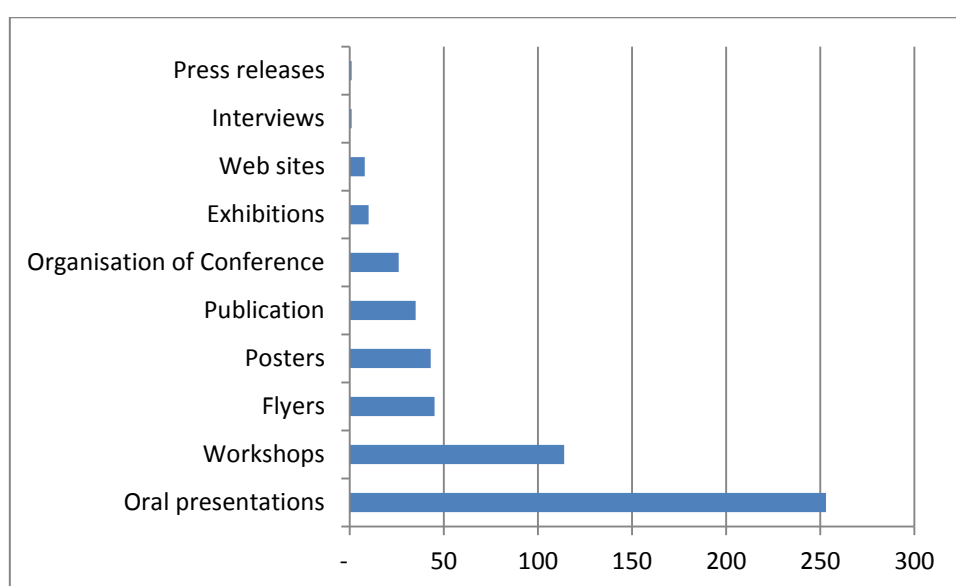
IBSE and Project deliverables were presented by partners or multinational groups of partners at international teacher/science education conferences, in the form of posters, oral presentations, mini-symposia, for instance,:

- Groupe International de Recherche sur l'Enseignement de la Physique (GIREP) – August 2010, 2012, 2014
- European Conference on Research in Chemical Education (ECRICE) – 2010 (Krakow), 2012 (Rome), 2014
- International Organization for Science and Technology Education (IOSTE) conference – 2010 (Bled), 2012, 2014
- Science and Mathematics Education Conference by CASTeL at DCU - September 2010, 2012, 2014
- European Science Education Research Association (ESERA) –2011 (Lyon), 2013 (Cyprus)
- Meeting of DivCEd EuCheMS (European Association for Chemical and Molecular Sciences) 2010,2011,2012
- ECTNA (European Chemistry Thematic Network Association) annual meetings
- ICASE (International Council of Associations for Science Education) conference – 2010 (Tartu), 2012, 2014
- ICCE (International Conference on Chemistry Education) 2010 (Taipei), 2012 (Rome)

- ICPE (International Conference on Physics Education) 2011, 2013
- MPTL (Multimedia in Physics Teaching and Learning) workshops, 2010, 2011, 2012
- European Conference on Educational Research (ECER) - September 2010, 2011, 2012
- ICTE (Information and Communication technologies in Education) Rožnov p. Radhoštěm, Czech Republic
- SCO (Sharable Content Object) Brno, Czech Republic

It means that most important international conferences in the years 2011-2013 were covered.

The classification in various into categories is not simply due to a change of their description in SESAM system in the course of the project (Fig.3).



*Fig.3 Distribution of various types of dissemination channels*

Project partners engaged in 253 oral presentations at national and international level.

All partners were engaged in workshops and conferences at national, European and international level to share project process, outcomes and examples of best practice. Among them the most active were: IPN, MAH & UMEA, CMA, DCU and UNIPA. Workshop targeted smaller audience such as 15-30 people, while conferences organised by partners up to 240 participants. All together 114 workshops and 26 conferences have been organised.

ESTABLISH has sought to enhance its dissemination efforts and activities when possible. For example, the teachers who were engaged at national level were invited and facilitated to attend the international biennial Science and Mathematics Education Conference (SMEC 2012) which took place on 7-9<sup>th</sup> June 2012 in Dublin City University, Dublin, Ireland, hosted in conjunction with ESTABLISH. Here they were given the opportunity to learn and also to inform the science education community as well as one another of their experiences of implementing IBSE in the classroom. This has been a very positive outcome of the project, enabling teachers to see their value and position in increasing

scientific awareness and knowledge in younger generations. Further details of this major dissemination event are described in case-study no. 3.

ESTABLISH project was also disseminated beyond the borders of the European Union. For example based on the contract between Charles University and North-east Federal University of M. K. Ammosov in Yakutsk, beneficiaries visited this university from 18th to 25th May 2013. During this stay, a total of 3 seminars were made- for university teachers (about 25 people) for university students (about 40 people) for a high school teacher (about 15 people) about the ESTABLISH project. Those presentations were really interesting for the participants and it was much discussed afterwards.

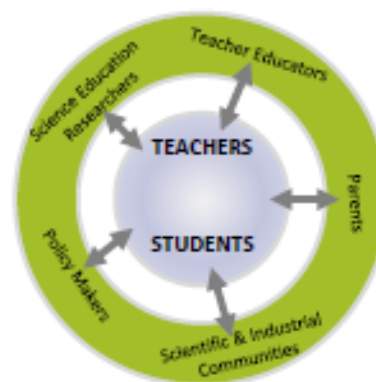
During a project period two leaflets and three common posters have been designed (Fig.4-6). The first items/editions described general idea, goals and plans, while the last – Project outcomes. Several partners designed their own posters, some of them in national languages.



## European Science and Technology In Action Building Links with Industry, Schools and Home

Inquiry-based teaching is an organized and intentional effort on behalf of a teacher to engage students in inquiry-based learning. The goal of inquiry teaching is not solely to transfer scientific knowledge, facts, definitions, and concepts, but rather to enhance students' ability to reason and to become independent learners who are capable of identifying main questions and find relevant answers by a gradually acquisition and expansion of a body of scientific knowledge and abilities. It is a student-centred approach to science learning and a range of types of inquiry activities exist which correspond to the degree of teacher's guidance and student independence involved. This project is based on the work of the FP7 ESTABLISH project, which involves a consortium of over 60 partners from 11 European countries.

The objective of ESTABLISH is the dissemination and use of an inquiry-based teaching method for science with second level students (age 12-18 years) on a large scale in Europe by creating authentic learning environments, involving all stakeholders to drive change in the classroom.



Bringing together the stakeholders to influence classroom practice



### FP7 ESTABLISH Beneficiaries

Country	Institution	Project Steering Committee
Ireland	Dublin City University (DCU) (Coordinator)	Dr. Eilish McLoughlin Dr. Odilia Räsänen Dr. Sarah Brady
Netherlands	AG Education Services (AGED) Centre for Microcomputer Applications (CMA)	Ms. Anna Gehrigs Prof. Ton Glemmelaar Dr. Eva Kadiwiler Prof. Nico Valandes
Cyprus	University of Cyprus (UCY)	
Sweden	University of Umeå (Umeå)	Dr. Christina Ottander Dr. Margareta Sjöberg
Poland	Malmö University (Malmö)	Dr. Iwona Maciejowska
Czech Republic	Jagiellonian University (JU)	Prof. Lech Dwořak
Malta	Charles University (CUN)	Prof. Hans Čížek
Slovakia	Acronix Units (AU)	Ms. Maryrose Rendos
Estonia	Universita Pavla Jozefa Šafárika v Košiciach (URP)	Dr. Martin Kineš
Italy	Taranta University (TARANTU)	Prof. Milla Kinnikila
Germany	Università degli Studi di Palermo (UNIPA)	Prof. Claudio Reda
	Carl von Ossietzky-Universität of Oldenburg (COUO)	Dr. Julia Michaelis
	Leibniz Institut für die Pädagogik der Naturwissenschaften und Mathematik an der Universität Kiel (IPN)	Dr. Ilka Pechmann
	Martha Luther Universität Halle-Wittenberg (MLU)	Prof. Martin Linder



Fig. 4 Introductory poster



## ESTABLISH project - teaching and learning units

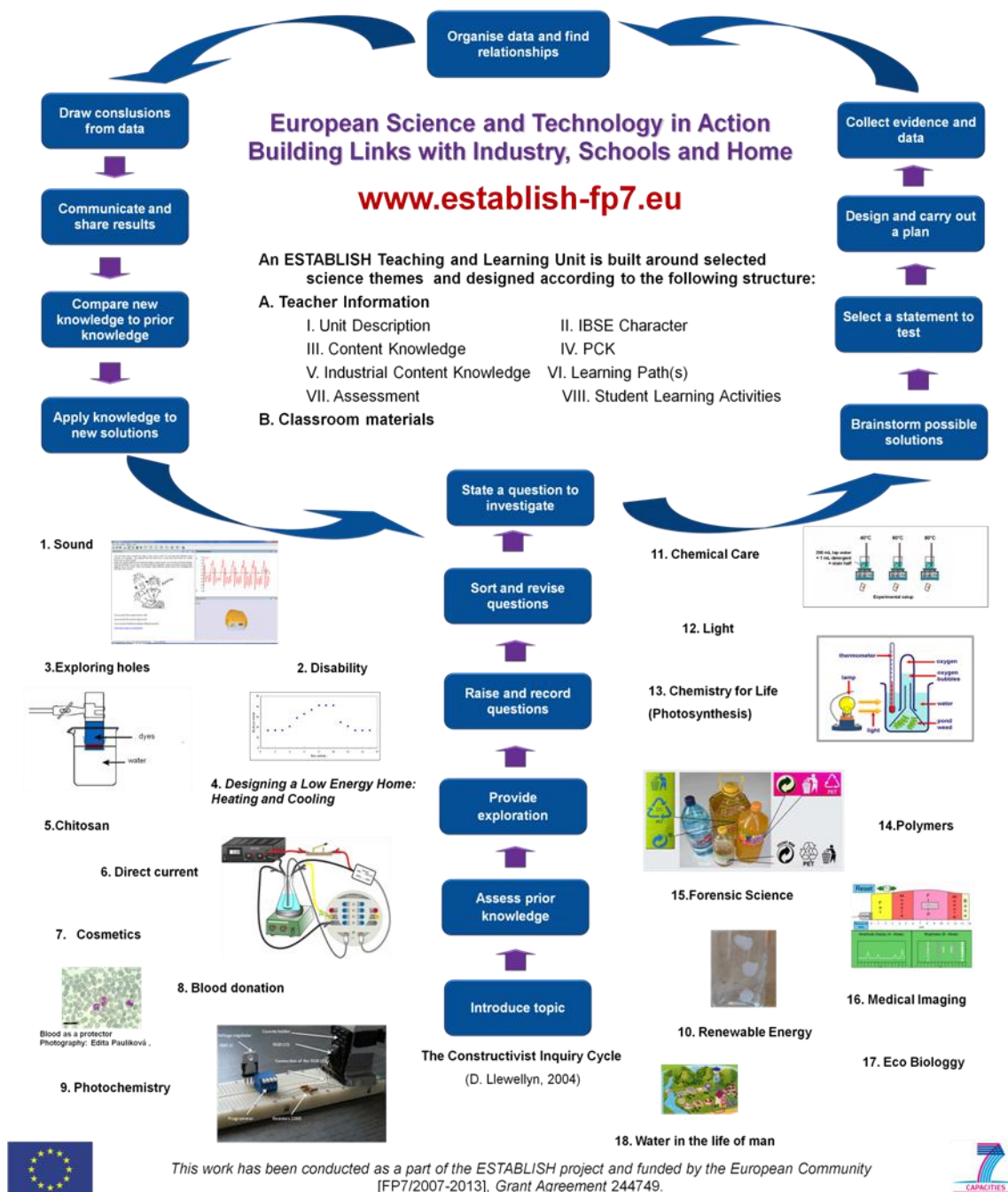


Fig.5 Outcomes Poster



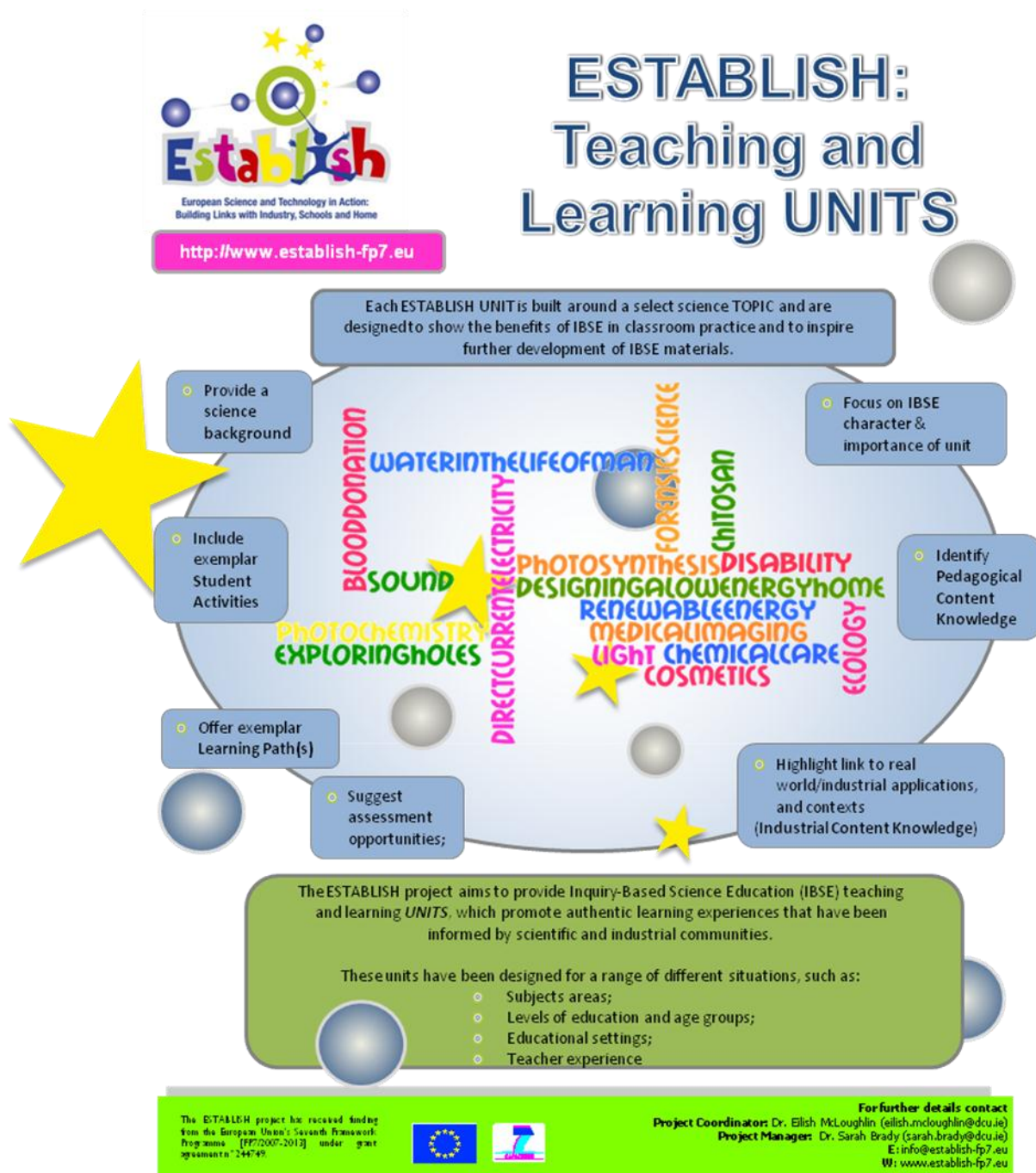


Fig. 6 Poster – learning units



## Formats of Dissemination Activities

**Publishing articles/reports in journals, newsletters, newspapers, at national, European and international level to share project process/outcomes and examples of best practice.” (O8.3)**

### Print Media

All partners published in printed form 35 articles, reports in journals, newsletters, newspapers, at national, European and international level to share project process, outcomes and examples of best practice. They were addressed to science teachers in e.g. Physical Sciences Magazine (DCU), Biologia w szkole, Chemia w szkole, Nauczanie Przedmiotów Przyrodniczych or planned for international scientific community in e.g. European Journal of Physics, American Journal of Physics, Chemistry-Didactics-Ecology-Metrology. In addition 41 papers in conference proceedings have been published as well as academic books and chapters focused on national contexts, including:

1. URBANOVÁ, K., ČTRNÁCTOVÁ, H. Didactic presentation as an instrument of enhancing science teaching clarity [in:] Research in Didactics of the Sciences . Pedagogical University of Kraków , 2010, 121- 125
2. Maciejowska I., Konsorcjum ESTABLISH, IBSE jako najbardziej modna strategia edukacyjna, Dydaktyka chemii (i innych przedmiotów przyrodniczych) od czasów alchemii po komputery, [w:] Redakcja: Małgorzata Nodzyńska PEDAGOGICAL UNIVERSITY OF KRAKÓW KRAKÓW, 2011, 73- 79,
3. Mária Ganajová et a. Implementácia IBSE metódy do prírodovedného vzdelávania na Slovensku [in:] Badania w dydaktykach nauk przyrodniczych (Research in didactics of the science), Pedagogical University of Kraków, 2012, 28-31
4. Paweł Bernard, Anna Białas, Paweł Broś, Małgorzata Krzeczowska, Iwona Maciejowska, Ewa Odrowąż, Elżbieta Szostak, ESTABLISH Consortium, ESTABLISH – Innovations in Teacher Training in Poland [w:] "Science-Society-Didactics", K. Potyrała & E.Rożej-Pabijan (ed.), Wydawnictwo Naukowe UP Kraków, 2013, 35-49
5. Nauczanie przedmiotów przyrodniczych kształtujące postawy i umiejętności badawcze uczniów, red. I.Maciejowska & E. Odrowąż, Wydział Chemii UJ, Kraków 2012, 180 pages, 500 copies
6. Nauczanie przedmiotów przyrodniczych kształtujące postawy i umiejętności badawcze uczniów. Część 2, red. I. Maciejowska, E. Odrowąż, Wydział Chemii UJ, Kraków 2013, 272 pages, 500 copies
7. Under the State Pedagogical Institute in Bratislava the book: Inquiry activities in science education is in preparation. Publication will be ready before the end of June and send to each secondary school in the country.

### On-line Media

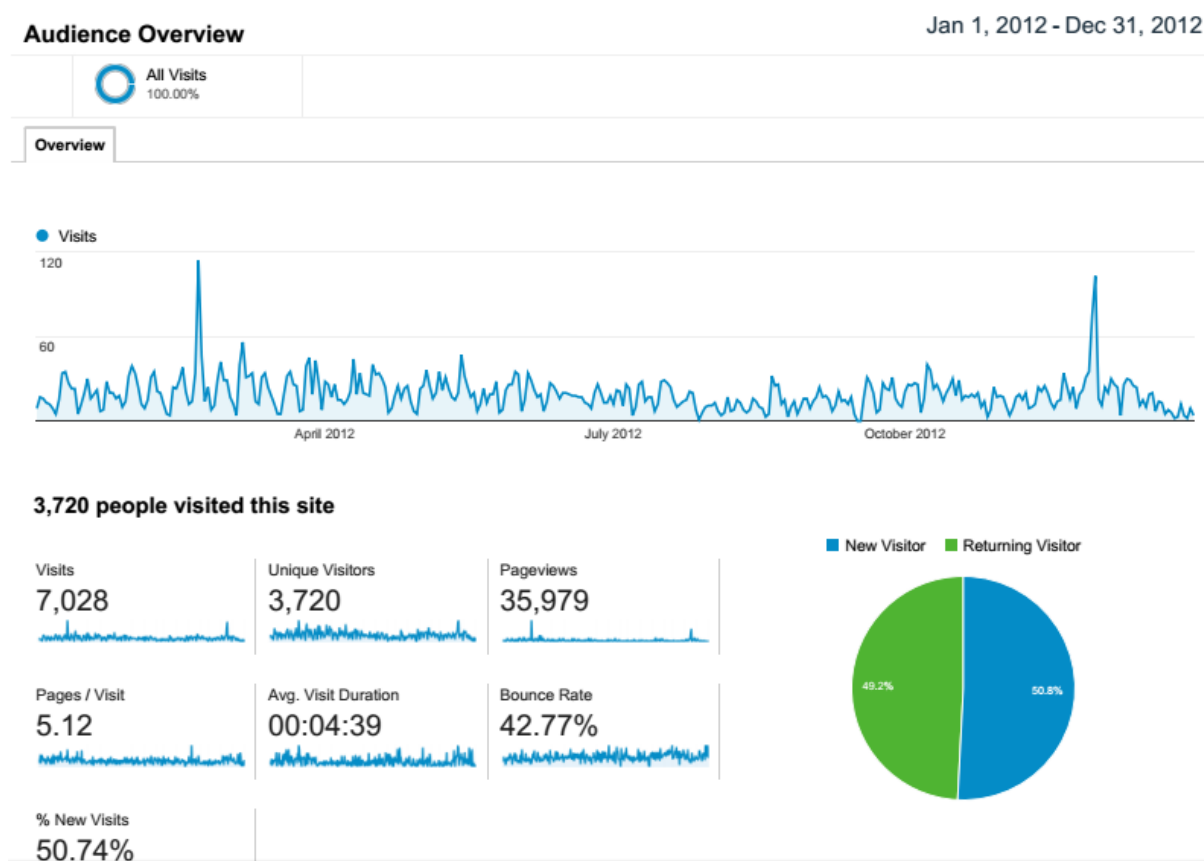
Also on-line publications were prepared e.g. Science in School - <http://www.scienceinschool.org/2011/issue21/polymers>,

as well as papers on partners' home pages and Newsletters (Acrosslimits Newsletters, CMA Newsletters):

- DCU - <http://www4.dcu.ie/news/2010/jan/s0110h.shtml>
- JU- [http://www.zmnch.pl/index.php?option=com\\_content&view=article&id=55&Itemid=49](http://www.zmnch.pl/index.php?option=com_content&view=article&id=55&Itemid=49)
- CMA - <http://cma-science.nl/english/projects.html#ESTABLISH>
- IPN - [http://www.ipn.uni-kiel.de/abt\\_chemie/ESTABLISH.html](http://www.ipn.uni-kiel.de/abt_chemie/ESTABLISH.html) ,
- AL - <http://www.acrosslimits.com/index.php/all-projects-list/8-projects/78-ESTABLISH> .

### Project website

Information on training opportunities and events organized within the projects were available in due time to the platform, and the partners contributed to the applicable sections of the platform (news, fora, activities, teaching materials, events, reports, etc). Project website has been developed by Across Limits Malta. The total number of visits increased from 934/year in 2010 to 7028/year in 2012 (see Fig.7)



*Fig.7 Project website audience overview*

ESTABLISH project URL was linked from various national and international websites such as:

- Department of Chemistry Education, Jagiellonian University  
[http://www.zmnch.pl/index.php?option=com\\_content&view=article&id=55&Itemid=49](http://www.zmnch.pl/index.php?option=com_content&view=article&id=55&Itemid=49),

- European Chemistry Thematic Network Association website - [http://ectn-assoc.cpe.fr/zglobal/links\\_of\\_interest.htm](http://ectn-assoc.cpe.fr/zglobal/links_of_interest.htm),
- ICASE – International Council of Associations for Science Education - website - <http://www.icaseonline.net/projects.html>

Examples of evaluation of national dissemination plans (MAH and UMEA, IPN) are presented in case-studies No 4 and 5.

### Postgraduate Research Dissertations & Theses

In addition this work has enabled students to conduct advanced research studies resulting in Master thesis have been written based on ESTABLISH project and defended: 1 in Palermo, 2 in Tartu, 2 in Poland:

- Nicola Pizzolato, Inquiry based learning experiences on thermal phenomena from secondary school to university: motivational aspects, conceptual knowledge and nature of science view, Palermo 2013 (in English)
- Karol Dudek, Inquiry based education in the context of the new curriculum and its impact on the image of science and scientist, Krakow 2012 (in Polish)
- Jacek Murczek, Development of school chemistry experiments (upper secondary school, basic level) promoting IBSE, Krakow, 2013 (in Polish)

In Kosice five doctoral dissertation are planned for next few years:

Tutor: doc. RNDr. Marián Kireš, PhD.  
 Thesis: **Scientific literacy development through students' active inquiry**  
 PhD student: Mgr. Mária Bilišňanská  
 Year of defence: 2016

Tutor: doc. RNDr. Zuzana Ješková, PhD.  
 Thesis: **Mathematics modelling of physics phenomena with computer support in physics education**  
 PhD student: Mgr. Veronika Timková  
 Year of defence: 2016

Tutor: doc. RNDr. Marián Kireš, PhD.  
 Thesis: **Gifted students' education oriented on Young physicists' tournament**  
 PhD student: Mgr. Lucia Mišianiková  
 Year of defence: 2017

Tutor: doc. RNDr. Zuzana Ješková, PhD.  
 Thesis: **Active inquiry in physics education**  
 PhD student: Mgr. Brigita Balogová  
 Year of defence: 2017

Tutor: doc. RNDr. Marián Kireš, PhD.  
 Thesis: **Experiments in physics education as a tool for competences development**  
 PhD student: Mgr. Katarina Krišková  
 Year of defence: 2017

## Case-studies

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### CASE STUDY 1 (AGES ) Engaging Industry

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Educational projects can often achieve higher levels of effectiveness by gaining the support of industry engaging industry. Engagement is a step beyond dissemination which is mainly concerned with raising awareness around the existence and objectives of the project. Engagement here implies a process of communication and influence that persuades the industry relevant representatives that there is a benefit to offering support for the project. The objectives of the engagement process are to involve and collaborate with a specific industrial partner.

#### Who to approach

There is no golden rule governing the decision on who to approach. Clearly much depends on the level of engagement required. For example, if the managers of a large national level project wished to acquire significant funding from an industry sector, the focus would be on the sector representative body and a high level series of discussions might well be expected. However, if the objective is to convince a local industry to provide personnel to visit schools, the focus would be on a relevant role in that organisation. Accordingly, the first step is to clarify the objectives of the exercise in terms of what is wanted and what it might offer to the industry involved.

Some background research on the following points is then necessary.

- In modern economies many organisations have published a CSR policy which can be found on their website. This often sets out their intentions regarding environmental issues, community involvement and education. These commitments offer opportunities for fruitful engagement.
- Many industries value exposure to students for purposes as a prospective employer
- They may perceive involvement with schools as beneficial in terms of PR. In a local context community reputation is highly valued.
- Some industries already have a relationship with schools in the locality. It is important to be aware of this so that the relationship can be seen to be augmented by the project. Otherwise such an existing relationship might be an obstacle to further commitments.
- The industry website or annual reports will provide information on the structure of the organisation and possibly some useful role profiles such as Communications Manager, Recruitment Manager or PR Manager.

The above research should help to indicate the best point of contact.

#### What to look for

Educational projects would usually be seeking support in one or more of the following ways.

- Provision of funding to support a project activity
- Provision of physical resources e.g. materials for a lab
- Provision expertise e.g. classroom visits by experts in a relevant field
- Hosting of school field trips to the site
- Provision of work experience to students
- Provision of expertise to mentor a school project related to the industry

- Exercising influence on policy makers or local or political representatives on a particular issue.

In all cases, a particular industry will need to know precisely what is required of them.

### **Action Plan**

It will take time to ESTABLISH viable and sustainable relationships with an industry. It is useful to follow a formal procedure and to keep contact records that can be developed over time. An effective procedure might be as follows.

- Decide what kind of support is required
- Identify the related industry and the organisation to be approached
- Review the organisation's website for any relevant references (education, recruitment, PR, CSR)
- If the organisation has a CSR policy, review it for any relevant references
- Prepare an introductory promotional document, setting out the advantages and benefits of being involved
- Make personal contact with the organisation. At this stage, even having carried out the above research, it is usually necessary to clarify who the best contact person is.
- Inquire whether the organisation has supported education initiatives and inquire whether they are aware of the advantages of doing so.
- Set up a face to face meeting as soon as possible.
- email the promotional documentation to the individual involved

### **Possible obstacles**

The above process is fairly simple but it requires energy, commitment and perseverance. However, flexibility is also required because each case needs to be assessed on its own merits. Accordingly, it is useful to be aware of the obstacles that might deter an organisation from collaborating with a project. Such obstacles include:

- Availability of funding. Only large organisations can afford to commit monies to a project.
- Lack of interest. If it is clear there is no interest in the project, it may be best not to pursue the issue at that point in time.
- Lack of commitment. If it is clear that there is no commitment to a longer term involvement it may still be worth pursuing. This is a question of judgement.
- Lack of short-term return. Some managers will be looking for short term returns or benefits that may not be feasible for the project to deliver.
- Lack of expertise. The organisation may feel that it does not have the expertise for engagement e.g. for visits to schools. In this case a possible approach is to make the task as easy as possible for them.

In general, it is more effective to avoid areas where resistance appears to be high and to focus on those where some level of commitment seems more likely.

### **Local, national or global?**

The coordination and resource set necessary for large educational projects are difficult to realise. Education is governed by national or regional policies and these policies are difficult to change in the short term. Global educational projects would be even more complex and, in fact, do not seem to exist. The overall objectives of a given project are central to the engagement challenge. The most ambitious projects may attempt to change to philosophy and mind sets of policy makers. There is no certainty that industry will be readily engaged in such a challenge. A particular industry views its market and its local community as important to its existence. Therefore, local level engagement involving schools is easier to achieve.

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**CASE STUDY 2 (JU) Teachers associations and their publications as dissemination channels**

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The context of dissemination in Poland is as described below:

- Poland is a large country, with a 268 000 number of teachers working in 12 000 secondary schools.
- Due to the organization school timetable, in many schools, there is only one teacher for each school subject: Chemistry, Biology and Physics.
- Traditionally, the best and the most active science teachers have been participating in work of the educational divisions of scientific societies, e.g. physical or chemical (PTChem) for many years. However, the objectives of these societies started to not stay in line with the teachers needs in the constantly reforming educational system (after the change of political system) in Poland, including the introduction of Science as an integrated subject. Therefore, in 1993, the Polish Association of Science Teachers (PSNPP) was ESTABLISHED, with its aim to carry out social work for the improvement of natural science subjects teaching, stimulation of teachers activity, dissemination of knowledge and skills from the field of natural sciences and integration of the teachers' society.
- Both types of associations organize annual meetings and publish journals. Journal of the Polish Chemical Society is bimonthly magazine "Orbital" releasing 1300 per issue, PSNPP publishes a quarterly periodical "Teaching natural science" in 500 copies.
- Since the 50s of the last century, on the Polish publishing market there has been present such Magazines as "Chemistry in school", "Physics in school", "Biology in school" published by the School and Pedagogical Publishers Ltd. In the past, almost every teacher could find them in the school library, whereas nowadays, they are issued in 3200/4000 copies.

The Polish partner decided to use the two described above channels (associations and their publications) to promote IBSE, the ESTABLISH project and dissemination of projects outcomes. During the past four years we were present at almost every meeting of the aforementioned organizations: PTChem and PSNPP.

At first, we were trying to get the teachers familiar with the concept of IBSE, which was new for them; then we encouraged them to participate in the project and to report their actions, finally encourage them to use various materials developed within the Project.

There were different forms of dissemination: lectures, oral presentations and posters, distributing leaflets and organizing workshops (every time for dozens of teachers). In addition, we made use of scientific sessions organized twice a year by the Chemical Education Division of the PTChem Krakow Branch.

To reach the broad range of recipients, we adopted the principle that each article has a different leading author, who imposes his/her own style, uses arguments characteristic for particular person and focuses on different aspects of particular problem.

And so, in the first years of the Project (2010 and 2011) we published:

- Elżbieta Szostak, Jak uczniowie mogą doświadczyć czym jest nauka? Projekt ESTABLISH (How can students experience what the science actually is? – Preliminary proposals of the

ESTABLISH project), Nauczanie Przedmiotów Przyrodniczych, Biuletyn PSNPP Nr 35 (3/2010) 49-50.

- Iwona Maciejowska, Nauczanie przedmiotów przyrodniczych przez odkrywanie i współpraca z przemysłem podstawą projektu ESTABLISH (Teaching of natural science subjects through scientific inquiry and cooperation with industry as the basis of the ESTABLISH project), PSNPP Bulletin, 2010
- Małgorzata Krzeczowska, Kształcenie przez odkrywanie – metoda na zainteresowanie uczniów na lekcjach biologii (Teaching by inquiry – a method to make students interested in biology), Biology in school, 2011,
- Iwona Maciejowska, Jak nauczyć studentów myśleć? ESTABLISH- edukacyjny projekt 7PR (How to teach students how to think? ESTABLISH – educational project 7PR), Orbital, 2011
- Ewa Odrowąż, Kształcenie przez odkrywanie – metoda na zainteresowanie uczniów na lekcjach chemii (Teaching through inquiry – the method based on students' interest in Chemistry), Chemistry in school, 2011

And in 2012 and 2013

1. Maciejowska I., Kształcenie postaw badawczych uczniów. Czym to się je?, Nauczanie przedmiotów przyrodniczych, Biuletyn PSNPP Nr 43 (3/2012), 50-53
2. Małgorzata Krzeczowska, Iwona Maciejowska, Ewa Odrowąż, Kształtowanie umiejętności badawczych uczniów. Po co? Dlaczego i jak?, Nauczanie przedmiotów przyrodniczych, Biuletyn PSNPP, Nr 47 (3/2013), 21- 23
3. Małgorzata Krzeczowska, Iwona Maciejowska, O II Letniej Szkole dla nauczycieli przedmiotów przyrodniczych zorganizowanej w ramach projektu ESTABLISH słów kilka, Orbital, 1/2013, 35-38

Some of our oral presentations at meetings of the aforementioned organizations PTChem and PSNPP:

1. Iwona Maciejowska – **Projekt ESTABLISH – zaproszenie do współpracy**. Sesja Naukowa PTChem dla Nauczycieli, Kraków, 26.11.2010
2. Iwona Maciejowska - **IBSE- co nowego w projekcie ESTABLISH**. Sesja Naukowa PTChem dla Nauczycieli, Kraków, 03.06.2011
3. Ewa Odrowąż, Iwona Maciejowska, Paweł Bernard , *Doskonalenie zawodowe w zakresie nauczania kształtującego postawy badawcze uczniów – propozycje na rok 2012/13*, 48. Sesja Naukowa PTChem dla Nauczycieli, Kraków, 30.11.2012,
4. Małgorzata Krzeczowska, Iwona Maciejowska, Karol Dudek, **Nauczanie kształtujące postawy badawcze uczniów – nowe materiały dydaktyczne projektu ESTABLISH**, 47. Sesja Naukowa PTChem dla Nauczycieli, Kraków, 20.04.2012
5. Iwona Maciejowska , Nauczanie przez dociekanie naukowe na lekcjach chemii w szkołach ponadgimnazjalnych, 55 Zjazd PTChem i SITPChem, Białystok, 16-20.09.2012



6. Ewa Odrowąż, **Z doświadczeń projektu ESTABLISH cz.1 – doskonalenie warsztatu dydaktycznego nauczycieli jako działanie długofalowe i kompleksowe**, 56 Zjazd PTChem i SITPChem, Siedlce 16-20.09.2013
7. Małgorzata Krzeczowska, **Z doświadczeń projektu ESTABLISH cz.2 – doskonalenie warsztatu dydaktycznego studentów – przyszłych nauczycieli**, 56 Zjazd PTChem i SITPChem, Siedlce 16-20.09.2013
8. Małgorzata Krzeczowska, Ewa Odrowąż, **ISBE workshop**, XX Zjazd PSNPP, Toruń, 20-23.09.2013
9. Iwona Maciejowska, Paweł Bernard, **Co nowego w projektach skierowanych do nauczycieli przedmiotów przyrodniczych w ramach 7. Programu Ramowego ESTABLISH, SAILS oraz IRRESISTIBLE?**, 50. Sesja Naukowa PTChem dla Nauczycieli, Kraków, 22.11.2013

Thanks to this high number of publications, we did not experience problems with the recruitment of teachers from across the Poland for in-service trainings organized within the project.

Our dissemination activities resulted in invitations to present IBSE idea and project outcomes to new group of teachers e.g.

1. I.Maciejowska' Kształcenie postaw i umiejętności badawczych uczniów w ramach nauczania przedmiotów przyrodniczych, Nowa podstawa programowa- projektowanie i ewaluacja procesu dydaktycznego, Kraków 12.05.2012 –invitation from the City Hall of Krakow
2. Iwona Maciejowska , Consortium ESTABLISH, European Science and Technology in Action. Building Links with Industry, Schools and Home, 2nd International Scientific Seminar « Science-Environment-Didactics », Kraków, 24-25.04.2012 – invitation from University of Pedagogy in Krakow
3. Iwona Maciejowska, IBSE w Krakowie. Kształcenie postaw i umiejętności badawczych uczniów w ramach nauczania przedmiotów przyrodniczych, ASTTI final conference, Warszawa, 05.12.2012 – invitation from ASTTI coordinator

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**CASE STUDY 3 (DCU) Science Teachers conference**

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The 5<sup>th</sup> biennial Science and Mathematics Education Conference (SMEC 2012) took place on 7-9<sup>th</sup> June 2012 in Dublin City University, Dublin, Ireland. With the chosen theme of “Teaching at the heart of learning” this was a joint conference of the Science and Mathematics Education Conference (SMEC) series and the FP7-funded project ESTABLISH.

Hosted by the Centre for the Advancement of Science and Mathematics Teaching and Learning, CASTeL, of Dublin City University & St. Patrick’s College, Drumcondra, this conference provided the 235 delegates with a variety of opportunities to address issues pertaining to the teaching and learning of science and mathematics at and across all educational levels, in particular: Classroom Practice, Evaluation & Assessment, Teacher Education and Reflective practitioners. As part of the ESTABLISH project ten partnering countries brought up to 20 secondary level science teachers to share, discuss and exchange ideas about how to teach and assess using inquiry in the science classroom.

### Conference Programme

The conference programme included a range of activities including plenary, oral and poster presentations, over 15 workshop sessions, while also facilitating round table discussion sessions for teachers to share and compare their experiences with using inquiry based science education in the classroom. Participants were also offered the opportunity to visit local scientific industries and research centres and meet scientists in their workplace to hear about their needs of future science graduates.

### Speakers of note

Opened by the President of Dublin City University, Prof. Brian MacCraith, the conference offered teachers and educators alike the opportunity to learn about innovations in the classroom with plenary presentations from renowned educators such as Prof. William McComas, University of Arkansas<sup>2</sup>; Prof. Paul Black, King’s College London<sup>3</sup>; Prof. Janet Ainley University of Leicester<sup>4</sup> and Prof. Ton Ellermeijer<sup>5</sup>, Centre for Microcomputer Applications in the Netherlands together with a broad range of contributions from leading Irish, European and international experts and such as Fibonacci<sup>6</sup>, Scientix<sup>7</sup> and Inquire<sup>8</sup>.

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<sup>2</sup> <http://coehp.uark.edu/4493.php>

<sup>3</sup> <http://www.kcl.ac.uk/sspp/departments/education/people/academic/blackp.aspx>

<sup>4</sup> <http://www2.le.ac.uk/departments/education/people/professor-janet-ainley/professor-janet-ainley>

<sup>5</sup> <http://cma-science.nl/cmmainfo.html>

<sup>6</sup> <http://www.fibonacci-project.ie/>

<sup>7</sup> <http://www.scientix.eu/>

<sup>8</sup> <http://www.inquirebotany.org/>

**Statistics at a glance:**

	<b>Attendance</b>	<b>Plenary Sessions</b>	<b>Contributed Oral Presentations</b>	<b>Workshops</b>	<b>Roundtable Discussions</b>	<b>Other</b>
<i>Thursday</i>	<b>202</b>	1	8	6 (5 unique)	2	Poster session
<i>Friday</i>	<b>235</b>	1	11	6 (5 unique)	2	Symposium on Analysis of Teaching;  Series of Industry Visits for ESTABLISH teachers
<i>Saturday</i>	<b>214</b>	2	8	6 (5 unique)	2	

**Feedback**

Following the completion of the conference an online evaluation was setup to capture the effect and impact of the conference. The survey was closed on 22 Oct 2012, at which time there were 49 responses, of which 40 were completed.

The survey looked to analysis three parts of the event:

1. Event Organisation & delivery
2. Communication of information
3. General Feedback about the content quality, flow and dynamics of the conference.

See appendix for details of the survey.

In relation to the organisation of the event, over 70% of the responses were very positive (citing very satisfied or extremely satisfied) regarding conference information, registration management, conference venue & facilities, conference meals and conference support on-site. It was noted that one response was unsatisfied with the conference meals.

In relation to communication of information, before and after the conference 59.5% of responses were positive (satisfied or very satisfied) regarding the information communicated before and after the conference. During the conference the percentage of responses increased to 85.1% choosing very satisfied or extremely satisfied with the communication of information received. It was noted that one response was unsatisfied with the communication of information before the conference.

In relation to general feedback on the conference, 87.2% of responses indicated they were very or extremely satisfied with the conference, and over 75.5% of responses were very positive regarding the format, duration, presentations and interactions between participants during the conference.

Regarding the quality of the presentations, at least 67.4% of those who responded were satisfied, very satisfied or extremely satisfied with the quality of the plenary, oral, poster, workshop presentations and the symposium.

Of those that answered the question regarding the industry visits (23) over 90% of these responses were very or extremely satisfied with the quality of the industry visits. (very satisfied = 12/23; extremely satisfied = 9/23)

When asked to describe in their own words their favourite aspects of the conference, a number of items emerged: workshop sessions, plenary presentations, ability to network, round table sessions, industry visits, format and internationality of conference and poster presentations. The order of these items, as shown in the following table, indicates that delegate enjoyed the interactive nature of the conference both in terms of the content of the conference as well as with other conference delegates.

What was your favourite aspect/session(s) of the conference programme (n=25)	Total	
<b>Workshop Sessions</b>	<b>7</b>	<b>28%</b>
<i>Plenary presentations</i>	<b>5.5</b>	<b>22%</b>
<i>Networking</i>	<b>5.5</b>	<b>22%</b>
<i>Round table sessions</i>	<b>2.5</b>	<b>10%</b>
<i>Industry Visits</i>	<b>2</b>	<b>8%</b>
<i>Format</i>	<b>1</b>	<b>4%</b>
<i>Internationality</i>	<b>1</b>	<b>4%</b>
<i>Posters</i>	<b>0.5</b>	<b>2%</b>

When asked to describe, again in their own words, what aspects of the conference delegates found least enjoyable, a high portion of comments were positive, saying that there were no such aspects. Others mentioned that they were disappointed with the quality and interactions on plenary, oral or workshop sessions, while some mentioned they found the conference too short, that they had to choose one sessions over another. Details of this analysis is found in the following table.

What was your least favourite aspect/session(s) of the conference programme (n=19)	Total	
<b>None</b>	<b>5</b>	<b>26%</b>
<i>Plenary Presentations</i>	<b>3</b>	<b>16%</b>
<i>Conference too short</i>	<b>2</b>	<b>11%</b>
<i>Workshops</i>	<b>2</b>	<b>11%</b>
<i>Lack of conference materials on USB in conference pack</i>	<b>1</b>	<b>5%</b>
<i>Lack of cross-country meetings</i>	<b>1</b>	<b>5%</b>
<i>Conference meal</i>	<b>1</b>	<b>5%</b>
<i>Punctuality</i>	<b>1</b>	<b>5%</b>
<i>Language difficulty</i>	<b>1</b>	<b>5%</b>
<i>Oral presentations</i>	<b>1</b>	<b>5%</b>

<i>Conference too long</i>	<b>0.5</b>	3%
<i>Location of poster presentation</i>	<b>0.5</b>	3%

When asked to highlight particular aspects they considered important for us to consider when planning future conferences, the majority of those who responded said that there was nothing important missing from the programme. Others suggested that more time should be given to networking and that mixing of delegations should be encouraged. Additionally it was suggested that sessions which present national case-studies should be included in the programme. An overview of the responses is given in the following table

<b>Q. 7 Please give us any feedback you consider important, so that we take it into account when planning a future conferences. e.g., Were there any areas missing from the programme that you would like to see included in future events?(n=17)</b>	<b>Total</b>	
<b><i>Nothing</i></b>	<b>6</b>	<b>35%</b>
<i>More time for networking &amp; encourage mixing</i>	<b>4</b>	24%
<i>Unclear about conference flow before event</i>	<b>1</b>	6%
<i>Improved location of posters</i>	<b>1</b>	6%
<i>Incomplete proceedings</i>	<b>1</b>	6%
<i>Too noisy at dinner</i>	<b>1</b>	6%
<i>Session for presentations of national case-studies</i>	<b>1</b>	6%
<i>Include opt-out for conference dinner &amp; receptions</i>	<b>1</b>	6%
<i>Other</i>	<b>1</b>	6%

## Funding

As with any other conferences of this size, SMEC 2012 | ESTABLISH Teacher Education conference was grateful for the generous funding made available from a number of local, national and international sources. In particular the conference organisers would like to acknowledge the support from Dublin City University's Research & Innovation and the Learning Innovation Unit; St. Patrick's College Drumcondra; Royal Society for Chemistry; Institute of Physics in Ireland; and Bord Fáilte for this year's conference together with the support from the European Union's Seventh Framework Programme [FP7/2007-2013] under grant agreement n° 244749 for the ESTABLISH project.

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**CASE STUDY 4 (IPN) Evaluation of national dissemination plans**


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IPN-Dissemination Plan :

Approach	Outcome
We would start using and testing the material in teacher training workshops in Kiel and Oldenburg, organised through the universities, the local teacher training structures (NILS in Lower Saxony and IQSH in Schleswig Holstein) and projects on context-based learning and the chemistry teacher training centre in Oldenburg.	➔ Numerous workshops done for Kiel; Oldenburg left the project
The first step of dissemination should be the distribution of the tested material among the other teacher training centres in Germany, covering almost every region in Germany. Using the network of context-based learning, material and ideas can also be disseminated to other countries, e.g. to the Netherlands or Israel.	➔ Reached teachers in several states of the country: Mühlheim (North Rhine-Westphalia) & Lüneburg (Lower Saxony), in addition to Schleswig-Holstein
Additionally, we still have sets of teachers working together from the projects SINUS, Chemie im Kontext and Physik im Kontext who could also use and test the material as part of their work.	➔ Done through concept of Stützpunktschulen
Another way of distribution are the large conferences for teachers, e.g. the division of chemical education of the German Chemical Society (GDCh) and the science and maths teachers association MNU,	➔ Poster GDCh 2012 ➔ Symposium GDCP 2012 ➔ MNU Students' Day 2011
and journals for teachers (e.g. Chemkon, MNU, NiU-Chemie, PdN-Chemie). Internationally, the chemistry education division of EuCheMS will also be used to disseminate material.	➔ 2 NiU-Chemie-Articles ➔ ChemKon-Article in progress
IPN could also involve partners from politics who are members of the IPN advisory board.	➔ Meeting at IPN advisory board 2013
National Journals: Chemkon, MNU, NiU-Chemie, PdN-Chemie, ZfDN	➔ See above
International Journals: IJSE, CERP	➔ Not done
National Conferences: Division of Chem Ed of the German Chemical Society (GDCh); national and regional meetings of the	➔ See above

teacher association MNU, GDCP

International Conferences: ESERA, ECRICE, Eurovariety, (NARST)

- ➔ ESERA 2011, Presentation
- ➔ Teacher conference in Dublin (together with SMEC) 2012, Workshops
- ➔ ECRICE/ICCE 2012, Presentation & Workshop
- ➔ Chem-Ed-Ireland 2012, Workshop
- ➔ IOSTE 2012, Presentation
  
- ➔ Meeting with partners for industry cooperation 2011, Lübeck
- ➔ Meeting with state ministry of education 2013

National Stakeholders: Division of Chem Ed of the German Chemical Society (GDCh), teacher association MNU, teacher training centres and state institutes for teacher training (e.g. NILS, IQSH)

- ➔ Public Outreach activities 2011, 2012, 2013

## Statistics

### International

- Organisation of workshops<sup>9</sup> (number, total number of participants): 3 (120; 2 of them in cooperation with DCU) Teachers
- Presentations: 3 (88) Educational research community

### National

- Organisation of conferences (number, total number of participants): 1 Symposium, (30) Educational research community
- Organisation of workshops (number, total number of participants)<sup>10</sup>: 1 (15) Teachers
- Presentations/ personal meetings: 1 meeting Industry/business; 2 meetings Policy makers; 1 (70) Teachers; 2 (180) Others, totally mixed audience

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<sup>9</sup> Separated meeting, those workshops which are NOT a part of TEP (teacher educational programme)

<sup>10</sup> Those workshops which are not included in regular TEP reported as apart of WP4

- Leaflets /flyers (total number of copies): 50 Educational research community; 50 Science research community
- Posters (Total size of audience): 1 (40) Science research community
- Publications (books, guidebooks), number; Total number of copies: 2 articles NiU-Chemie Teachers
- Websites: IPN Educational research community

**Thesis :** Kirsten Fischmann: Conceptualization and investigation of a Lab-Session focusing on Inquiry based Learning for Pre-service teachers. Kiel 2012 (in German)

**Remarks:** In the case of national dissemination:

- education research community can be understood as Science education research community.
- education research community and teachers are not necessarily mutually exclusive audiences and often mix.



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**CASE STUDY 5 (MAH & UMEA), Evaluation of national dissemination plans**

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**Dissemination Sweden**

Basically we have described to do three types of activities in the dissemination plan:

1. Information to different kinds of stakeholders
2. Articles in journals
3. Presentation at conferences - nationally and internationally.

In the following we quote the Swedish dissemination plan and comment on it.

Student teachers at different universities can spread information about what we have learnt from the project. We have valuable contacts with a number of universities with teacher education all over Sweden. Our student teachers are connected to the school district through the education which means that they can have an impact on school development.

We have been involved in organizing workshops for student teachers and they been asked to work with some of activities in school. A group student teachers in a technology participated in a workshop about ESTABLISH in 2012 Reported to SESAM.

We have not only informed student teachers but also teachers in school and our colleagues. I

In the document below a meeting with lectures at Swedish universities is reported.

In 2012 we organized workshops for science educators at both Malmö University and Umeå university.

The teachers participating in the EU-project SAILS had a half-day workshop on ESTABLISH.

We have also spread information about ESTABLISH to different networks and to colleagues at universities. Umeå has presented ESTABLISH at regional teacher conferences in 2010 and 2012.

School head masters will also be targeted.

Umeå has presented ESTABLISH at regional conferences for principals and for school leaders in the region in 2010, 2011 and 2012

-There are two organizations for science teachers in Sweden, one for Biology teachers and one for teachers in Mathematics, science and technology. They both distribute a journal in which we will write about the project. There is another journal Pedagogiska magasinet (Pedagogical magazine) which publishes articles about school, teaching and research.

International Journals: International Journal of Science Education, Research in Science Education, NorDiNa.

It has been rather difficult to write papers for research journals. However we have written two articles for a journal about Biology Education – Bi-lagan.

URL: [http://www.bioresurs.uu.se/bilagan/bilagan3\\_2013.cfm](http://www.bioresurs.uu.se/bilagan/bilagan3_2013.cfm)

- Ottander & Ekborg (2013) Samhällsfrågor med naturvetenskapligt innehåll.

Ekborg & Ottander (2013) Funktionsnedsättning – att arbeta med undersökande arbetssätt i biologi.

### **International Conferences: ESERA 2011, ESERA, 2013, IOSTE 2010**

At ESERA 2011 in Lyon a symposium was organised. The topic was "Development of research based units in ESTABLISH: the example of Disability" Disability was developed and written by the Swedish group.

Maria Sandström presented ESTABLISH at the ETEN meeting in Belgium 2013. ETEN is an European network for teacher educators.

At ERIDOB 2012 in Berlin we distributed flyers and posted the poster.

We have presented ESTABLISH at annual Swedish conference for teacher educators in Sweden – FND with posters in Kristianstad 2012. We also posted posters at regional conferences in technology education in Norrköping, Uppsala and Göteborg 2011 and distributed at a regional conference for science teachers in Växjö 2013.

Christina Ottander presented ESTABLISH at the Nordic Research Symposium NFSUN 2011 in Linköping, Sweden. The symposium is organized every third year. Posters were also posted. Maria Sandström presented at Biennette for Teachers in Science & Mathematics in Stockholm 2013.

To conclude we have, with a few exceptions followed the plan. In most cases we have done more activities than we suggested in the application. Most of these activities have worked well and we have met a positive response and great interest. However it has been difficult to write papers for research journals as ESTABLISH is not a research project.

The meetings with teachers and teacher educators have been very successful.

We have organized a number of workshops in Malmö and Umeå. Some of them have been included in the teacher education programme which is part of wp 4 and 5. Besides this Umeå has arranged workshops with teachers who have participated in-service education, which has been specifically about ESTABLISH or IBSE, at Umeå university.

Margareta Ekborg has worked for three days 1 February 2013 with teachers in Malta.

During the last year (2013) partners from Sweden (Umu and MaH) have been invited to give key note presentations and workshops at three national teacher conferences (listed below). Stakeholders from National Agency for Education and directors from the three national science resource centres (Swedish Centre for School Biology and Biotechnology; The National Resource Centre for Chemistry Teachers; National Resource Centre for Physics Education) also attended the conferences. We were

also invited to write two articles for Bi-lagan, a journal for teachers published by the Swedish Centre for School Biology and Biotechnology.

#### The national conferences:

**NO-biennial in Umeå**, 25-26 September, 2013. Conference for 200 teachers (grade 4-9) from the northern region of Sweden.  
[http://www.trippus.se/eventus/eventus.asp?eventus\\_id=8680&lang=swe&c=515857543444656350764D724735636E422F6B354D546D30555A6646746E6662](http://www.trippus.se/eventus/eventus.asp?eventus_id=8680&lang=swe&c=515857543444656350764D724735636E422F6B354D546D30555A6646746E6662)

Key note lecture by Christina Ottander about why do inquiry-based science education and how to do it. The title was: Undersökande arbetssätt. Varför då?, Hur då?

Workshop by Madelen Bodin about inquiry and simulations in physics education. The title was: Om Algodoo för intresse och förståelse i fysik och teknik

**NO-biennial in Karlstad**, 7-8 October, 2013. Conference for 200 teachers (grade 4-9) from the southern region of Sweden.

[http://www.trippus.se/eventus/eventus.asp?eventus\\_id=8680&lang=swe&c=515857543444656350764D724735636E422F6B354D546D30555A6646746E6662](http://www.trippus.se/eventus/eventus.asp?eventus_id=8680&lang=swe&c=515857543444656350764D724735636E422F6B354D546D30555A6646746E6662)

Workshop by Margareta Ekborg and Maria Sandström about linking industry to the inquiry based science education. The title of the workshop was: Om undersökande arbetssätt och hur man kan arbeta med industri/näringsliv i NO-undervisningen (7-9)

**Nationellt lektorsmöte inom de naturvetenskapliga ämnena**, Sigtuna 9-10 September, 2013.  
<http://lektornv.se>

A conference arranged by the National Agency for Education and the three national science resource centres (Swedish Centre for School Biology and Biotechnology; The National Resource Center for Chemistry Teachers; National Resource Center for Physics Education) for upper secondary science teachers with a doctoral degree in science. 50 teachers (lektorer) attended the conference.

Key note lecture by Christina Ottander about how to implement research results from inquiry-based science education to school development initiatives. The title was: Möte mellan undervisning och ämnesdidaktisk forskning – hur kan lektorer bidra?

Christina Ottander has also given a presentation **for the stakeholders parents and grandparents** at a meeting arranged by the local organisation belonging to the DKG International society for key women educators. The meeting was May 7, 2013 and gathered 15 people interested in science education.

#### Publications for dissemination:

Two articles are published in a journal for teachers, Bi-lagan.  
[http://www.bioresurs.uu.se/bilagan/bilagan3\\_2013.cfm](http://www.bioresurs.uu.se/bilagan/bilagan3_2013.cfm)

Ottander & Ekborg (2013) Samhällsfrågor med naturvetenskapligt innehåll.

Ekborg & Ottander (2013) Funktionsnedsättning – att arbeta med undersökande arbetssätt i biologi.

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**CASE STUDY 6 (UNIPA) Exhibition as a dissemination channel**

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*Claudio Fazio, University of Palermo Physics Education Research Group*

Science exhibitions can be very effective to provide students and teachers a platform to share information and accomplishments with their peers and other stakeholders of the education process.

As it is well known, during science fair exhibitions, visitors can:

- combine science content and process skills,
- implement new ideas, applying constructivist learning cycles and inquiry based learning methods,
- achieve high level of excitement, engagement, and motivation,
- have the opportunity to "demonstrate" something different from traditional paper-and-pencil activities,
- forge connections with scientists and professionals,
- discuss with peers to allow for confirmation or disconfirmation of their understanding.
- contribute to keep the event fresh, informative and entertaining for students and visitors alike.

During the last four years (i.e. from 2010 to 2013) the University of Palermo Physics Education Research Group (UoP\_PERG) shared the expertise and the research results obtained during the ESTABLISH project in two different types of science exhibitions.

In the first type of exhibition UoP\_PERG actively organized and participated to "Open Days" at the Department of Physics and Chemistry, where UoP\_PERG is based, (the Open Days are organized one per year, in November). During these exhibitions university researchers and students were involved in describing to primary and secondary school students and teachers what research in Science is. A relevant part of these exhibitions was devoted to show how the application of Science Inquiry methods to learning can radically change the view people have of Science and of its "boring" teaching/learning methods. Many experiments taken from ESTABLISH Units were used to show how science can be learnt in a simple and enjoying way, also by using "common-life" material that can be easily found at home. The number visitors attending each Open Day at the Department of Physics and Chemistry can be quantified in about 500-600.



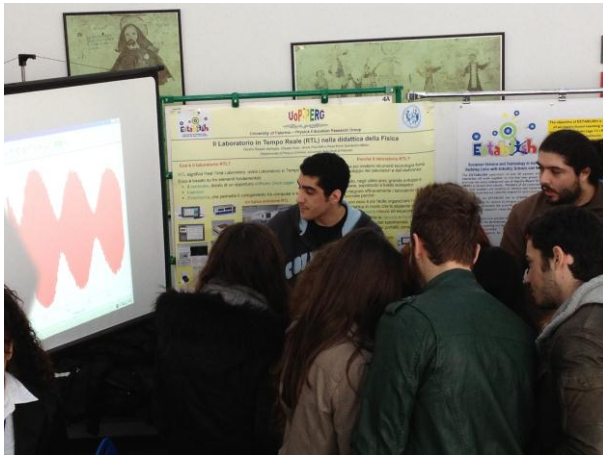
During the exhibitions, visitors were allowed to experiment some of the teaching/learning activities developed for the ESTABLISH Units. This was particularly appreciated by teachers, that could try learning activities and laboratory equipment to see if they were fitted to their teaching needs.



The second type of exhibition took place at the Conference and Didactic Centre of University of Palermo, inside the University Campus, one per year from 2010 to 2014 (normally in February). During these 1- week science fairs the Centre was transformed into a meeting place, where ordinary people, students, parents and teachers could examine and deepen scientific themes and experiments, also experimenting some interaction and interest, which breaks-up the monotony of traditional exhibits . The exhibitions saw the active participation of students and teachers of schools, universities and research centres of all Sicily, engaged in demonstrating to visitors scientific exhibits designed and built by them, covering all aspects of science and science inquiry.

In this framework, UoP\_PERG described and demonstrated many experimental and modelling activities developed for the ESTABLISH teaching/learning units (Designing a Low Energy Home, Sound, Light, Electricity) to about 9000- 10000 people during each 1- week exhibition. UoP\_PERG researchers and physics students also used Information and Communication Technologies (Real Time Laboratory tool and computer assisted modelling environments) in order to demonstrate how learning can be enhanced by using Inquiry tools that allow the learner to see, in real time, the results

of their measurements and to build descriptive models of reality. During the exhibition the ESTABLISH posters were presented and discussed with the visitors and the ESTABLISH dissemination material (flyers) was distributed.





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**CASE STUDY 7 (MLU) Cascading effect of building up collaborations with industry**

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The networking activities during the ESTABLISH project have enabled the development of fruitful collaborations between education and industry. Due to their activities in the project, MLU have begun a collaboration with the largest German publisher of schoolbooks (Klett-Verlag, Stuttgart). After one year the publishing company have requested MLU to be member of the academic board of a newly created newspaper on STEM-Education in Germany ("MINT-Zirkel"). The creation and publication of a paper instead of a magazine was a strategic decision to create a more "fresh-looking" publication, which is distributed in German schools for free, with runs of 100,000 every second month. This publisher has organized 5 teacher conferences on regional and national level, at which MLU joined, spreading the ideas of ESTABLISH through lectures, posters, booths and workshops. Following these meeting more invitations have arisen, including the opportunity to speak at the national opening of ERASMUS+ in April 2014. Another important contact driven by the attendance of these meetings is to national STEM network ("Nationales MINT Forum") organized by the most important publicly traded companies like BASF, Mercedes, Bayer and other members of the German DAX-Group. MLU have participated in their meetings and contributed to the discussions. During the autumn conference in 2013 a network was founded, containing contacts to various stakeholders like teachers, school principals, teacher educators, chambers of commerce, universities, school administration, science labs and companies. This network was initiated at the conference, and the participants have welcomed its foundation as a necessary activity. After the conference in November 2013 more meetings were made, involving more companies and their organisations. To sum up, the publisher brought MLU during ESTABLISH into contact to important stakeholders in the region and on national German level.

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**CASE STUDY 8: the ESTABLISH project activities impact on dissemination**

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**UPJŠ Košice, Slovakia**

Within ESTABLISH project activities in field of in-service teacher training we realised the series of courses oriented on IBSE. As teacher training faculty we maintain relations with schools due to many reasons: pre-service teacher training practice, recruit of future students, popularisation of science and further teacher education through Ministry of Education certificated courses. Long-time interactions with teacher with both sides benefits creates credit of our faculty, which was strongly improved also by ESTABLISH project activities.

Our IBSE teacher training activities shows importance of inquiry in science education, the role of educated teacher with inquiry skills and practical experiences from educational activities. Our teacher also recognised importance of team work at school, as minimum we recommended cooperation of science teachers (Physics, Chemistry and Biology or Mathematics, Physics and Informatics) under the school management umbrella. Our support is focussed on teachers' team cooperation and on IBSE idea understanding by school principals. For school directors our faculty organise the **Club of school directors**, where once per quarter the meetings oriented on actual educational topics are organised. Nowadays, we can see the real impact of all our partial ESTABLISH activities on project dissemination.

Teachers trained within ESTABLISH IBSE courses initiated **school projects** through different agencies. Project goals are focused on inquiry, modernisation of education, using of modern technologies in education, computer based science education, assessment of inquiry activities, etc. Its pleasure for us, schools not only purchase equipment, but also plan to organise teacher training activities. We will participate as external lecturers, reviewers of materials, tutors. For the next few years after the ESTABLISH project, the inquiry ideas and its realisation will have real support within following school projects.

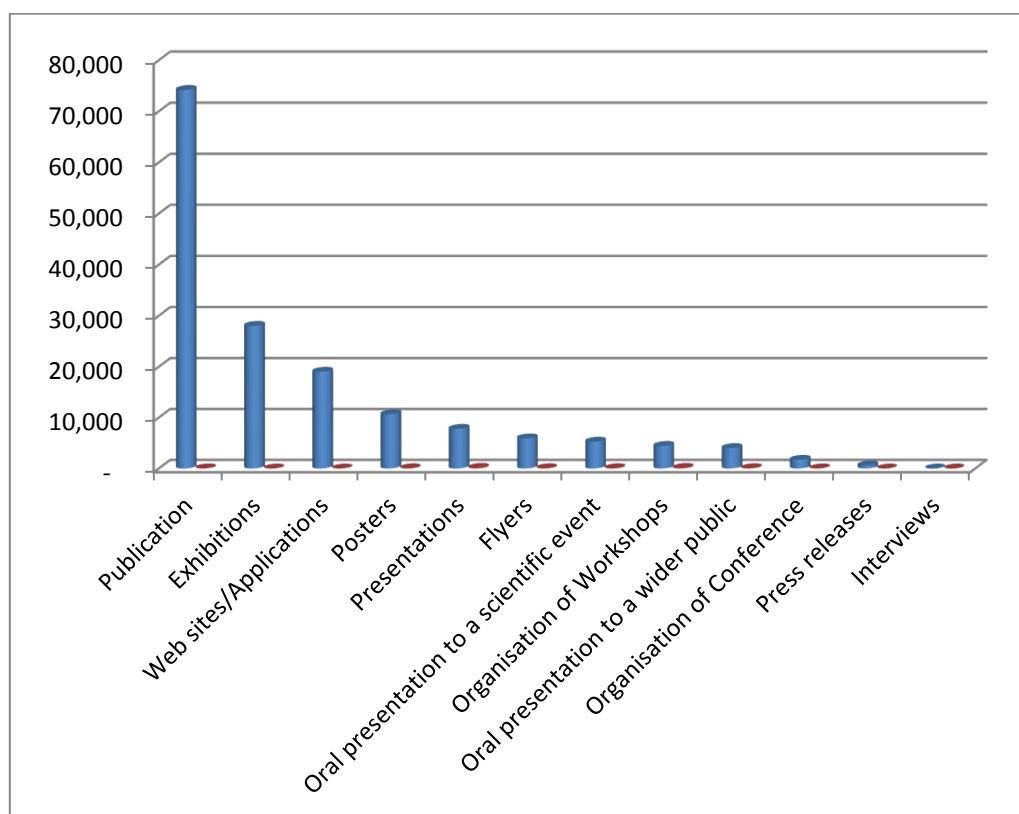
The next dissemination impact we can see through **teachers' seminars** and science days at schools. We are invited by our trained teacher to lead the seminars for other teachers at school, oriented on inquiry activities, active learning and computer based measurements. We hope, step by step, the groups of teachers at school will be more positively inclined to the modern trends in science education.

Finally we can mentioned our success with **research project**: Research on the efficiency of innovative teaching methods in mathematics, physics and informatics education, which we obtained from Slovak research and development agency, for the next three years.



## Impact

So as to quantify the breath of impact of ESTABLISH's dissemination strategy an audience size for each dissemination activity was estimated. As is illustrated in the following graph (Fig. 8) the range for each activity is significant. However, what this graph cannot show is the depth of impact that the different activities allow. For example while an exhibition is useful to bring awareness of the project to many people, organisation of workshops and presentations at conferences for specific target audiences engage the audience at a much deeper level. It is acknowledged though that all channels need to be employed to maximise the impact of the project's promotion.



*Fig.8 Size of audience*

A key performing indicator for scientific research community is the number of oral presentations given as a result of the project. While this project is more focused on the practice and implementation of IBSE rather than research, over nine thousand (9303) oral presentations were made over the lifetime of the project at both scientific events and to the wider public. A unique form of dissemination also used during the project was the organisation of exhibitions which were prepared by UNIPA (described in Case No 6) and CMA. They enabled awareness of the project to occur with the largest number of recipients – all together more than twenty eight thousands people.

Posters presentations (43) were commonly used to dissemination at local contexts for 2,340 visitors (in Polish, Swedish and English) as well as to the global community, with almost seven thousands (6,800) people from all over the World have opportunities to watch project posters. It is estimated that the readership of the publications in which ESTABLISH contributed is almost 75 thousand (74,199).

Four partners, namely JU, UNIPA, DCU and MU printed more than 500 flyers in national languages (Swedish, Italian, Polish) and more than 2000 in English which were disseminated mainly during national and international conferences.

The original dissemination plans were prepared to promote IBSE as teaching and learning methodology primarily within national contexts and through the scientific research community as this was the more familiar format for many of the project's beneficiaries. These national dissemination plans were reviewed by respective beneficiaries to determine if the targets and objectives of each were achieved. Two examples of these reviews are provided within case-studies no. 4 & no. 5. The adoption of this goal-orientated approach is useful to focus the dissemination efforts of the project. It is also noted that many of the beneficiaries, as a result of ESTABLISH, have worked together to expand the scope of dissemination in particular language areas e.g. MAH and UMEA in the case of Scandinavian countries, CUNI, JU and UPJS for Slovakian colleagues, MLU and IPN for German speaking audience (Germany, Switzerland, Austria).

### Success breeds success

As a result of the continuous project promotion and dissemination of teacher education materials and programmes, beneficiaries have been honoured with invitations to participate in additional international conferences as keynote plenaries. These conferences include invited plenaries and symposia at:

- GIREP 2014, Palermo, Italy
- ESERA 2014, Turkey
- ECRICE 2014, Jyväskylä, Finland
- NARST 2015, Chicago, USA

Additionally, other science education researchers and educators have noted the quality of the scientific resources that ESTABLISH has produced and requested to translate and share the resources through national platforms and teacher education exchanges.

## Conclusion

The objective of the ESTABLISH's dissemination activities has been through regular communications to generate an increased awareness as well as engage a variety of audiences to drive a change (increased implementation of IBSE) in the way that science is taught in school throughout Europe.

The variety of levels of dissemination as well as the multiple tools or channels available to conduct this dissemination were selected as appropriate for partners and their national contexts. The combination has resulted in a wide variety of possible approaches to engage all groups of stakeholders. A particular challenge of ESTABLISH has been the engagement of new groups of stakeholders which have been traditionally avoided/neglected in cooperation with universities in many countries, such as: industry, school headmasters, publishing houses, policy makers, examination boards etc. ESTABLISH has developed approaches of how to stimulate and foster of partners institution to use new communication and dissemination channels which will extended beyond the life-time of the project.

It is acknowledged that sustainable promotion is reliant on the production of resources that audiences deem to be useful. Thus a trend of gradual increase of activities has been observed over the life time of the project, with an explosion of activities observed following the publication of the ESTABLISH teacher education materials and programmes. Accordingly, it is necessary to keep them up to date or to engage in an intensive dissemination exercise at the end of the project when the online material is available. The quality of these contributions has been recognised by conference organisers with invitations issued for ESTABLISH representation at future conferences, such as GIREP 2014, ECRICE 2014 and NARST. Thus the impact of ESTABLISH will continue to grow beyond the life-time of the project.

Due to the coordination and support nature of the ESTABLISH project, there have very few research oriented papers published as the project was focused on the practice of facilitating and implementing inquiry-based approach to science education. Thus, more of the efforts were channelled towards delivering teacher training to change of their attitudes than educational research. It is recognised though that a number of the project's reports maybe informative for the research community and it is intended later this year and next year to submit the following project reports as scientific papers and communications:

- Guide to the development of units & Framework for units
- Framework for ESTABLISH Teacher Education
- Obstacles to implementing IBSE
- Status of IBSE in ESTABLISH countries
- Key forces report, model of involvement of stakeholders
- Effective models for implementing teacher education across Europe
- Effective instruments for profiling teachers
- Profile of in-service teachers (interim and final)
- Profile of pre-service teachers (interim and final)
- The impact of Inquiry Based Science Education on second level students

Partners have noticed that because so many projects founded recently by European Commission deal with Inquiry Based Science Education it would be reasonably to organise joined conference where all of those initiatives and their outcomes would be presented. Such conferences should involve a variety of stakeholders, especially policy makers. It can show the ways in which the recommendations from the Rocard report can be implemented in reality with the help of international projects. Presentations of good IBSE practice examples for national policy makers can multiply an impact of educational systems and policy.

Overall, the core concept for success in bringing a change to promote and facilitate the implementation of IBSE has been the continuous engagement with and between the key stakeholders in STEM education, at regional, national or international level.

## Appendix

### ESTABLISH Dissemination Activities available on SESAM

Dissemination Format	Count of Nº	Sum of Size of audience (Descending Order)
Publication	35	74,199
Exhibitions	10	28,020
Web sites/Applications	8	19,029
Posters	43	10,662
Presentations	129	7,799
Flyers	45	5,922
Oral presentation to a scientific event	50	5,274
Organisation of Workshops	114	4,431
Oral presentation to a wider public	74	4,029
Organisation of Conference	26	1,715
Press releases	1	600
Interviews	1	4
<b>Grand Total</b>	<b>536</b>	<b>161,684</b>

<b>Audience Type</b>	<b>Count of Nº</b>	<b>Sum of Size of audience (Descending Order)</b>
Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias	14	41,523
Scientific community (higher education, Research)	206	36,620
Civil society	98	33,833
Scientific community (higher education, Research) - Civil society	78	21,146
Industry - Civil society - Policy makers	1	10,000
Scientific community (higher education, Research) - Policy makers	16	6,927
Civil society - Medias	1	5,000
Scientific community (higher education, Research) - Civil society - Policy makers	10	1,511
Scientific community (higher education, Research) - Civil society - Medias	4	1,050
Scientific community (higher education, Research) - Industry - Policy makers	4	995
Scientific community (higher education, Research) - Civil society - Policy makers - Medias	2	550
Civil society - Policy makers	9	534
Scientific community (higher education, Research) - Industry - Civil society	1	500
Industry - Civil society - Medias	1	500
Industry - Civil society	6	355
Industry	63	259
Scientific community (higher education, Research) - Industry - Civil society - Policy makers	4	227
Policy makers	9	120
Scientific community (higher education, Research) - Industry	7	23
Medias	1	10
Industry - Policy makers	1	1
<b>Grand Total</b>	<b>536</b>	<b>161,684</b>

## List of Peer-Reviewed publications

TITLE	Authors	Title of the periodical/series	Number/date/frequency	Publisher	Place of publication	Date of publication	Relevant pages	Open Access available	DOI (where available)
Inovace obsahu a metod výuky přírodních věd v současné společnosti.	ČTRNÁCTOVÁ, H., ČÍŽKOVÁ, V.	Chemické rozhledy	11 (5)		Slovak Republic, Bratislava	03/05/2010	139-146	Yes	
Didactic presentation as an instrument of enhancing science teaching clarity.	URBANOVA, K., ČTRNÁCTOVÁ, H.	Research in Didactics of the Sciences (Monograph) - Conference Proceedings	Research in Didactics of the Sciences conference	Pedagogical University of Kraków	Poland, Krakow	01/07/2010	377-379	Yes	
Současné školství a výuka chemie u nás.	ČTRNÁCTOVÁ, ZAJÍČEK, J.	Chemické listy	104 (8)	Česká společnost chemická - Czech Chemical Society	Czech Republic, Prague	02/08/2010	811-818	Yes	
Grafy logických struktur poznatkových systémů a pojmové mapy.	ŠULCOVÁ, R., ČTRNÁCTOVÁ, H.	Aktuální aspekty pregraduální přípravy a postgrad. vzdělávání učitelů chemie. - Conf. Proceedings	Aktuální aspekty pregraduální přípravy a postgraduálního vzdělávání učitelů chemie	Ostravská univerzita, Ostrava	Czech Republic, Ostrava	01/09/2010	266-272	Yes	
An investigation of environmental temperature effects on energy exchange by thermal radiation	Onofrio Rosario Battaglia, Claudio Fazio, Nicola Pizzolato, Rosa Maria Sperandeo-Mineo	American Journal of Physics	Vol. 81/Issue 12	American Association of Physics Teachers	United States	01/12/2013	923		

<b>Open inquiry-based learning experiences: a case study in the context of energy exchange by thermal radiation</b>	Nicola Pizzolato , Claudio Fazio , Onofrio Rosario Battaglia	European Journal of Physics	Vol. 35/Issue 1	Institute of Physics Publishing	United Kingdom	01/01/2014	15024		<a href="http://dx.doi.org/10.1088/0143-0807/35/1/015024">http://dx.doi.org/10.1088/0143-0807/35/1/015024</a>
<b>Open-inquiry driven overcoming of epistemological difficulties in engineering undergraduates: A case study in the context of thermal science</b>	Nicola Pizzolato , Claudio Fazio , Rosa Maria Sperandeo Mineo , Dominique Persano Adorno	Physical Review Special Topics - Physics Education Research	Vol. 10/Issue 1	American Physical Society	United States	01/02/2014	010107 (25 pp.)		10.1103/PhysRevSTPER.10.010107
<b>Introduction of inquiry based science education into polish science curriculum – general findings of teachers’ attitude</b>	Paweł Bernard, Iwona Maciejowska, Ewa Odrowąż, Karol Dudek, Rory Geoghegan	Chemistry-Didactics-Ecology-Metrology	Vol. 17 (1-2)	DeGruyter		17/01/2013	49-59	Yes	10.2478/cdem-2013-0004
<b>Curricular development of structure-property-relations exemplified with ESTABLISH materials (in progress)</b>	Parchmann, Ilka; Finlayson, Odilla	Science and Education		Springer Netherlands		31/12/2014	Not available		
<b>Industry and Design processes in ESTABLISH project (in progress)</b>	Parchmann, Ilka; Finlayson, Odilla	Education in Chemistry		Royal Society of Chemistry		31/12/2014	Not available		



## List of Conference proceedings

TITLE	Authors	Proceedings	Publication Date	Start Date of Conference/Workshop	End date of Conference/Workshop	Publisher	Publisher Location	Relevant pages	Open access is/will be provided
Physics Alive	N. Pizzolato, O. R. Battaglia, R. M. Sperandeo Mineo	An Inquiry Based Approach to the study of energy exchange by thermal radiation	01/08/2011	01/08/2011	05/08/2011	University of Jyväskylä, Finnish Cultural Foundation	Jyväskylä, Finland	272-277	Yes
Physics Alive	Claudio Fazio, Giovanni Tarantino and Rosa Maria Sperandeo-Mineo	Teachers' competences about Inquiry Based approaches to the analysis of Thermal Phenomena: implications for an appropriate training	01/08/2011	01/08/2011	05/08/2011	University of Jyväskylä, Finnish Cultural Foundation	Jyväskylä, Finland	19-24	Yes
Proceedings of Twelfth International Symposium Frontiers of Fundamental Physics [FFP12]	N. Pizzolato, O. R. Battaglia, C. Fazio, R. M. Sperandeo Mineo	Energy Exchange By Thermal Radiation: Hints and Suggestions for an Inquiry Based Lab Approach	21/11/2011	21/11/2011	23/11/2011	University of Udine (Italy)	Udine (Italy)		Yes
Proceedings of Twelfth International Symposium Frontiers of Fundamental Physics [FFP12]	Claudio Fazio, Giovanni Tarantino, Rosa M. Sperandeo Mineo	Investigating Teacher Pedagogical Content Knowledge Of Scientific Inquiry	21/11/2011	21/11/2011	23/11/2011	University of Udine (Italy)	Udine (Italy)		Yes

<b>Inquiry-based education in physics at slovak secondary schools</b>	Ivan Duľa, František Gomboš, Zuzana Ješková	Science and Mathematics Education Conference : Teaching at the heart of learning	07/06/2012	07/06/2012	09/06/2012	Dublin City University	Dublin		
<b>Inquiry-based teaching and learning of direct current electricity</b>	Zuzana Ješková, Ľudmila Ondeová, Marián Kireš	Science and Mathematics Education Conference : Teaching at the heart of learning	07/06/2012	07/06/2012	09/06/2012	Dublin City University	Dublin		
<b>Implementácia IBSE metódy do prírodovedného vzdelávania na Slovensku</b>	Mária Ganajová ... [et al.]	Badania w dydaktykach nauk przyrodniczych (Research in didactics of the sciences)	02/07/2012	16/07/2012	19/07/2012	Pedagogical University of Kraków	Krakow	28-31	
<b>Science on Stage teacher training course in Slovakia</b>	Marián Kireš, Zuzana Ješková, Mária Nováková	Science and Mathematics Education Conference : Teaching at the heart of learning	07/06/2012	07/06/2012	09/06/2012	Dublin City University	Dublin	66-69	
<b>Metóda aktívneho bádania vo výučbe prírodných vied</b>	Mária Ganajová ... [et al.]	Aktuálne trendy vo vyučovaní prírodovedných predmetov	12/10/2012	15/10/2012	17/10/2012	Pedagogická fakulta Trnavskej univerzity v Trnave	Trnava, Slovakia		
<b>Prekonajme sami seba</b>	Marián Kireš, Zuzana Ješková, Claudio Fazio	Tvorivý učiteľ fyziky V : národný festival fyziky 2012	13/04/2012	15/04/2012	18/04/2012	Slovak Physical Society	Košice	153 - 157	Yes
<b>Výučbové materiály na tému Zvuk v projekte ESTABLISH</b>	Zuzana Ješková, Marián Kireš, Ewa Kedzierska	Tvorivý učiteľ fyziky V : národný festival fyziky 2012	13/04/2012	15/04/2012	18/04/2012	Slovak Physical Society	Košice	147 - 152	Yes

<b>Don't be afraid of physics - Interactive activities from Physics for basic school pupils</b>	Ludmila Onderova, Zuzana Jeskova, Marian Kires	WCPE : The World Conference on Physics Education : book of abstracts	29/06/2012	01/07/2012	06/07/2012	Bahcesehir Universtesi	Istanbul	392	Yes
<b>Impact of IBSE methods and IBSE materials on students' learning</b>	Zuzana Jeskova ... [et al.]	WCPE : The World Conference on Physics Education : book of abstracts	29/06/2012	01/07/2012	06/07/2012	Bahcesehir Universtesi	Istanbul	246	Yes
<b>Inquiry-based science education for physics teaching and learning - the ESTABLISH approach</b>	Ton Ellermeijer ... [et al.]	WCPE : The World Conference on Physics Education : book of abstracts	29/06/2012	01/07/2012	06/07/2012	Bahcesehir Universtesi	Istanbul	29	Yes
<b>In-service teacher training for using of IT in inquiry based activities</b>	Marian Kires, Zuzana Jeskova	WCPE : The World Conference on Physics Education : book of abstracts	29/06/2012	01/07/2012	06/07/2012	Bahcesehir Universtesi	Istanbul		Yes
<b>Implementation of IBSE methods and teaching materials in science education in Slovakia</b>	Ganajová M. ... [et al.]	The 5th International Conference Research in Didactics of the Sciences	26/06/2012	27/06/2012	29/06/2012	Pedagogical University of Kraków	Kraków	43	
<b>Digitálna knižnica pre projektové vyučovanie a bádateľské vzdelávanie v chémii</b>	Petra Lechová... [et al.]	The 5th International Conference Research in Didactics of the Sciences	26/06/2012	27/06/2012	29/06/2012	Pedagogical University of Kraków	Kraków	96-99	
<b>Bádateľské aktivity vo výučbe chémie</b>	Mária Ganajová, Milena Kristofová	Zborník z 1. národnej konferencie učiteľov chémie	31/01/2013	01/02/2013	02/02/2013	Združenie učiteľov chémie			

<b>Inquiry- and project-based learning about plastic and plastic waste</b>	Ganajova, Lechova	ICCE 22 : 22nd International Conference on Chemistry, ECRIC 11 : 11th European Conference on Research in Chemical Education	13/07/2012	15/07/2012	20/07/2012	Italian Chemical Society	Roma	386	
<b>Príprava budúcich učiteľov na bádateľsky orientovanú výučbu prírodných vied</b>	Katarína Kimáková, Mária Ganajová	EDUCO : Dynamics of Institutional Education in the Context of Training of Teachers Specialized in Science, Agriculture and Related Fields	02/02/2012	03/02/2012	04/02/2012	Česká zemědělská univerzita v Praze	Praha	84-92	
<b>Inquiry based biology education – piloting the unit „Blood donation“ in Slovak schools</b>	Lenka Škrabeková ... [et al.]	SMEC 2012 : Science and Mathematics Education Conference : Teaching at the heart of learning	06/06/2012	07/06/2012	09/06/2012	Dublin City University	Dublin	91-94	
<b>Inquiry-based activities for the topic plastic and plastic waste</b>	Mária Ganajová ... [et al.]	SMEC 2012 : Science and Mathematics Education Conference : Teaching at the heart of learning	06/06/2012	07/06/2012	09/06/2012	Dublin City University	Dublin	214 - 219	
<b>Inquiry based chemistry education - piloting the unit "Exploring holes" in Slovak schools</b>	Alena Spišiaková ... [et al.]	SMEC 2012 : Science and Mathematics Education Conference : Teaching at the heart of learning	06/06/2012	07/06/2012	09/06/2012	Dublin City University	Dublin	205 - 209	
<b>Inquiry-based versus project-based method of teaching the topic Plastic</b>	Petra Lechová, Mária Ganajová, Milena Kristofová	SMEC 2012 : Science and Mathematics Education Conference : Teaching at the heart of learning	06/06/2012	07/06/2012	09/06/2012	Dublin City University	Dublin	210 - 213	

<b>Inquiry-based activities in topics: polymers, plastics and plastic waste</b>	Hana Čtrnáctová ... [et al.]	The 5th International Conference Research in Didactics of the Sciences	26/06/2012	27/06/2012	29/06/2012	Pedagogical University of Kraków	Kraków	29	
<b>Preparing teachers for the use of ICT in the framework of inquiry based science education (IBSE) - the ESTABLISH approach</b>	KEDZIERSKA, Ewa – JEŠKOVÁ, Zuzana - BA TRAN Trinh - ELLERMEIJER, Ton – KIREŠ, Marián	Proceedings of the 10th International Conference on Hands-on Science	28/06/2013	01/07/2013	05/07/2013	Hands on Science network	Košice	290 - 298	Yes
<b>25. In-service teacher training in IBSE in Slovakia and its impact on teachers and students in the framework of the ESTABLISH project</b>	JEŠKOVÁ, Zuzana, KIMÁKOVÁ Katarína – GANAJOVÁ, Mária, KIREŠ, Marián	Proceedings of the 10th International Conference on Hands-on Science	28/06/2013	01/07/2013	05/07/2013	Hands on Science Network	Košice	272 - 276	Yes
<b>26. Experience with the implementation of inquiry-based activities enhanced by digital Technologies a tone of the Slovak grammar schools</b>	JEŠKOVÁ, Zuzana – TIMKOVÁ Veronika, HORVÁTHOVÁ Mária	Proceedings of the 10th International Conference on Hands-on Science	28/06/2013	01/07/2013	05/07/2013	Hands on Science Network	Košice	67-72	Yes
<b>Project ESTABLISH – chemistry and biology</b>	ČÍŽKOVÁ, Věra – ČTRNÁCTOVÁ, Hana - GANAJOVÁ, Mária- KIMÁKOVÁ, Katarína ŠMEJKAL, Petr	Proceedings of the 10th International Conference on Hands-on Science	28/06/2013	01/07/2013	05/07/2013	Hand on Science Network	Košice	135 - 141	Yes
<b>Experience in using Inquiry-based method</b>	GANAJOVÁ, Mária-	Proceedings of the 10th International Conference	28/06/2013	01/07/2013	05/07/2013	Hands on Science	Košice	131 -	Yes

in chemistry teaching	KRIŠTOFOVÁ, Milena	on Hands-on Science				Network	ce	135	
Teacher preparation for inquiry-based biology education at P.J. Šafárik University	KIMÁKOVÁ, Katarína – LEŠKOVÁ, Andrea	Proceedings of the 10th International Conference on Hands-on Science	28/06/2013	01/07/2013	05/07/2013	Hands on science Network	Košice	254 - 258	Yes
Science on stage activities as an inspiration for inquiry based science education	M. Kireš, Z. Ješková	: Proceedings of the 8th International Conference on Hands-on Science Focus on multimedia	14/09/2011	15/09/2011	17/09/2011	Hands on Science Network	Ljubljana	145 - 147	Yes
Implementing an inquiry based approach to teaching sound in five different national contexts	Kires Marian ... [et al.]	Science Education Research : 9th International Conference Science Learning & Citizenship	04/09/2011	05/09/2011	09/09/2011	ESERA	Lion	205	
PROFILING IN-SERVICE TEACHERS ACROSS EUROPE TO DETERMINE THEIR ATTITUDE TO IBSE	Laura Barron, Odilla Finlayson, Deirdre McCabe, Claudio Fazio, Christina Ottander, Margareta Ekborg, Ilka Parchmann, Sarah Brady, and Eilish McLoughlin	ESERA 2013 Conference Proceedings	02/09/2013	02/09/2013	07/09/2013	European Science Education Research Association	Nicosia, Cyprus		Yes
BRINGING INNOVATIVE IBSE TEACHING TO SCHOOL: A COLLABORATIVE APPROACH OF UNIVERSITY AND SCHOOL	Martin Lindner, Louise Bindel, Stephan Domschke, Laura Barron, Odilla Finlayson, Sarah Brady, and Eilish McLoughlin	ESERA 2013 Conference Proceedings	02/09/2013	02/09/2013	07/09/2013	European Science Education Research Association	Nicosia, Cyprus		Yes

INQUIRY BASED SCIENCE EDUCATION AND COLLECTING EVIDENCE ABOUT ITS IMPACT ON STUDENTS (ESTABLISH PROJECT APPROACH)	Kekule, M., Žák, V., Ješková, Z., Kimáková, K., Ganajová, M., Kireš, M.,	ESERA 2013 Conference Proceedings	02/09/2013	02/09/2013	07/09/2013	European Science Education Research Association	Nicosia, Cyprus		Yes
TEACHERS' AND STUDENTS' VIEWS ON INDUSTRY-RELATED COMPETENCES	Miia Rannikmae, Jack Holbrook, Klaara Kask, Anne Laius, Moonika Teppo, Odilla, Finlayson, Sarah Brady, and Eilish McLoughlin	ESERA 2013 Conference Proceedings	02/09/2013	02/09/2013	07/09/2013	European Science Education Research Association	Nicosia, Cyprus		Yes
Learners as initiators through inquiry based scienceeducation – experiences from the European project ESTABLISH	Eilish McLoughlin, Odilla Finlayson and Sarah Brady	International Conference on Engaging Pedagogy	06/12/2013	06/12/2013	07/12/2013	ICEP	Sligo, Ireland		
The views of preservice and inservice teachers on IBSE	Laura Barron, Odilla Finlayson and Eilish McLoughlin	Science and Mathematics Education Conference : Teaching at the heart of learning	07/06/2012	06/06/2012	09/06/2012	Dublin City University	Dubl in, Irela nd	39-44	Yes
Science Education in Context of Requirements of Current Society.	ČÍŽKOVÁ, V., ČTRNÁCTOVÁ, H.	Socio-cultural and Human Values in Science and Technology Edu.–XIVth IOSTE World Symp. Proceedings	01/06/2010	13/06/2010	18/06/2010	IOSTE University of Ljubljana, Slovenia	Bled , Slov enia	1324-1326	Yes
Transition Metals – The Transformation of a Scientific Text to a	MATOUŠKOVÁ, Š., ČTRNÁCTOVÁ, H.	10th European Conference on Research in Chemical Education -	04/07/2010	04/07/2010	09/07/2010	Pedagogical University of Kraków	Pola nd, Krak	173-	Yes

Learning Text		Conference Proceedings					ow	174	
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## List of Article/Section in an edited book or book series

Title	Author(s)	Title of the book (series)	Volume	Date of publication	Publisher	Publication location	Relevant pages	Open access is/will be provided to this publication
IBSE jako najbardziej modna strategia edukacyjna	I. Maciejowska, Konsorcjum ESTABLISH	Dydaktyka chemii (i innych przedmiotów przyrodniczych) od czasów alchemii po komputery				Kraków	73-79	Yes
ESTABLISH – Innovations in Teacher Training in Poland	Paweł Bernard, Anna Białas, Paweł Broś, Małgorzata Krzeczowska, Iwona Maciejowska, Ewa Odrowąż, Elżbieta Szostak, ESTABLISH Consortium	Science-Society-Didactics		01/06/2013	Wydawnictwo Naukowe Uniwersytetu Pedagogicznego	Kraków	35-49	No
Didactic presentation as an instrument of enhancing science teaching clarity.	URBANOVÁ, K., ČTRNÁCTOVÁ, H.	Research in Didactics of the Sciences (Monograph) - Conference Proceedings		01/07/2010	Pedagogical University of Kraków	Poland, Kraków	121	Yes
Implementácia IBSE metódy do prírodovedného vzdelávania na Slovensku	Mária Ganajová ... [et al.]	Badania w dydaktykach nauk przyrodniczych (Research in didactics of the science)		02/07/2012	Pedagogical University of Kraków	Poland, Kraków	28-31	Yes

## List of Thesis/Dissertation

Title	Author	Date of approval	Institution name	Institution location	Open access is/will be provided to this publication
<b>Inquiry based learning experiences on thermal phenomena from secondary school to university: motivational aspects, conceptual knowledge and nature of science view.</b>	Nicola Pizzolato	17/03/2014	University of Palermo	Palermo, Italy	Yes
<b>Inquiry based education in the context of the new curriculum and its impact on the image of science and scientist</b>	Karol Dudek	31/05/2012	Jagiellonian University in Krakow	Krakow, Poland	No
<b>Development of school chemistry experiments ( upper secondary school, basic level) promoting IBSE</b>	Jacek Murczek	17/06/2013	Jagiellonian University in Krakow	Krakow, Poland	No
<b>Conceptualization and investigation of a Lab-Session focusing on Inquiry based Learning for Pre-service teachers. Kiel 2012 (in German)</b>	Fischmann, Kirsten	30/09/2012	Christian-Albrechts-Universität zu Kiel		
<b>Aktivita pro badatelsky orientovanou výuku v biologii - Inquiry-based educational activities in biology</b>	Nedomová Martina	30/05/2012	Faculty of Science, Charles University in Prague	Prague	Yes

## List of University Publications / Scientific Monographs

Title	Author(s)	Title of the monograph	Volume	Date of publication	Publisher	Publisher location	Open access
<b>The Development and Implementation of Industry Informed Inquiry Based Units for Chemistry Teachers (ESTABLISH Project)</b>	Odilla E. Finlayson and Sarah Brady,	Chemistry Education: EduQ	14	01/07/2013	IEC	Barcelona	Yes
<b>Nauczanie przedmiotów przyrodniczych kształtujące postawy i umiejętności badawcze uczniów</b>	Eds.: Iwona Maciejowska, Ewa Odrowąż	Nauczanie przedmiotów przyrodniczych kształtujące postawy i umiejętności badawcze uczniów	1	01/09/2012	Wydział Chemii UJ	Kraków	Yes
<b>Nauczanie przedmiotów przyrodniczych kształtujące postawy i umiejętności badawcze uczniów</b>	Eds.: Iwona Maciejowska, Ewa Odrowąż	Nauczanie przedmiotów przyrodniczych kształtujące postawy i umiejętności badawcze uczniów	2	01/04/2013	Wydział Chemii UJ	Kraków	Yes
<b>ESTABLISH Overview and Outcomes (in German; in progress)</b>	Parchmann, Ilka	IPN-Blätter	2014	30/06/2014	Leibniz-Institut für die Pädagogik der Naturwissenschaften und Mathematik	Kiel, Germany	