European Coordinating Body for Maths, Science and Technology (ECB)

DELIVERABLE SUBMISSION SHEET

To: Noora Eronen *Project Officer*

EUROPEAN COMMISSION
DG Research & Innovation
B7, COV2 06/069
B-1049 Brussels/Belgium

From: EUN Partnership AISBL

Project acronym: ECB Project number: 266622

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The following deliverable:

Deliverable title: Observations summary report

Deliverable number: D2.3

Deliverable date: 25/02/2013

Partners responsible: Universitat Autònoma de Barcelona

Status: ☑ Public ☐ Restricted ☐ Confidential

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Published in February 2013. The views expressed in this publication are those of the authors and not necessarily those of EUN Partnership AISBL.

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The work presented in this document is partially supported by the European Commission's FP7 programme – project ECB – European Coordination Body (Grant agreement Nº 266622). The content of this document is the sole responsibility of the consortium members and it does not represent the opinion of the European Commission and the Commission is not responsible for any use that might be made of information contained herein.

ECB - WP 2

D2.3 - OBSERVATIONS SUMMARY REPORT

CONTRACT NO	266622
DATE	25/02/2013
ABSTRACT	This document presents a set of preliminary recommendations for improving both the establishment and maintenance of school-industry partnerships and their effectiveness as a way of engaging young people in STEM careers. Such recommendations are based on the field of educational sciences, science education and psychology, as well as on the analysis of existing European initiatives. A catalogue of practices, policies and organizations supporting school-industry partnerships is also included.
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WORKPACKAGE	WP 2
CONFIDENTIALITY LEVEL[1]	PU
FILING CODE	ECB D2.3 Observations summary report
RELATED ITEMS	

DOCUMENT HISTORY

Version	Date	Reason of change	Status	Distribution
V1	14/01/2013	1st draft	Draft	Reviewers
V2	10/02/2013	1st review of draft	Draft	UAB
V3	19/02/2013	2 nd review of draft	Draft	UAB
V4	25/02/2013	Final version	Offical	European Commission

[1] 1 PU = Public
PP = Restricted to other programme participants (including the EC services);
RE = Restricted to a group specified by the Consortium (including the EC services);
CO = Confidential, only for members of the Consortium (including the EC services).
INN - Internal only, only the members of the consortium (excluding the EC services)

Executive summary

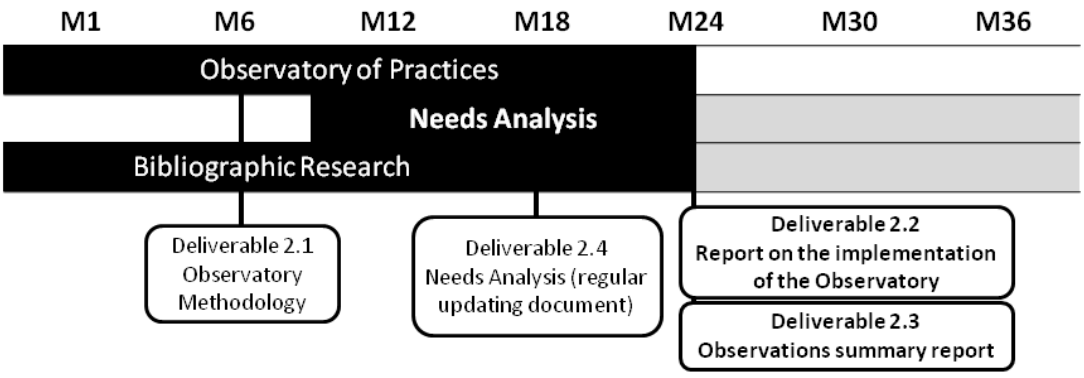
The ECB/inGenious project is a large-scale research and evaluation effort which aims to strengthen links between education and industry to boost young people's interest in STEM careers as a way of addressing several of the challenges related to schience, technology, engineering and mathematics (STEM) in Europe. Since 2000, several strategies have been launched with the aim of transforming Europe into a competitive and dynamic knowledge-based economy. All of these strategies share the intention of increasing human resources employed in STEM as part of the initiatives to strengthen innovation, which is a motor for economic progress. In this context, closer cooperation between education and industry could undoubtedly help address the skills gap by equipping people with the right skills for the jobs of today and tomorrow.

Within the ECB/inGenious project, the main aim of which is to contribute to making school-industry collaborations as effective as possible and to expanding them across Europe, the tasks performed in Workpackage 2 –WP2, entitled **"Observatory of practice and needs analysis – Monitoring Research Developments"**, are addressed to explore both the current situation of school-industry partnerships in Europe and the main existing challenges in them.

The Observatory of Practices aimed at collecting good education practices of school-industry collaboration and STEM education policies (pilot programmes, policy reforms, promotion campaigns, etc.) to increase students' interest in STEM subjects at primary and secondary level of education through industrial partnerships. On the other hand, the Needs Analysis was established in order to identify problematic issues in current school-industry collaborations, both at national and at European level.

The present document (Deliverable 2.3), forms part of a set of deliverables from the project, and has been based on the results obtained from the Observatory of Practices and the initial stages of the Needs Analysis.

The methodologies established for the Observatory and for the Needs Analysis were described in Deliverables 2.1 and 2.4, respectively, while the preliminary results from the implementation of the Observatory programme are presented in Deliverable 2.2.



The study that has been performed in the frame of the Observatory and the initial stage of the Needs Analysis identified several challenges that need to be overcome to facilitate the establishment and maintenance of school-industry partnerships effectively in contributing to the fostering of young people's interest in STEM careers. Based on the findings of this study gathered and analysed to date, several measures that could help to overcome these challenges are proposed in the form of a set of preliminary recommendations. It is worth mentioning that the number of practices and policies collected so far (64 and 40, respectively) does not enable definite recommendations to be made, although it allows giving some suggestions for further consideration.

Taking into account the variety of barriers that exist, we have distinguished between two types of recommendations depending on the kind of challenges that they might help to overcome.

According to the initial stage of the Needs Analysis performed so far, one of the main challenges in school-industry collaborations is the establishment and maintenance of these partnerships. In this sense, and based on the particular kinds of difficulties that have been identified, the first set of recommendations is to improve the establishment and maintenance of school-industry partnerships and includes:

- Recommendations at policy-making level
- Recommendations for increasing the number of collaborations
- Recommendations for establishing and maintaining collaborations

It has been found that the existence of facilitator organizations linking school and industry can assist in fostering school-industry relationships. Such organizations represent an added value for the establishment and maintenance of such collaborations, since they can help partners overcome many of the practical barriers found by companies and schools when they are to collaborate. In particular, such organisations can offer :

- Easier connection and more effective communication
- Wider reach of teachers and students compared to a single company
- More content variety
- Neutrality in mediating between the diverse range of needs and industry and schools
- Continuity and long-term commitment
- Enhancement effect to enlarge the number of stakeholders involved

On the other hand, the study performed within the Observatory of Practices has given rise to a diversity of challenges that could prevent school-industry partnerships to reach the objective of contributing to increase the number of young people choosing STEM careers.

In this sense, based on the analysis of the practices performed in the Observatory, the second set of recommendations is for improving the effectiveness of school-industry practices to engage young people within STEM careers and includes:

- Recommendations on the focus of the partnerships
- Recommendations to address the different age groups
- Recommendations on the implementation of the practices
- Recommendations on the evaluation of the practices

Finally, the present document also includes a catalogue of the practices provided by the partners of the project and the policy actions collected within the Observatory, as well as several examples of ECB/inGenious partner organizations which have been identified as success stories in linking school and industry. It is worth mentioning that this catalogue is not intended to be an exhaustive repository, but a collection of intitiatives that can be inspiring for teachers, industrial companies and policy makers to enhance future sharing and further development of school-industry collaborations. Many of these exemples, however, will be included in the practices database developed within Workpackage 4, which is one of the outputs of the project that will allow teachers and other stakeholders having the necessary information to contact the promoter organizations of these practices.

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1 INTRODUCTION ABOUT THIS DELIVERABLE

The following report forms part of a set of deliverables framed in the ECB/inGenious project, which is devoted to reinforcing and analysing school-industry partnerships as a way to foster young people's interest in, and engagement with, Science, Technology, Engagement and Mathematics (STEM) careers in Europe.

In particular, this document (Deliverable 2.3) presents a set of preliminary recommendations for improving both the establishment and maintenance of school-industry partnerships and their effectiveness as a way of engaging young people with STEM careers. Such recommendations are based on research in the field of educational sciences, science education and psychology, as well as on the experience of previous existing European initiatives that have been identified in the frame of the ECB/inGenious project. In fact, the present document also includes a catalogue of good practices and policies that have been collected from the partners of this project, and which can be inspiring for teachers, industrial companies and policy makers to enhance the sharing and future development of school-industry collaborations. Moreover, many of these examples will be included in the practices database which is being developed in Workpackage 4, so that teachers and other stakeholders can have the necessary details to contact the promoter organizations if they wish to.

The development of the catalogue included in this document has been possible thanks to the Observatory of practices, which has been performed with the aim of collecting:

- Good practices of school-industry collaboration, promoted by industries and STEM-related companies; and
- Policy actions (pilot programmes, policy reforms, promotion campaigns, etc.) to increase students' interest in STEM subjects at primary and secondary level of education through industrial partnerships.

The established methodology for the Observatory was presented in a previous document (Deliverable 2.1), whereas the results of having implemented this Observatory are presented in a document (Deliverable 2.2) which is closely linked to this one (Deliverable 2.3).

Degree of achievements

This report is based on the Observatory of Practices and the initial stages of the Needs Analysis performed so far. Since the sample of the Observatory was smaller than expected, and the Needs Analysis is not still complete, the findings and recommendations are provisional, and further consideration will be required in the light of the additional evidence that is still to be collected.

- Deliverable 2.3 had to be sent to the Comission on the 31st of January, following the DoW of the project. However, the delivery date has been slightly delayed.

- This is a final version of the Deliverable 2.3.

Risk Analysis

The study performed in WP2 regarding the Observatory of Practices is not able to represent a reliable picture of the European reality regarding school-industry partnerships due to the low amount of data collected so far from partners and Ministries of Education. Moreover, due to the delay in the organisation of the national workshops, the results of the Needs Analysis at national level are not still available. However, once the national reports have been analysed, it will be possible to refine and complete the preliminary recommendations presented in this document.

Deliverable Number	**Deliverable Title**	**Delivery date** [2]
D2.1	Observatory methodology	*M9 (Nov 2011) – Delivered*
D2.2	Report on the implementation of the observatory	M24 (Feb 2013)
D2.3	**Observations summary report**	**M24 (Feb 2013)**
D2.4	Needs Analysis (regular updating of the document)	M18 (Jul 2012) [3]
D2.5	Country reports on research developments	M30 (Jul 2013)
D2.6	EU synthesis report	M36 (Feb 2014)

Table 1: List of deliverables for Workpackage 2 and expected delivery dates.

[2] For clarity, the timeline of the Project is expressed in months (M), starting at M1 (February 2011) and ending at M36 (January 2014).

[3] Due to internal agreements, the delivery date for this document was postponed to M24 (February 2013).

2 ADDRESSING THE LACK OF STEM PROFESSIONALS IN EUROPE

The Lisbon Special European Council held in 2000 had the objective of strengthening employment, economic reform and social cohesion as part of a knowledge-based economy strategy. In 2005, after an evaluation process which helped to clarify its scope and aims, the Lisbon Strategy was re-launched with the initiative « Working together for growths and jobs », and several measures specifically targeted the younger generation (EC, 2010). The re-launched strategy aimed at **endowing this group with the human capital and the skills needed** in a dynamic knowledge-based economy. In fact, in 2004 the High Level Group (HLG) on Human Resources for Science and Technology[4] warned that new human resources for STEM would not be attracted at the required level unless governments translated their political goals urgently into new research jobs and better career perspectives (Gago, 2004). In particular, the HLG pointed out that the Lisbon and Barcelona EU objectives of attaining 3% of GDP for R&D would roughly require a minimal level of eight researchers per thousand in the workforce (in 2001, the number of researchers per 1000 of the workforce, in full-time equivalent or FTE, was 5.7 for the EU-15). They argued, moreover, that reliance on importing suitable qualified workers from outside the EU is not sustainable in the long term, given the global nature of the market and the dynamics at play, and that EU ambition will not be met on the present trajectory of increasing the numbers entering STEM career. In fact, although absolute numbers of science and technology (S&T) students have been rising in line with access to higher education, their relative share has been falling in tertiary education and upper secondary levels in several OECD countries (OECD, 2008).The decreasing trend along the last decade is shown in Figure 1, according to updated data from Eurostat Education Statistics.

In this context, increasing the human resources employed in STEM is part of the initiatives to strengthen innovation, which is a motor for economic growth and for solutions to social and environmental challenges. Closer cooperation between education and industry could undoubtedly help raising awareness of STEM careers and equipping people with the right skills for the jobs of today and tomorrow. In fact, evidence exist suggesting that employer's involvement with education has positive impacts in terms of preparedness for work, developing job and work skills, improving work-based competences, attitudes and behaviours, enhanced employability and higher initial wage rates (NCSR, 2008).

In this sense, the European Round Table of Industrialists (ERT) has been at the forefront of addressing the perceived challenges and prepared a report in order to assess how business can help to address the roadblocks that threaten Europe's Future prosperity (ERT, 2009). With this report, the ERT together with European Schoolnet, established the basis for the creation of a European Coordinating Body, with the aim of fostering young

[4] The High Level Group (HLG) was part of the Commission's strategy to address the Lisbon EU Summit declaration of March 2000.

people's interest in STEM careers by reinforcing links between schools and industries through STEM education activities.

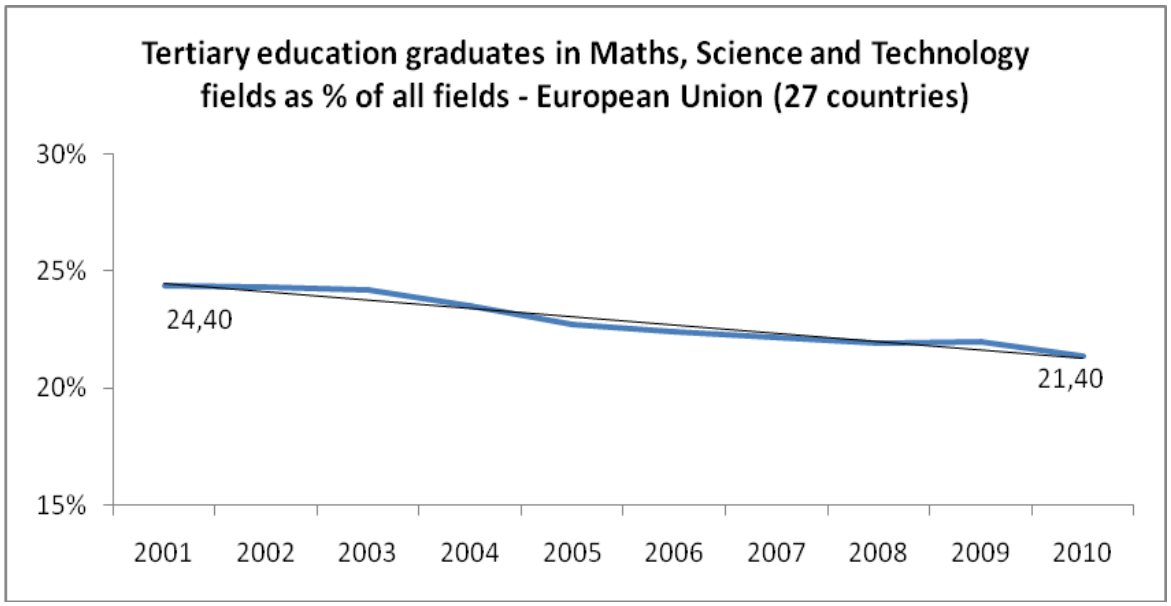

Figure 1: Relative share of tertiary education graduates in STEM (Graphic elaborated from *Tertiary education graduates*. Data available at Eurostat Database[5]. Last update 07.08.12)

2.1. School-Industry partnerships: motivation and benefits

School-industry partnerships have long been a mechanism for bringing the world of work closer to education, especially in the case of vocational training. However, apart from aspects that are purely vocational, the collaboration between industry and schools can also be motivated by other reasons, such as the will to show young people the world of STEM professionals in order to help counter-balance stereotypes and to inform them about current and future perspectives of STEM careers. It has been argued that students decisions about study and career paths are primarily based upon interest in a particular field, and on their perception of jobs prospects in that field (OECD, 2008). Moreover, positive contacts with science and technology at an early age can have a long-lasting impact, while negative experiences at school, due to uninteresting content or uninspired teaching, are often very detrimental to future choices.

Teachers are a very influential factor in shaping career aspirations. Apart from the pedagogical approaches used to teach STEM disciplines in school, teachers' perceptions are also transmitted to students. There is sometimes a big disconnection between the

[5] http://epp.eurostat.ec.europa.eu/portal/page/portal/education/data/database

curriculum content and teachers' perceptions, on the one hand, and the real world of STEM and STEM professionals, on the other hand. In fact, in many countries most primary (and sometimes also secondary) teachers come from a non-STEM background, and they do not have access to information on career prospects for STEM students. Thus, many STEM teachers may need to upgrade their skills and knowledge, and a way to do so is through collaborating with industry. Having this in mind, school-relationships can positively contribute to foster more students to lean towards STEM careers when making their carer choice.

According to a recent report published by NFER, evidence suggests that employer involvement with schools has a positive impact on students' vocational/employability skills, knowledge and understanding, academic and learning outcomes, health and well-being and enjoyment and engagement, as it is shown in Figure 2 (Burge, Wilson, & Smith-Crallan, 2012).

On the other hand, employers' involvement with school governing bodies can positively contribute to the leadership of schools (Mann & Stanley, 2010), and the development of teachers' experties in particular curriculum areas can be also improved with the support of employers' involvement through the provision of advice and curriculum-related resources.

Research evidence also highlights the potential benefits of employer involvement for employers themselves. According to Mann & Oldknow (2012), while a range of motivating factors have been identified, four are found consistently:

- **Staff recruitment:** employer engagement in general, and work experience in particular, have become seen as a primary means of improving important "employability skills" (such as team working, problem solving, effective communications, etc.) in future recruits.

- **Staff development:** employers have much to gain from engagement activities in terms of staff development. According to a landmark 2010 report which sought to quantify the financial benefits of such developments activities, "there is clear evidence that the skills and competences developed through volunteering assignments are of direct relevance to companies involved", and volunteering assignment in education represent "a highly cost-effective way to develop certain core competences" (Corporate Citizenship, 2010).

- **Staff engagement:** reviews of the employee perceptions demonstrate that volunteering with education serves to increase motivation and commitment to employers.

- **Corporate reputation:** school leaders feel that a primary benefit to employers from their engagement with schools is improved reputation and stronger links with the communities in which they operate.

Therefore, collaboration between schools and industry can be motivated by multiple intentions and can bring a wide range of positive outcomes to the different stakeholders. This document, however, is specifically focused on the interest of these partnerships as a way of fostering young people's interest in, and engagement with, STEM careers.

Outcome	Details
Vocational skills, knowledge and understanding	• Insight into the world of business • Increased knowledge of certain industries • Awareness of best-suited careers • Enhanced career aspirations • Insider advice from employees • Improved work-readiness • Improved transitions to work or FE
Academic and learning outcomes	• Deeper understanding of particular subjects • Better integration of theory and practice in subjects • Improved dedication • Enhanced skills development • Improved academic results • Increased motivation • Lower drop-out rates and improved attendance • Positive attitudes towards learning
Health and well-being	• Improved social and emotional well-being (e.g. greater self-esteem, higher aspirations, improved goal setting and a more positive outlook on life) • Reductions in behaviour management issues
Enjoyment and engagement	• Greater enjoyment gained from learning • Introduction of new perspectives • Greater relevance created through real-life connections • Improved engagement • Improved attendance • Positive relationships with mentors
Employment and earnings	• Sustained employment and earnings gains (especially among young men)[5] • Access to better opportunities • Creation of personal networks through school-employer networks • Better career decisions
Family life	• Career Academies also showed positive effects on increasing family stability

Sources: AIR UK (2008); Bennett (2008); Fischer (2008); Kemple with Willner (2008); Cowen and Burgess (2009); Mann *et al.*(2010); Business-School Connections Roundtable (2010); Stern *et al.* (2010); Lonsdale *et al.* (2011)

Note: Findings from AIR UK (2008); Lonsdale *et al.* (2011) and Mann *et al.* (2010) derive from multiple studies. Findings from Kemple with Willner (2008) and Stern *et al.* (2010) refer to Career Academies in the US.

Figure 2: Outcome for students – from (Burge et al., 2012).

2.2. Reinforcing the links between industry and education : the ECB/inGenious Project

The ECB/inGenious project is a large-scale research and evaluation effort which aims to strengthen links between education and industry to boost young people's interest in STEM careers. In fact, although there is a great diversity of initiatives intended to promote the quality and innovation of STEM education at school –many of them promoted by universities, policy makers, informal learning environments, etc. – (Gerloff-Gasser, Jann, & Kyburz-Graber, 2007), those designed in collaboration with industries can be specially interesting for enhancing young people's interest in STEM careers and jobs (Burge et al., 2012). In fact, as it was extensively explained in the Deliverable 2.1, the process of career decision making is influenced by several factors, many of which can be strongly emphasized through the collaboration between school and industry[6].

In this sense, the different workpackages involved in the project (Figure 3) jointly contribute to making school-industry partnerships as effective as possible to foster young people's interest in STEM careers, and to expanding them across Europe. In particular, the Workpackage 2 (WP2) is mainly focused on exploring the current situation of school-industry partnerships and their main existing challenges in Europe, two questions which are being addressed through the establishment of an Observatory of Practices, the performance of a Needs Analysis, and detailed bibliographic research.

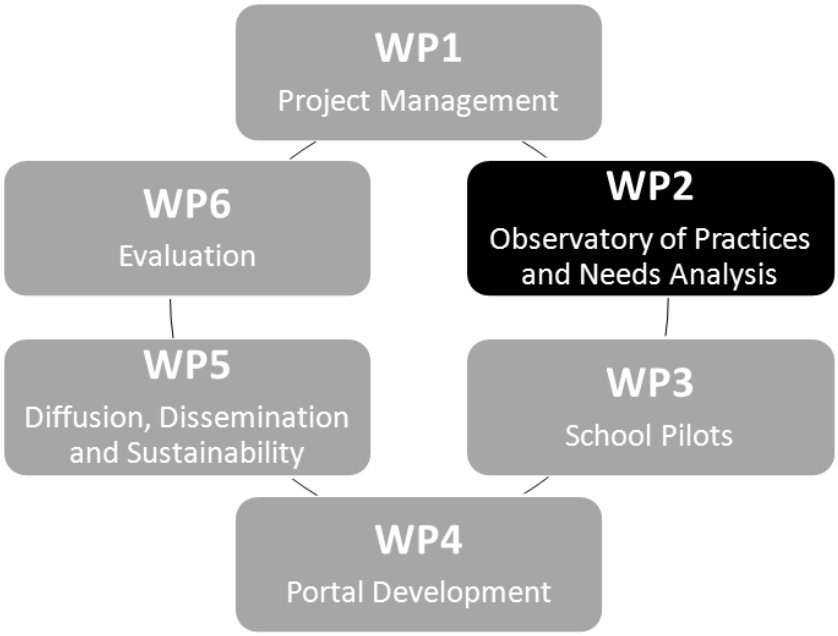

Figure 3: Work packages in the ECB/inGenious project.

[6] Along the whole document, we will refer to school-industry partnerships or collaborations exclusively in the field of STEM.

2.3. WP2 in ECB/inGenious

As already mentioned, the work performed in WP2, entitled **"Observatory of Practices and Needs Analysis – Monitoring Research Developments"**, explores both the current situation in Europe regarding school-industry partnerships and the challenges that might exist in the field.

The work developed within this WP2 is closely related to the other workpackages, since some of the practices collected for the Observatory are being implemented in the School Pilots (WP3) and will subsequently be evaluated by WP6, while the whole set of collected practices and policy actions will be gathered together in a database available through the portal (WP4).

Concerning the Observatory of Practices, the methodology was established from two different perspectives, as explained in more detail in the Deliverable 2.1:

- On the one hand, to collect and analyse practices of school-industry collaboration in order to identify good practices following a set of criteria;

- On the other hand, to develop a permanent system for a repository containing a great number of initiatives carried out in Europe. This repository will be developed together with Workpackage 4.

One of the main purposes of the Observatory is to identify good practices in order to disseminate them and stimulate new ones. In this sense, the results of applying the Observatory methodology are presented in a separate document (Deliverable 2.2), while this document (Deliverable 2.3) contains a set of reccommendations, according to the research and the experience observed so far, for improving both the establishment and maintenance of school-industry partnerships and their effectiveness as a way of fostering young people's interest in STEM careers. The catalogue of education practices and policies included in this document is an example of the existing initiatives in Europe, and intends to be inspiring for other teachers, industrial companies and policy makers to enhance future sharing and further development of school-industry collaborations. Furthermore, many of these examples will feed the permanent repository developed in Workpackage 4, which will include details of the practices for teachers and other stakeholders willing to participate.

The Needs Analysis, on the other hand, aims to identify the main challenges and obstacles to effective school-industry partnerships, and it will be a crucial step to allow making effective decisions and recommendations for improving the effect of such collaborations upon fostering young's interest in STEM careers in Europe. The strategy that has been defined for the performance of this Needs Analysis process, aimed to identify gaps and problematic issues in current partnerships at national and European level, has been summarised in Deliverable 2.4. The results that will arise from the process, which will be focused on needs both from an educational and an industrial point of view, will be collected in a final European synthesis report (Deliverable 2.6), according to the timeline of the project (Figure 4).

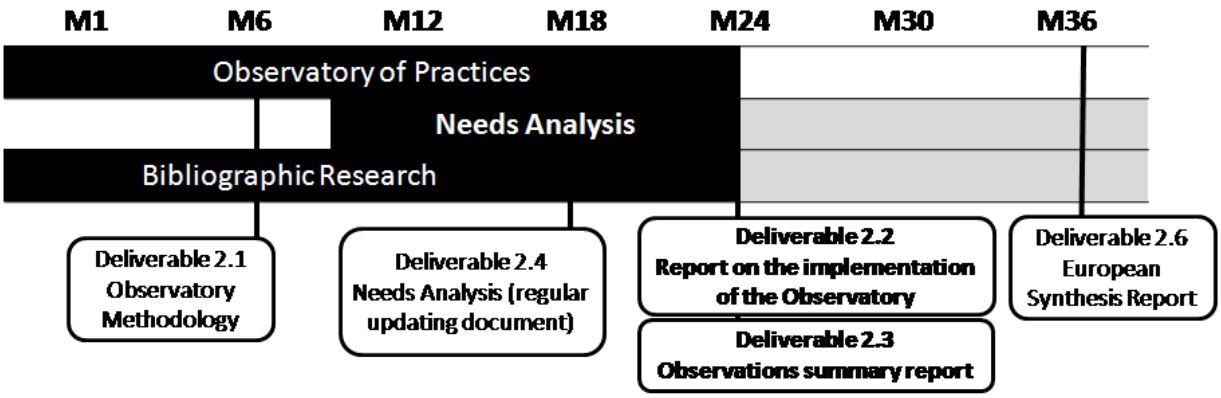

Figure 4: Timeline of the project.

It is important to highlight several elements of the added values that will come out of this work, such as the fact that it will allow identifying key aspects that can help to design successful school-industry practices aimed to foster young students' interest in STEM careers, or the fact that it will enable identification of good practices in order to disseminate them and stimulate new ones.

3 IDENTIFYING IDEAS FOR THE IMPROVEMENT OF SCHOOL-INDUSTRY PARTNERSHIPS

Collaboration between the worlds of industry and education can bring benefits for both parties, and moreover, it represents a way of helping to foster young people's interest in STEM careers. There are currently many examples of joint school-industry projects around the world, although in some countries there is more tradition than in others in this kind of relationships. Despite the benefits that these initiatives can bring, it is not always easy to carry them out and reach the desired objectives. Thus, it is necessary to optimize the resources devoted from all the involved parts to make them as effective as possible with the aim of getting the expected benefits. In this sense, a set of preliminary recommendations for further consideration are presented below to help in improving school-industry relationships. These recommendations are based on the bibliographic research and on the experience that the different partners of this project have shared with us.

It must be taken into consideration that the reasons for participating in these collaborations can be very diverse (for example, contributing to increase the number of students choosing STEM careers, or trying to foster enterpreneurship among young people). Even so, the difficulties that exist in establishing and maintaining such collaborations are often independent of the defined objectives of the project. For this reason, we will distinguish between two types of recommendations, depending on the kind of challenge that they intend to overcome:

- Recommendations for improving the establishment and maintenance of school-industry collaboration;
- Recommendations for improving the effectiveness of school-industry practices to foster young people's interest in STEM careers.

3.1. Preliminary recommendations for improving the establishment and maintenance of school-industry partnerships

The Needs Analysis that is being developed in the frame of WP2 aims at identifying the main challenges and obstacles both in policy and practice encountered in establishing school-industry partnerships, and will allow making effective decisions to improve the impact of such collaborations upon fostering young people's interest in STEM careers in Europe.

From the information collected so far through the surveys and reports, different challenges have been identified. Perhaps not surprisingly, one of the main weak points in school-industry collaboration is the establishment and maintenance of these partnerships, which involve a great variety of stakeholders: school teachers, school principals, STEM professionals and employees, and policy makers at different levels.

Given that the initial response rate from the Ministries of Education to the questionnaire was poor, additional efforts will be made to improve the response rate. Also, the National Needs Analysis workshops and the resulting reports have not yet been completed. Therefore, there may be additional recommendations or modifications to be made at a later stage in the project.

A preliminary set of recommendations for further consideration are given below, which have been derived from the initial findings transmitted by partners of the Project through the Needs Analysis, as well as the existing bibliography on the subject.

3.1.1. Preliminary recommendations for further consideration: policy-making level

School-industry relationships exist in most countries, and although occurring independently of the political context, they can be supported by certain education policies. Considering that the lack of STEM professionals is a general concern which can have economic and social effects, the involvement of a range of organizations is desirable to pursue common objectives. Policy makers in departments of education, economic affairs, social affairs and trade and industry can thus play an important role in supporting school-industry relationships.

In some cases, there is a lack of coordination between municipal, regional and national policy development and implmentation targeted at the development of school-industry partnerships, so that the efforts devoted from authorities at different levels are not properly aligned and are not used in the most efficient way. Several examples of policies at national and regional level have been identified within the Observatory of practices which can support all kinds of school-industry partnerships via specific centres where the different stakeholders can meet together or via networks of companies and schools. A network of companies gives an added value to school-industry partnerships by being able to increase the offer regarding the target group which can be addressed and the types of collaboration that can be established with schools. Moreover, policy makers might give high importance to the promotion of sustainable partnerships between the business and the educational sectors in a local area. In fact, most of the collaborative actions involving students take place at local level, and proximity is seen as very positive to facilitate both the establishment of relationships and its effectiveness.

One of the barriers that has been identified through the initial stages of the Needs Analysis process is the fact that teachers are finding an excessive pressure from educational authorities for introducing frequent structural changes. In fact, it often happens that a new policy initiative starts before it had been possible to generate a valid long-term assessment of the last one. This situation can frustrate teachers and headmasters and make them less open to further new projects that might come from industry.

Preliminary recommendations for further consideration:

- Involve several bodies from public administration, such as the departments of education, economic affairs, trade and industry, social affairs, etc., as key players to support school-industry partnerships at national/regional/local levels.

- Improve coordination within the initiatives promoted by policy directives at municipal, regional and national levels, in order to avoid duplication and enhance synergies among the various kinds of actions targeted at the development of school-industry partnerships.

- Promote sustainable partnerships between the business and the educational sectors at local level.

- Support should be provided for the creation and/or maintenance of clusters of stakeholders involved in school-industry partnerships:

    - These clusters should facilitate the communication between representatives from the worlds of education (teachers, headmasters, career counselors and other school staff), industry (employers and employees belonging to different professional categories) and other institutions such as chambers of commerce, industrial associations, etc.;

    - It is important that these clusters work at local level to facilitate the involvement of stakeholders from the same area in the partnerships and to

enhance the performance of contextualised practices. Moreover, the clusters should be coordinated at national or regional level in order to reach a broad audience and to transfer actions among the different local scenarios.

- Although educational reforms need to be pushed forward, it is necessary that they look to the long term, since too frequent structural changes in the educational system might be counterproductive.

3.1.2. Preliminary recommendations for increasing the number of collaborations

The links between the worlds of industry and education can be motivated by multiple purposes and can bring a wide range of positive outcomes to the different stakeholders. However, it is not always easy to find teachers and companies willing to collaborate, since there can be several reasons which impede it. The time expenditure required to participate in this kind of collaborations is one of the main barriers for both teachers and STEM professionals to collaborate. There might be other reasons which stop teachers from collaborating with industry, such as the overlapping of these activities with school calendar, the lack of assessment about the quality of school-industry practices, or the fact that some teachers might be not familiar enough with science and technology topics relevant for industry. Thus, although many teachers would like to participate in these activities, they can feel that the additional efforts they have to devote do not compensate for the benefits they see for their students. There are, however, many teachers who get involved in these collaborations, although in some cases they do not have the comprehension or support of their colleagues, and thus, represent isolated examples within schools.

On the other hand, the participation of teachers and students in collaborative activities with industry can be sometimes hindered by the lack of financial support to schools. It is obvious that financial barriers do exist both for schools and for companies, and so it is worth mentioning that there are different kinds of programs promoted by policy makers at regional, national and European levels, which can provide appropriate resources for funding certain kinds of school-industry initiatives. As an example, we can mention the Leonardo da Vinci mobility programme which, as stated by an inGenious teacher, funded several students in a school in Italy to go for 3-weeks work placements in different companies. This type of funding, however, is only available for an extremely small fraction of students that need to be reached.

<u>Preliminary recommendations for further consideration:</u>

- Establish frameworks that stimulate teachers' involvement in school-industry collaborations. The existence of incentives promoted from educational authorities could represent a measure to encourage teachers to cooperate with industries. Such incentives do not need to be economic rewards, but educational authorities could facilitate the relaxation of teaching hours as recongnition of the time devoted by teachers to collaborate with industry.

- Increase support from school heads and governing bodies to those teachers who participate in school-industry activities.

- Increase promotion of existing grants and other programs, at regional, national and European levels, which can provide funding for activities of school-industry collaboration.

3.1.3. Preliminary recommendations for establishing and maintaining collaborations

The first steps to initiate a school-industry partnership can take time, since it is not always easy to find the appropriate contact persons or to end up with a project that is of interest for both schools and companies. Maintaining the collaboration might be also a hard task, especially when it depends on particular relations between individuals, and if there is not a certain degree of commitment from both parties which ensures a sustainable link, the school-industry partnership can be unstable. In fact, and according to Burge et al. (2012), a successful school-business partnership should involve, among other things, a clear vision of what all parties want to achieve; commitment, cooperation and leadership across all stakeholders; and time to build relationships and for professional development.

In a survey of 78 inGenious teachers, 82% agreed that the involvement of an extra work load is one of the main barriers in school-industry partnership. Although the time devoted by teachers to implement school-industry practices can be considered as part of their teaching task, the management required to establish and maintain the contact with companies represents an additional burden that they might not be willing or able to assume. On the other hand, centralizing those management tasks through a coordinator would facilitate the participation of more teachers in this kind of activities.

<u>Preliminary recommendations for further consideration:</u>

- Formalize the collaboration between the educational institution and the company through an agreement such as a memorandum of understanding or a letter of intent (if possible, through their management representatives). This can help to ensure more sustainable links, since those depending on a particular relationship between individuals can result in collaborations that are more fragile.

- Organise regular meetings where all parties take part, in order to facilitate professional alignment from the very beginning. Matching of expectations of each part and good planning are crucial (Carl, 2012).

- Get a STEM coordinator at the school who is responsible of managing the collaboration with industry as part of school involvement in STEM activities.

3.1.4. Added value of the existence of organizations linking school and industry

We have suggested a set of preliminary recommendations based on certain challenges in school-industry partnerships which have been identified mainly through the initial findings of the Needs Analysis and those from the implementation of the Observatory of Practices.

Most of the barriers identified so far relate to the establishment and maintenance of school-industry partnerships resulting from the complexity of the collaboration and the additional effort that it represents for both the company and the school. It must be taken into account that, despite the benefits they can obtain from the partnership, the main objectives of both parties diverge and collaboration is not usually considered to be an end in itself. In this sense, the existence of organizations which can facilitate and foster school-industry relationships is crucial for improving the efficiency and the efficacy of these collaborations. In fact, we find success stories in coutries such as The Netherlands, Sweden, Denmark, Germany and the United Kingdom, where different kinds of organizations link school and industry, as it is detailed in Annex III. These organizations, which can be either public or private or public-private, represent an added value for the establishment and maintenance of school-industry collaborations, since they can help overcome many of the practical barriers found by companies and schools which are willing to engage in joint activities. Some of the reasons which make these organizations represent an added value compared to the situation in which they do not exist are the following:

- **Easier connection:** they offer the possibility to establish more structured co-operation between schools and companies, avoiding the dependency on individual contacts and facilitating a fluent dialogue between the different parts. In fact, the existence of an organization in charge of linking schools and companies might help to overcome many of the main barriers for employer engagement, according to a teachers' survey performed in the UK: finding the time to approach companies; knowing what will appeal to business; lack of suitable staff to support business involvement; and the fact that schools and business speak different languages (Edcoms, 2007).

- **Wider reach:** in many cases, it is easier for these organizations, than for a single company, to organise events at national and/or regional level, which allows reaching a larger number of schools/students and, thus, achieving a greater impact.

- **More content variety:** since these organizations usually count on several different companies, they can offer a higher variety of "contexts" available to be linked with the school curriculum. Moreover, counting on different companies makes it easier to offer collaborations for different educational levels, from primary to university, while a single company will probably be more focused on a particular age-range of pupils and will offer a lower variety of activities. A larger pool of role models can also be made available if many different companies are members of such organization.

- **Neutrality:** in some cultures school-industry relationships are viewed with scepticism especially when they are promoted by a single company. The fact that these collaborations are promoted by an organization representing several companies, and in some cases the involvement of state authorities, makes it easier to conceive of school-industry partnerships as a mechanism for achieving common objectives for different sectors, instead of as an excuse to achieve the particular interests of a certain company.

- **Continuity and long-term commitment:** sometimes the collaboration between schools and companies can be fragile, especially when it depends on particular relationships between individuals. From the experience of several partners in ECB/inGenious, the existence of an organization supporting school-industry partnerships has brought a cohesive effect which helps to ensure sustainable links for the long term.

- **Enhancement effect**: despite the benefits that school-industry partnerships can have for employers, it is not always easy to convince them to become involved. Companies which form part of an organization linking school and industry can have a positive effect in convincing new companies to join and cooperate with education, since it is likely that they all will share common challenges and points of view. Moreover, the members of partner companies are more likely to highlight the benefits of school-industry collaborations convincingly.

Having these considerations in mind, and as already highlighted in section 3.1.1, it is highly recommended to support the establishment/maintenance of organizations linking school and industry, at national, regional and/or municipal level, in order to facilitate the successful development of school-industry partnerships.

3.2. Preliminary recommendations for improving the effectiveness of school-industry practices to foster young people's interest in STEM careers

The study performed within the Observatory of Practices has raised a diversity of challenges that could prevent school-industry partnerships to reach the objective of fostering young people's interest in STEM careers. In the present section some preliminary recommendations based on the results of the mentioned study are given that may help to overcome those challenges.

3.2.1. Preliminary recommendations on the focus of the partnerships

According to the literature there are mainly four factors influencing young people in the process of deciding on potential careers (DeWitt et al., 2011; Wynarczyk & Hale, 2009; Fouad, 2007; Gago, 2004):

A. Students' engagement in the study of STEM in school
B. Information about careers and jobs in industry

C. Awareness of whether the students' characteristics and interests fit with those required for STEM careers
D. Social perception of the work related with STEM careers

School-industry partnerships can contribute to improve these factors, although the way to approach them will be closely related to the age-group of students and thus, the different activities developed in partnership must be properly adapted to the level of education.
In order to be able to have an impact on the process of career decision-making by young people, the actions performed in collaboration with schools and industries may be addressed to, at least, one of the previous factors. The study that has been performed by the authors of this document (and presented in Deliverable 2.2) indicates that most school-industry practices are focused on providing teachers and students with resources and information about STEM topics and, in a lesser degree, on highlighting the individual traits that condition them. It could be inferred that there is a general view according to which the personal characteristics and skills are not affecting too much the decision of someone in choosing one kind of studies or another (vocational vs academic education, STEM vs humanities). This might mean that it is necessary to "promote" these factors, to make aware they are relevant for the process of career decision-making, and that it is possible to influence on them.

In order to do so, a set of criteria was developed during the design of the Observatory methodology that might help the designers of the practices to be able to impact on the different factors. Moreover, when designing a particular practice it has to be considered not only how much it is convenient for engaging well prepared students in STEM careers but also its quality as an educational resource. In this sense, the set of criteria for good practices includes general education requirements that are expected in a good practice as a way to assess its robustness.

<u>Preliminary recommendations for further consideration:</u>

- In order to be effective as an educational tool, a practice should:
  - Have clearly defined and achievable goals.
  - Integrate evaluation as part of its design.
  - Be sustainable over a long period of time.
  - Connect with the students' STEM curriculum.
- In order to be able to engage students in the study of STEM disciplines in school (Factor A), a practice should:
  - Propose activities focused on STEM **content knowledge.**
  - Propose activities focused on **promoting STEM skills** (inquiry, ability to solve problems, analytical techniques, etc.)
  - Propose activities focused on **STEM attitudes.**
  - Intend to promote positive attitudes towards STEM disciplines (seen as external motivation).

- Incite **real engagement** of students in its development through activities such as:
  - Working around questions/problems: asking questions and encouraging students to formulate their own.
  - Proposing problems as open-ended questions.
  - Designing activities of inquiry.
- Provide a **foundation of factual knowledge** and intend to apply the concepts over different topics.
- Create an atmosphere that allows an extensive communication between students and the teacher/monitor/expert leading the session.
- Take into consideration the previous knowledge, skills and beliefs of the target audience usually counting on expert advice (from teachers or external experts).
- Facilitate that students become aware of their thought processes and then adapt them to attend the specific needs (metacognition).
- Propose the application of knowledge from one context to another, in order to promote the ability to abstract and generalise.
- Propose exercices for making connections between different ideas.

- In order to be able to effectively provide information about careers and jobs in industry (Factor B), a practice should:
  - Inform and make understandable the work performed by professionals in STEM jobs via career counsellor and/or teachers or via role models.
  - Get to know the **academic profile** of the STEM professionals.
  - Intend to demystify the **personal profile** of people in STEM careers (capabilities, skills, etc.) through role-model exercices.
  - Promote **skills well appreciated in STEM jobs** (capability for teamwork, communicating in different forms of language, etc.)

- In order to be able to promote an awareness of whether the students' characteristics and interests fit with those required for STEM careers (Factor C), a practice should:
  - Assist students to choose careers that match their personality to certain jobs after having reflected on their interests and abilities.
  - Propose scientific activities and/or technological problems through which students can realize their good capabilities to deal with them and don't believe they exceed their coping capabilities.
  - Provide scenarios or situations for the **identification** of students with some type of STEM professional (role model) or some type of STEM job (role playing).

- In order to be able to improve the social perception of work related to STEM careers (Factor D), a practice should:
  - Intend to improve the social (parents, media, friends, etc.) perception of STEM jobs and careers.
  - Showcase the social relevance, ethics or social responsibility of the work in the industry.
  - Intend to give awareness of the social utility of the industrial products, and to highlight the sensitivity of the industry to the environmental issues.
  - Intend to transform the stereotypical view of STEM professionals in industry as people without possible personal initiatives into the view of creative, innovative people.
  - Make students more aware of the usually high social status of the STEM professionals.
  - Foster girls and ethnic minorities into STEM jobs and careers.

3.2.2.Preliminary recommendations to address the different age groups

The study performed in the frame of the ECB/inGenious project has shown that most of school-industry partnerships address the students from secondary school. The high importance given to this age group might be due to the fact that these students will make the career decision soon after. It may also be due to the fact that it is easier for industry professionals to create or adapt material for this age group. By contrast, the audience from primary school is not currently given enough consideration, even though most primary students have generally positive views of science and would thus be easier to keep their engagement in STEM careers.

However, studies indicate that after the age of 10/11 children's science attitudes start to decline (notably from ages 10-14) with a further diminishing of aspirations in STEM studies (Archer, Osborne, & DeWitt, 2012). This fact must be kept in mind since it migh affect the decisions that students make along their educational path. Although the age at which decisions about STEM studies are made depends on the country, the choice is made in secondary school, which in most European countries begins at ages 10-12 (Eurydice, 2013). Since many students form career aspirations long before the point at which they have to make the subject choices in school (Archer et al., 2010; Osborne & Dillon, 2008), more focus is needed in primary students to foster and maximize their interest in STEM subjects and careers. Otherwise, those who decide not taking STEM studies in secondary education will become progressively harder to engage in these studies in the future.

On the other hand, apart from deciding between STEM, business and human studies, students in secondary school have to choose between vocational and general education. Thus, it would be suitable to help them to focus on an appropriate career which fits their skills and interests. On the contrary, practices focused on primary school students could contribute to increase their engagement with STEM disciplines and their intellectual or

personal abilities to deal with science and mathematics. In any case, it may be too early to inform this audience about the particular job opportunities existing in the labour market, although it is possible to give them information about careers in and from STEM (Archer et al., 2012).

Regarding the practices analysed in the Observatory, the study has also shown that most of them claim to address more than one subject related to STEM since they are designed in a transversal manner, by linking the different fields that are actually involved in real work places. This gives a broad view of the multidisciplinary reality that exists in jobs, which could look attractive for students that do not have a strong vocation.

Preliminary recommendations for further consideration for addressing the needs of primary level students:

- As many students make their first “de-selection” of STEM studies in the 11-13 age group, it may be necessary to devote more resources at the primary school level to stimulate their continued interest.
- Emphasise the importance of scientific observations, hands-on practical activities such as designing experiments as well as conducting and presenting them. Also activities linked to discussions and argumentations, such as formulating possible explanations and collaborative project-work, are recommended (Eurydice, 2011).
- The use of debating current scientific and societal issues, self-directed project work and videoconferences may be more suited to older age-groups (Eurydice, 2011).
- Approach the practice through multidisciplinary topics in order to give relevance and meaning to the studies performed at school.

Preliminary recommendations for further consideration for addressing the needs of secondary level students:

- At lower secondary level, apart from the activities already recommended for pupils at primary level, more reflective activities such as designing and conducting experiments, describing or interpreting phenomena scientifically or framing a problem in scientific terms are strongly recommended. Debating current scientific and societal issues and self-directed project work are also mentioned. The use of more advanced ICT in terms of computer simulations or video conferences is recommended foar more often for secondary students than for primary level pupils (Eurydice, 2011).

- According to Wolf (2011), there is little value in work experience prior to the age of 16 even though there remains the need for effective work experience for 16-19 years old.

3.2.3. Preliminary recommendations for further consideration on the implementation of the practices

The information collected about school-industry partnerships is mainly about lectures and about providing didactic material for use in class. It can be concluded, therefore, that most of the practices take hours or some days to be performed. It has to be considered, however, that research studies warn that "one-off" events do not have long-term impact on the process of career choice (Archer et al., 2012). Few actions of those provided take longer than a month, which would allow students to work deeply and jointly with STEM professionals around some specific topic.

Regarding the location chosen to perform the practices, it has been found that most of them are implemented in the schools. It might be good to increase the number of practices taking place inside the company facilities since it would give students the added value of better understanding of STEM industries and work places. In fact, the report "Learning for Jobs" (Field, Hoeckel, Kis, & Kuczera, 2010) suggests the need of strengthening careers guidance through visits to workplaces and work experiences. In any case, a practice taking place in an industrial location must be well designed in order to be useful for the students' learning.

On the other hand, the use of appropriate pedagogical approaches to engage the audiences is important in order to be able to achieve the planned objectives. It is observed that in most cases, industry approaches the students, in class or in the industrial facilities, by giving information about careers or about STEM subjects in a transmissive way more than in a constructivist way. However, in order to increase the self-efficacy of the students, that is, to contribute to developing their self-efficacy and capability to perform concrete tasks related to the work of STEM, it is effective to make them play the role of a STEM professional.

Finally, the involvement of role models in the implementation of school-industry practices can be very positive, since they are viewed by students not as disciplinarians, in the way that teachers are, but as working in the "real world" and as being enthusiastic about their job (Mann & Stanley, 2010) [7].

[7] Royal Society, *Taking a Leading Role:*

http://royalsociety.org/uploadedFiles/Royal_Society_Content/Supporting_scientists/Equality_and_Diversity/Young_people%27s_views.pdf

Preliminary recommendations for further consideration:

- Not to address the audience in a single-off event, but participate in a series of events over a period of time or in single long-term collaborations. Preparatory and follow-up activities are also recommended with respect to each individual event.

- Visits to workplaces should be in alignment with the curriculum whenever possible and flow naturally into or from classroom activities and with which the STEM professional have been involved at the preparation stage and in the follow-up work associated with the visit.

- The use of role playing by means of work experience or by the proposal of an industry to solve a real problem can be very valuable; this is also effective in increasing the knowledge of the students about certain specific STEM topics and in developing flexible knowledge and effective problem solving skills.

- The 2010 report by YouGov recommends that a work experience placement should offer a wider range of varied work and a good preparation to go into accommodating the students (YouGov, 2010).

- Regarding the transmission of career information to the students, it is important to involve the participation of role models that bring the reality of STEM jobs closer to the students from the behaviour and the testimony of STEM professionals.

3.2.4. Preliminary recommendations for further consideration on the evaluation of the practices

Apart from the practical issues that can arise when designing and implementing a school-industry practice (such as logistical and organizational obstacles), one of the main challenges is to connect the content of the practice with the school curriculum. In fact, teachers often value activities in collaboration with industry as a way of giving real-life context and, thus, improving the content of school STEM disciplines. However, a clear matching between the industrial topics developed by companies and the school curriculum is essential to guarantee the satisfaction of both teachers and STEM professionals. The content of the practice should also be determined by a set of objectivees clearly defined from the beginning, which should ideally be evaluated after the implementation of the practice. Evaluation will help to assess whether the objectives were properly achieved, and propose improvements if this was not the case. In this sense, Burge et al. (2012) have highlighted that a successful school-business partnership should involve focus on curriculum, well-structured programme design, and early intervention.

Moreover, several large-scale European projects aiming to perpare good and innovative school practices have stressed on the necessity of including an evaluation process (i.e.

GRID[8], MATERIALS SCIENCE[9], PENCIL[10], TRACES[11], etc.). Actually, evaluation is essential in order to implement a well-designed and effective action, considering the planned objectives. There are always many players in an action: students, teachers, STEM professionals, the social culture of the region, parents, etc. Thus, it might be useful to evaluate the outcomes of the practices from all the different points of view and to check if the defined aims have been effectively achieved. The result of such a process can help to improve the action in order to be able to reach the foreseen goals in case they have not. Moreover, such a process can help to understand the added value that the collaboration with an industry has on the students' learning. This collaboration can be essential in order to stress on Factors B, C and D (Career information, Personal Characteristics and Social Perception of STEM professionals and jobs) and also to give relevance to the STEM disciplines studied at school. In any case, withoug a proper evaluation process that can document and demonstrate this added value, it is not possible to state the real benefits of school-industry collaborations.

Preliminary recommendations for further consideration:

- Make the curriculum of the course evident and transparent to the employees of the company. Finding projeccts that are of interest to both the school and the company and is clearly connected to the school curriculum is one of the main barriers that exist for the establishment of collaboration. By providing the members of the company with text books and different examples of task papers, teachers can bring the curriculum closer to industrialists in order to work together to define the content of the collaboration (Carl, 2012).

- Evaluate the projects according to the objectives that were set at the beginning. The results of the evaluation will help to confirm if the partnership made a difference or if improvements should be made. It will help to promote cumulative refinement from year to year. Moreover, it will prove if there is a good reason, in the future, to continue to put energy, money and time into school-industry cooperation.

[8] Based on the information in the official website: http://www.grid-network.eu/

[9] Based on the information in the official website: http://lsg.ucy.ac.cy/MaterialsScience

[10] Based on the information in the official website: http://www.xplora.org/ww/en/pub/xplora/nucleus_home/pencil.html

[11] Based on the information in the official website: http://www.traces-project.eu/

4 EUROPEAN INITIATIVES IN THE FRAME OF SCHOOL-INDUSTRY PARTNERSHIPS

The Observatory of Practices aimed at collecting good practices of school-industry collaboration and STEM education policies (pilot programmes, policy reforms, promotion campaigns, etc.) endeavouring to increase students' interest in STEM subjects at primary and secondary level of education through school-industry partnerships.

The different examples collected in the Observatory, which constitute the sample used to perform the analysis presented in Deliverable 2.2, are included in a catalogue (Appendix I). It is worth mentioning that this catalogue is not intended to be a repository of practices, although it will feed the permanent repository that will be developed in collaboration with Workpackage 4. Moreover, due to the low amount of national policies received so far, the Ministries of Education will be contacted again in order to require them to provide more information on existing policies which can help to support school-industry partnerships. In any case, the examples collected so far and shown in the catalogue can be inspiring for teachers, industrialists and policy makers across Europe to enhance future sharing and further development of school-industry collaborations.

4.1. Collection of information in the Observatory of Practices

Two different surveys were launched to gather information about the existing collaborations in Europe in the mentioned frame.

One of the surveys was addressed to policy makers in Europe. A total of 34 answers were collected through questionnaires, and six other policies were identified via booklets and websites, particularly from local authorities who provided examples of policy actions at municipal or regional level. All the policies are presented in Annex I, each of them in a table including: its name; the country where it is implemented; a short description provided by the policy maker; the scope of the policy (national, regional or local); the type of initiative according to a categorisation performed in the frame of Observatory of practices.

The other survey was addressed to representatives from indudstry and National Platforms. Initially, only partners of ECB/inGenious were contacted and required to provide information about the education practices they developed. Afterwards, it was agreed to include also examples from non-partner organizations in order to have a larger sample for the analysis. Although a total of 64 practices have been gathered so far, only those provided by ECB/inGenious partners (49) have been included in Annex II. Each practice is presented in a table that includes basic information such as its name, the promoter organization, some implementation details, and a short description provided by the corresponding partner. Moreover, the study performed in the Observatory allowed to identify which factors influencing young people when making their career choice can be stressed by the different practices, and for each of them this information is also detailed in the table. Furthermore, in the frame of the Observatory all the practices were analysed and categorized into 11 different initiatives, that is, 11 different types of relationships established between industry and the educational world. These 11 types of partnerships

can be grouped into four big categories (see table 1), and for each practice both the category and the kind of initiative are also included in the table.

Categories	Initiatives
Providing of resources for schools to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)	1. STEM industry collaborates in the design and elaboration of material to be used as a support for schools in implementing their educational programmes. 2. STEM industry promotes STEM education through science ambassadors 3. STEM industry contributes to update teachers' knowledge about certain STEM-related industrial topic
Establishing personal communication of STEM professionals with students	4. STEM professionals go to schools to give a talk or to establish some dialogue with students about job/academic background 5. STEM professionals go to schools to give a talk or to establish some dialogue with students around industrial applications 6. STEM industry offers an expert for a debate with students around topical and controversial subjects
Giving accessibility to the company premises for schools/students	7. STEM industry offers its premises to be visited by students with the possibility of including some activities 8. STEM industry offers its premises in order that teachers perform some lessons relating students' curriculum with activities of the company
Engaging STEM professionals with students' work	9. STEM industry proposes a research project or study in depth around certain topic and in collaboration with the professionals working in the industry 10. STEM industry offers the possibility of an Internship for some students 11. STEM industry proposes a technological challenge to be surmounted for students

Table 1: Categorization of initiatives of school-industry partnerships.

Finally, and as pointed out in section 3.1.4, in the frame of the ECB/inGenious project it has been highlighted that the existence of organizations supporting school-industry partnerships represents an added value as a way of facilitating the establishment and organization of these relationships. Several ECB/inGenious partner organizations (National Platforms) have been identified as success stories in linking school and industry, and have been classified as public-private, public and private, depending on their funders. For each of these organizations, a table summarising its main features is presented in Annex III, including information about the establishment (year of creation, motivations and promoters), the funding, the involvement of private companies, the types of actions carried out and their scope. This information, which has been provided by the partners of ECB/inGenious in representation of these organizations, intends to show the variety of success stories for promoting school-industry partnerships, and can also inspire the establishment of similar structures in other countries in which they do not yet exist.

5 CONCLUSIONS

This document forms part of a set of deliverables framed in the ECB/inGenious project, a large-scale research and evaluation effort trying to strengthen links between education and industry to boost students' interest in STEM careers as a way of addressing several of the challenges related to science, technology, engineering and mathematics (STEM) in Europe.

Through an Observatory of Practices, the programme has aimed to collect examples of good practices of school-industry collaboration and policy actions (pilot programmes, policy reforms, promotion campaigns, etc.) that endeavour to increase students' interest in STEM subjects at primary and secondary level of education. Moreover, a Needs Analysis approach has been established in order to identify and explore solutions to problematic issues in developing school-industry collaborations, both at national and at European level.

This document is a summary report that has been elaborated from the evidence collected to date from both the Observatory of Practices and the initial stage of the Needs Analysis. It has been highlighted that collaboration between schools and industry can be motivated by multiple purposes and can bring a wide range of positive outcomes to the different stakeholders. The will to show young people the world of STEM professionals in order to help breaking stereotypes and to inform them about current and future perspectives of STEM careers are some of the main motivators propelling such relationships.

Students' benefit in a variety of ways from collaborations between education and industry, for example: improving their vocational/employability skills, knowledge and understanding, academica and learning outcomes, health and well-being, and enjoyment and engagement.

The leadership of schools can also be positively influenced by employers' involvement with school governing bodies, and the support of employers' involvement through the provision of advice and curriculum-related resources can contribute to improve the development of teachers' expertise in particular curriculum areas.

School-industry partnerships can also bring potential benefits to employers, who might be motivated by several reasons, mainly related to four factors: i) staff recruitment; ii) staff development; iii) staff engagement; and iv) corporate reputation.

Despite the many benefits that school-industry collaboration can bring, the current study has identified several challenges that need to be overcome to facilitate the establishment and maintenance of such partnerships as a way of contributing to foster young people's interest in STEM careers. Based on the results of this study, several measures which could help to overcome these challenges have been proposed in the form of a set of preliminary recommendations.

Taking into account the variety of barriers that exists, we have distinguished between two groups of preliminary recommendations depending on the kind of challenges that might help to overcome.

The establishment and maintenance of school-industry partnerships has been found to be one of the main challenges, according to the initial stages of the Needs Analysis performed so far. In this sense, and based on the particular kinds of difficulties that have been identified, a first set of **recommendations for improving the establishment and maintenance of school-industry partnerships** has been given:

Preliminary recommendations for further consideration: policy level

- Involve several bodies from public administration, such as the departments of education, economic affairs, trade and industry, social affairs, etc., as key players to support school-industry partnerships at national/regional/local levels.

- Improve coordination within the initiatives promoted by policy directives at municipal, regional and national levels, in order to avoid duplication and enhance synergies among the various kinds of actions targeted at the development of school-industry partnerships.

- Promote sustainable partnerships between the business and the educational sectors at local level.

- Support should be provided for the creation and/or maintenance of clusters of stakeholders involved in school-industry partnerships:

    - These clusters should facilitate the communication between representatives from the worlds of education (teachers, headmasters, career counselors and other school staff), industry (employers and employees belonging to different professional categories) and other institutions such as chambers of commerce, industrial associations, etc.;

    - It is important that these clusters work at local level to facilitate the involvement of stakeholders from the same area in the partnerships and to enhance the performance of contextualised practices. Moreover, the clusters should be coordinated at national or regional level in order to reach a broad audience and to transfer actions among the different local scenarios.

- Although educational reforms need to be pushed forward, it is necessary that they look for the long term, since too frequent structural changes in the educational system might be counterproductive.

Preliminary recommendations for increasing the number of collaborations

- Establish frameworks that stimulate teachers' involvement in school-industry collaborations. The existence of incentives promoted from educational authorities could represent a measure to encourage teachers to cooperate with industries. Such incentives do not need to be economic rewards, but educational authorities could facilitate the relaxation of teaching hours as recongnition of the time devoted by teachers to collaborate with industry.

- Increase support from school heads and governing bodies to those teachers who participate in school-industry activities.

- Increase promotion of existing grants and other programs, at regional, national and European levels, which can provide funding for activities of school-industry collaboration.

Preliminary recommendations for establishing and maintaining collaborations

- Formalize the collaboration between the educational institution and the company through an agreement such as a memorandum of understanding or a letter of intent (if possible, through their management representatives). This can help to ensure more sustainable links, since those depending on a particular relationship between individuals can result in collaborations that are more fragile.

- Organise regular meetings where all parties take part, in order to facilitate professional alignment from the very beginning. Matching of expectations of each part and good planning are crucial (Carl, 2012).

- Get a STEM coordinator at the school who is responsible of managing the collaboration with industry as part of school involvement in STEM activities.

It has been pointed out that the existence of organizations linking school and industry can facilitate and foster school-industry relationships. Such organizations represent an added value for the establishment and maintenance of such collaborations, since they allow overcoming many of the practical barriers found by companies and schools when they are to collaborate. In particular, such organizations can offer:

- Easier connection and more effective communication
- Wider reach of teachers and students compared to a single company
- More content variety
- Neutrality in mediating between the diverse range of needs and industry and schools
- Continuity and long-term commitment
- Enhancement effect to enlarge the number of stakeholders involved

On the other hand, the study performed within the Observatory of Practices has risen up a diversity of challenges that could prevent school-industry partnerships to reach the objective of contributing to increase the number of young people choosing STEM careers. In this sense, and based on the analysis of the practices performed in the Observatory, another set of **recommendations for improving the effectiveness of school-industry practices to foster young people's interest in STEM careers** has been presented:

Preliminary recommendations on the focus of the partnerships

- In order to be effective as an educational tool, a practice should:
  - Have clearly defined and achievable goals.
  - Integrate evaluation as part of its design.
  - Be sustainable over a long period of time.
  - Connect with the students' STEM curriculum.
- In order to be able to engage students in the study of STEM disciplines in school (Factor A), a practice should:
  - Propose activities focused on STEM **content knowledge.**
  - Propose activities focused on **promoting STEM skills** (inquiry, ability to solve problems, analytical techniques, etc.)
  - Propose activities focused on **scientific attitudes.**
  - Intend to promote positive attitudes towards STEM disciplines (seen as external motivation).
  - Incite **real engagement** of students in its development through activities such as:
    - Working around questions/problems: asking questions and encouraging students to formulate their own.
    - Proposing problems as open-ended questions.
    - Designing activities of inquiry.
  - Provide a **foundation of factual knowledge** and intend to apply the concepts over different topics.
  - Create an atmosphere that allows an extensive communication between students and the teacher/monitor/expert leading the session.
  - Take into consideration the previous knowledge, skills and beliefs of the target audience usually counting on expert advice (from teachers or external experts).
  - Facilitate that students become aware of their thought processes and then adapt them to attend the specific needs (metacognition).
  - Propose the application of knowledge from one context to another, in order to promote the ability to abstract and generalise.
  - Propose exercices for making connections between different ideas.
- In order to be able to effectively provide information about careers and jobs in industry (Factor B), a practice should:
  - Inform and make understandable the work performed by professionals in STEM jobs via career counsellor and/or teachers or via role models.
  - Get to know the **academic profile** of the STEM professionals.
  - Intend to demystify the **personal profile** of people in STEM careers (capabilities, skills, etc.) through role-model exercices.

- Promote **skills well appreciated in STEM jobs** (capability for teamwork, communicating in different forms of language, etc.)

- In order to be able to promote an awareness of whether the students' characteristics and interests fit with those required for STEM careers (Factor C), a practice should:
  - Assist students to choose careers that match their personality to certain jobs after having reflected on their interests and abilities.
  - Propose scientific activities and/or technological problems through which students can realize their good capabilities to deal with them and don't believe they exceed their coping capabilities.
  - Provide scenarios or situations for the **identification** of students with some type of STEM professional (role model) or some type of STEM job (role playing).

- In order to be able to improve the social perception of work related to STEM careers (Factor D), a practice should:
  - Intend to improve the social (parents, media, friends, etc.) perception of STEM jobs and careers.
  - Showcase the social relevance, ethics or social responsibility of the work in the industry.
  - Intend to give awareness of the social utility of the industrial products, and to highlight the sensitivity of the industry to the environmental issues.
  - Intend to transform the stereotypical view of STEM professionals in industry as people without possible personal initiatives into the view of creative, innovative people.
  - Make students more aware of the usually high social status of the STEM professionals.
  - Foster girls and ethnic minorities into STEM jobs and careers.
  -

Preliminary recommendations to address the different age groups

Preliminary recommendations for further consideration for addressing the needs of primary level students:

- As many students make their first "de-selection" of STEM studies in the 11-13 age group, it may be necessary to devote more resources at the primary school level to stimulate their continued interest.

- Emphasise the importance of scientific observations, hands-on practical activities such as designing experiments as well as conducting and presenting them. Also activities linked to discussions and argumentations, such as formulating possible explanations and collaborative project-work, are recommended (Eurydice, 2011).

- The use of debating current scientific and societal issues, self-directed project work and videoconferences may be more suited to older age-groups (Eurydice, 2011).

- Approach the practice through multidisciplinary topics in order to give relevance and meaning to the studies performed at school.

Preliminary recommendations for further consideration for addressing the needs of primary level students:

- At lower secondary level, apart from the activities already recommended for pupils at primary level, more reflective activities such as designing and conducting experiments, describing or interpreting phenomena scientifically or framing a problem in scientific terms are strongly recommended. Debating current scientific and societal issues and self-directed project work are also mentioned. The use of more advanced ICT in terms of computer simulations or video conferences is recommended foar more often for secondary students than for primary level pupils (Eurydice, 2011).

- According to Wolf (2011), there is little value in work experience prior to the age of 16 even though there remains the need for effective work experience for 16-19 years old.

Preliminary recommendations for further consideration on the implementation of the practices

- Not to address the audience in a single-off event, but participate in a series of events over a period of time or in single long-term collaborations. Preparatory and follow-up activities are also recommended with respect to each individual event.

- Visits to workplaces should be in alignment with the curriculum whenever possible and flow naturally into or from classroom activities and with which the STEM professional have been involved at the preparation stage and in the follow-up work associated with the visit.

- The use of role playing by means of work experience or by the proposal of an industry to solve a real problem can be very valuable; this is also effective in increasing the knowledge of the students about certain specific STEM topics and in developing flexible knowledge and effective problem solving skills.

- The 2010 report by YouGov recommends that a work experience placement should offer a wider range of varied work and a good preparation to go into accommodating the students (YouGov, 2010).

- Regarding the transmission of career information to the students, it is important to involve the participation of role models that bring the reality of STEM jobs closer to the students from the behaviour and the testimony of STEM professionals.

Preliminary recommendations for further consideration on the evaluation of the practices

- Make the curriculum of the course evident and transparent to the employees of the company. Finding projeccts that are of interest to both the school and the company and is clearly connected to the school curriculum is one of the main barriers that exist for the establishment of collaboration. By providing the members of the company with text books and different examples of task papers, teachers can bring the curriculum closer to industrialists in order to work together to define the content of the collaboration (Carl, 2012).

- Evaluate the projects according to the objectives that were set at the beginning. The results of the evaluation will help to confirm if the partnership made a difference or if improvements should be made. It will help to promote cumulative refinement from year to year. Moreover, it will prove if there is a good reason, in the future, to continue to put energy, money and time into school-industry cooperation.

Finally, a catalogue of different European initiatives is presented, which includes the practices provided by the partners of the project and the policy actions collected within the Observatory, as well as several examples of ECB/inGenious partner organizations which have been identified as success stories in linking school and industry. This catalogue is not intended to be an exhaustive repository, but a collection of initiatives that can be inspiring for teachers, industrial companies and policy makers to enhance future sharing and further development of school-industry collaborations. Many of these examples, however, will be included in the practices database developed in Workpackage 4, which is one of the main outcomes of the project that will allow teachers and other stakeholders having the necessary information to contact the promoter organizations of these practices.

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ANNEX I

Catalogue of policy actions to support school-industry collaborations

Name	IMST
Country	Austria
Description	IMST, an initiative by BMUKK in cooperation with the University Klagenfurt to support the interest in STEM subjects in schools. It supports talks in schools by STEM professionals, interviews, visits, etc.
Scope	Regional
Type	Promotion of collaborative projects between educational institutions and local enterprises and/or authorities aimed to support students throughout their educational path.

Name	The Academy for the Talented Youth
Country	Denmark
Description	The Capital Region of Denmark: The role of the regions as regards education is primarily concerned with initiating projects across different disciplinary, organisational and educational boundaries using regional and EU (structural) funding. The following project is funded with public regional funds and with above 50% co-funding from other public and private entities. The Academy for the Talented Youth (Akademiet for Talentfulde Unge): The purpose of the project is to supply young students with the right preconditions, intellectual challenges and experiences to qualify their daily work and naturally guide them onwards to begin a longer academic education and strengthen their capabilities to study. A further purpose is to create closer collaborative relations between upper secondary education, longer academic educations and business in the region, and hence on the long run qualify the business' recruitment of employees. The project is organised with a physical centre located on a school for higher secondary education and with student participation from almost all schools of higher education in the region. The activities take place at universities and business locations to intrigue the students beyond their normal habitat. The activities are organised as student seminars, summer camps, and mentor and network activities that take place between students, teachers, professors and business representatives. The participating students are chosen by their home schools, because they pay a minor tuition fee for each student participating. All activities are extra curriculum and held in the students' spare time. It is yet considered prestigious for the students to participate and the project has received attention in both media and on national level because it spurs students to engage in scientific seminars on mathematics, science, technology or politics and similar academic activities. By giving the talented young people a place to meet and exchange experiences with each other, and not feeling strange for having an academic interest, the project is increasing the students' and his/her surroundings' academic level. But the project is also promoting a culture where it is accepted to speak of the talented and gifted young people, which is normally not well-seen in Denmark. The Academy opened in 2008 and was in 2010 been prolonged with further two years. The Capital Region of Denmark initially supported with 1,2 mil. DKK and has prolonged with 1,4 mil. DKK.

Scope	Regional
Type	Establishment of a science centre to be used in an informal education environment where, among other, collaborative relations with business in the region take place.

Name	Danish Science Municipalities
Country	Denmark
Description	In the framework of the project: "Danish Science Municipalities 2008-2011" a model for facilitating sustainable development in science education has been introduced in 25 out of the 98 Danish Municipalities. The model is based on coordination and continued development of local school initiatives within a municipal framework involving stakeholders such as local enterprises and politicians. A Science Municipality is a municipality having a strategy for developing the science education in correspondence with the municipal strategy for business development. Please refer to the model below: Each Municipality should in dialogue with the local stakeholders develop a coherent strategy for science education, which among a range of measures could include: - Facilitating schools' utilization of informal learning resources (such as science centres, businesses and local natural resources) in the region - Organizing recurring science events to bring stakeholders together and make efforts visible to the public. Due to the introduction of the model the interaction between Industry-School has been formalized in the Municipalities in more ways e.g.: - Industries being represented in a Science Board with local stakeholders, - Partnerships between Municipality, industries and schools related to the development and implementation of science education and science events, - Specific curriculums involving stuff and role models from local industries. The effect of the closer relationship between local and municipal efforts has been documented to be very effective, if rather difficult to initiate and maintain. A key to success is an engaged municipal science coordinator who can overcome the cultural gap between Industry and School.
Scope	National
Type	Establishment of specific partnerships between educational, industrial and economic authorities to promote actions addressed to schools and/or teachers.

Name	National Centre for Science Education
Country	Denmark
Description	The strategy of the National Centre for Science Education, Denmark includes three main objectives. These are derived from the law on "Establishment of a national centre of the education in science, technology and health" and the visions from "A Common Boost." 1. Development of systematic knowledge sharing within the area Through its activities, the National Centre for Science Education, Denmark will provide an overview on existing knowledge and disseminate this information. Furthermore we will support relations and networking both inside the education

system and between players in the formal education system and in the informal learning environments - including relevant companies, museums and science centres. A systematic dialogue with and gathering of knowledge from especially Northern and European resource centres is a vital task.

Via its other activities, the National Centre for Science Education, Denmark will contribute to identify the issues and need for knowledge that should be included in the research and development strategy of scientific didactics.

2. Improving the scientific dimension of the general education of all children and young people. The National Centre for Science Education, Denmark will support the work of teachers and educational institution managements in order to strengthen, innovate and develop the education in science, technology and health as well as equivalent subject areas in primary schools, the upper secondary education, technical colleges and relevant further education - for instance by the means of IT-based teaching resources. Furthermore, we will support the development and renewal of the education contents and form as well as disseminate experiences from practice and research. We will help students to find the connecting thread through the course of education from kindergarten to Ph.D. and increase recruitment by supporting the development of municipal strategies for the education in science, technology and health.

3. The National Centre for Science Education, Denmark supports the development of knowledge environments with special competences in science, technology and health. We will support the cooperation and coordination between the existing science environment based on so-called informal science learning environments consisting of technology and science centres, nature schools, museums etc.

Within the three main objectives, the action plan for 2010-13 contains performance requirements, indicators and mile stones for the following areas of effort as determined by the board:

Collection of knowledge. To be able to coordinate and develop collaboration between the formal and informal environments it is necessary to create an overview of existing networks, projects, activities and materials aimed at education in science, technology and health. Naturally this has to include primary schools and upper secondary education in the formal and informal environments, as well as in public and private companies.

Dissemination of knowledge. To ensure that the collected knowledge is made available, it is necessary to establish easily accessible and relevant portals, communication systems and communication forms. Through these, educators and other persons with an interest in science, technology and health will be able to find teaching resources, inspiration and join networks for the development of new projects or activities.

Knowledge sharing and creation of networks. To ensure a better interaction between the informal and the formal environment, the centre will improve knowledge sharing and network creation between formal and informal learning environments and other players in the field. To ensure knowledge sharing among schools and within the individual school, the centre will contribute to the development of municipal strategies for the education in science, technology and health.

Development of teaching resources. To support the development of best practices in primary schools, upper secondary education and technical schools - and to create a better synergy between the different educational institutions - an improved integration of national, regional and local informal teaching environments, teaching resources must be developed. These can support the interaction between different educational institutions and informal environments and public and private companies as well.

Identification of knowledge requirements. Through the network and development activities we aim to get in close contact with the local environments for education and

	further training. In this way, the National Centre for Science Education, Denmark has an opportunity to assist in identifying actual and future knowledge requirements and be able to point out subjects that needs further research within education in science, technology and health. Fundraising: The legislation expects that after a start-up phase, the centre and its partners will raise funding via foundations and the like corresponding to the public funding. During the first four years, the centre must develop competences and a reputation in order to create a basis for support of a considerable part of the total budget of the centre by means of fundraising activities.
Scope	National
Type	Assist the formal and informal STEM educational environment through a centre of science education that, particularly, supports relations between the educational system and companies.

Name	Conferences around best practices
Country	Denmark
Description	Arranging a conference for teachers, leaders and different actors from the industry each year in January. The conferences were lasting one day. Each year conference took up a new area of collaboration between school and industries to investigate how teachers and representatives for industries within this area could practice collaboration. The last area was “ideas for best practice in collaboration between school and farms/industry related to agriculture”. Here teachers, school leaders, farmers, farmer’s organizations, university and represents for companies producing technology for agriculture took part. In the morning short speeches were held preceding science in farming and technology related to farming and relating this science to school curriculum. In the afternoon represents from schools, farms and industry were in smaller groups to work out concrete plans of instruction and make arrangements for schools and classes. After the day a number of schools and farms/agriculture industries had agreements on starting a industry-school relationship and agreements on what this arrangement should contain.
Scope	Region
Type	Create STEM networks where teachers can interact with STEM professionals and find opportunities for collaboration.

Name	Partnership Guide
Country	Denmark
Description	Description of a policy action made by two municipalities in Denmark Partnership-guide: The two municipalities of Assens and Herning have in cooperation developed a Partnership-guide about how to create mutual binding cooperation between schools and industry or organisations. The goal of the guide is to inspire and give advice, so that future partners can avoid the greatest problems and pitfalls, when they are working across their different cultural background – when for example a public school have to cooperate with a large international company. The target groups for the guide are future partners among schools, industry and organisations. The guide is 24 pages and contains:

	- Why should you use your time on partnerships? - Why partnerships instead of cooperation? - Tips and ideas - Statements from key persons in the municipalities and industries. - Models of how to go from cooperation to partnerships. - Teaching goals and applied subject knowledge - Example of goals for a school-industry partnership - Initiatives, organisation and division of labour - Quality assurance - Roots in the community and the management's importance for partnerships - 3 cases of different partnerships: a) Example of partnership agreement between a school and an organisation. b) Example of an information letter from a school to an industry. c) Example of a letter for students with an introduction to a week of working with the local industry.
Scope	Local
Type	Development of guides to support the establishment and sustainability of effective school-industry partnerships.

Name	Forskningens Døgn
Country	Denmark
Description	Esbjerg Kommune: One of the goals our strategy has is to provide concrete actions for Kindergarten children, school and high school students and university students that foster there interest in STEM through an active partnership between for example Industry and school. Our first action is "Forskningens Døgn". A Science fair where DONG Energy and Mærsk Oil, and our universities intermediate their knowledge about energy. The main target for all stands on this science fair is that children from the 5th grade get a lot of "Hands on activity" and the opportunity to ask question professionals can give the answer to.
Scope	Local
Type	Organisation of fairs involving local companies and educational institutions where students can interact with different companies around STEM topics

Name	The Science Team K Project
Country	Denmark
Description	The aim of the Science Team K project was to increase the interest in science and technology among young people in the local area around Kalundborg city (DSC, 2007). To do so, the project was based on several elements: - Training of teachers - Networking between institutions

	- Support to new education equipment and activities - Evaluating and sharing experiences The project was financially supported by the Lundbeck Foundation, an international pharmaceutical company engaged in research and development, production, marketing and sale of drugs for the treatment of psychiatric and neurological disorders. This regional project, which was managed by the NGO Danish Science Communication and had been monitored and evaluated by the Danish University of Education, served as a pilot study for the subsequent Science Municipality project (2008-2011), which involved 25 Danish municipalities. One of the points highlighted by the evaluation group as an important hindrance to the long term success of improving science teaching locally was that the Science Team K project was based on a "quid pro quo" model that only extended to the involved schools and their teachers. In this sense, they suggested that it would have been prudent to have demanded an equal effort and investment from local enterprises and politicians who also benefited from the Science Team K project (DPU, 2007).
Scope	Local
Type	Courses/lectures for teachers on STEM topics with the involvement of local companies.

Name	School network
Country	Denmark
Description	The project aims to establish a special school network between Esbjerg Gymnasium and Gymnasium Rosborg and Danfoss Solutions and environmental consulting company Orbicon / Leif Hansen on energy use and energy improvements and linked to the annual work on the development of a science festival. In order this implementation can become a reality, which also becomes an educational effect, it is necessary to allocate resources to develop courses and practical framework, which can take place.
Scope	Local
Type	Facilitate sustainable development in STEM education by coordinating local schools and local enterprises.

Name	The Vision and philosophy group
Country	Denmark
Description	Hvidovre: Collaboration between public schools and sciences companies and shops will be strengthened. This is done through cooperation with NTS centre. We try to find and describe a method/model that could be used by other Communes. We use this model: The Vision and philosophy group consists of representatives from the informal learning environments, hospital, school managements, science spearhead group, technical management, business communities, high school and a politician. This group paint the broad brush strokes. How we will get the economy? What can we do to stimulate a positive science culture? How do we evaluate and what positive signs do we see? And what challenges do we have ahead of us? Science spearheads is a forum where 1 science teachers from the 11 local schools each represent their school. These representatives are the project's driving force. They develop teaching courses and test them in collaboration with the informal learning environments. They also seek to spread knowledge about the projects work to science teachers at their schools. This group helps to develop science cultures with an active academic and didactic dialogue

	between science teachers. The 11 public schools spearheads will be upgraded. This is done by offering them 2 PD modules. The municipality consultant acts as a square between the "vision and philosophy of the group" and the "science spearheads." The Consultant shall collect and publish teachers' courses.
Scope	Local
Type	Focus groups formed by different stakeholders in the society, including people from the business community, to plan a strategy to stimulate a positive science culture

Name	Siemens Adoption Arrangement
Country	Denmark
Description	The local branch of the international company adopts a school class (7th – 9th form) in order to increase the pupils' interest and learning of science and technology. This kind of projects often involves the scientific subject Physics/Chemistry, Mathematics, Danish and Social studies and often lasts 3 years with one monthly contact. The teacher and the responsible person at the company meets within the start of the project in order to plan the project to agree on what the pupils are expected to do (before, during and after visits at the company) and what they are expected to learn. The pupils will work with and study a case given them by the company. The class will visit the company both for being given lectures on the subject (case) and to deliver the results of their work/study.
Scope	Local
Type	Facilitate sustainable development in STEM education by coordinating local schools and local enterprises.

Name	Organic Farm Adoption Arrangement
Country	Denmark
Description	A large local organic farm adopts a school class (from 2nd form and several years after) for a period of time (often 3-4 weeks) with meetings 3 times a year in order to increase the pupils interest and learning of science related to farming. The school subjects involved can be the scientific subject Biology, Geography, Physics/Chemistry and Mathematics – sometimes also Danish and Social studies. The teacher and the responsible person at the farm meets within the start of the project in order to plan the project: what are the pupils expected to do before, during visits and after visits - and what are they expected to learn. The pupils will visit the farm several times in order to have lectures by staff at the farm. Often the project includes that the pupils do practical work in the field and/or with the animals. This means that the class will visit the farm both for being given lectures on different aspects of farming, to do different kinds of work in groups and – finally – to deliver the results of their work/study.
Scope	Local
Type	Facilitate sustainable development in STEM education by coordinating local schools and local enterprises.

Name	Autumn Holiday Camp
Country	Denmark
Description	Pupils in form 6th 8th, 9th and 10th are invited to join a camp in the autumn holiday arranged together with local companies. The pupils are given an introductory presentation to the engineering and other relevant aspects of company employment by an executive manager. After the introductory presentation the pupils visit 3 to 4 different companies in order to learn about the different kinds of work that engineers do. The aim is to relate the science teaching to the real world outside the school and to make the pupils interested in choosing a scientific line at the upper secondary school – and after that to choose an education as an engineer (either chemistry or technology etc.)
Scope	Local
Type	Organisation of fairs involving local companies and educational institutions where students can interact with different companies around STEM topics

Name	First LEGO League
Country	Denmark
Description	A project which is a partnership between The Copenhagen High School of Engineering and the municipality of Ballerup. The project is targeted at grade 6 to 8 at the lower secondary school. Each year has a special topic e.g. Smart Move, Food Factor or Body Forward. In each participating school class the pupils form groups of 6 to 8. For 8 weeks the each group do research, work out their presentation and design a robot to drive on a given and difficult lane. On a Saturday after the eight weeks the group of pupils participates with other groups in a contest with their presentation and their robot in front of a jury. There are 500-600 pupils participating every year. The aim is to make the pupils work with scientific problem solving in a way that is very motivating so that they experience science as fun, relevant and important in the society.
Scope	Local
Type	Facilitate sustainable development in STEM education by coordinating local schools and local enterprises.

Name	Teacher's course
Country	Denmark
Description	In cooperation with the national farming organization "Landbrug&Fødevarer" the municipality of Ballerup has arranged courses in production of different kinds of food on Danish farms. After the course the teachers are transported out into the country to three large, but different farms to see and to learn in practice. The aims are to qualify the teachers both on scientific topics in the practical world of farming and on the special status and position farming has in the Danish society.
Scope	Local

Type	Courses/lectures for teachers on STEM topics with the involvement of local companies.

Name	Chocolate manufacturing
Country	Denmark
Description	The municipality of Ballerup has made an arrangement with a large, local chocolate company for a whole week to make It possible for school classes to be supervised in their projects on various aspects of chocolate manufacturing. The project varies from how to grow the cocoa tree in Ghana, harvesting the cocoa bean, the local treatment etc. and children's work to energy and digestion etc. Among the aims is to make the scientific subject relevant and meaningful for the pupils.
Scope	Local
Type	Facilitate sustainable development in STEM education by coordinating local schools and local enterprises.

Name	Project on co-operation
Country	Denmark
Description	Together with Innovation Centre Copenhagen has the municipality of Ballerup arranged a 12 hour camp in order to evolve methods to make it fairly easy for lower secondary schools, high schools etc. and firms/factories/business to make educational interaction possible and rewarding for all participants. In the camp participated representatives from business and factories, the high school of engineering, upper secondary schools, a university, various organizations, pupils, teachers and leaders from the municipality. The camp was a success, but unfortunately the timing was bad because the camp was hold just as the economic crisis started! It showed afterward that it was very difficult in fact impossible to engage private firms in cooperate and design scientific "problem" which the pupils was supposed to analyse and work out realistic solutions for.
Scope	Local
Type	Organisation of fairs involving local companies and educational institutions where students can interact with different companies around STEM topics

Name	Local partnerships
Country	Czech Republic
Description	Activities in the field of promotion of Industry-School partnerships are rather local and are based on partnerships between vocational secondary schools and industry business in their immediate neighbourhood or region. These activities involves mostly excursions, work placements etc. Some active schools also apply (through their local authority) for smaller projects financed.
Scope	Local

Type	Facilitate sustainable development in STEM education by coordinating local schools and local enterprises.

Name	Science is the Future
Country	Czech Republic
Description	The aim of the project "Science is the future" is to increase the attractiveness of science and technology for elementary and secondary school pupils through a cooperation of companies and schools and show pupils that a career in this field has a future. The project is a part of the platform Schools Business - Business schools, which is based on the successful initiative of the Irish School of Business Partnership currently involving 120 large companies and 167 secondary schools throughout Ireland. The Czech project is at its beginning and involves at the moment two companies, Bayer and IBM, and two pilot schools. The projects are open to any other companies or schools that are interested to join it. The project is aimed at primary schools (8th grade) and secondary schools (3rd grade) and it is one to one project – 1 school: 1 company. The project has got four modules: working skills (excursion, CV workshops and science in practice), mentoring, part-time jobs for pupils, teacher training. Project coordination is in charge of a civic association AISIS, the project management involves in addition to representatives of the Ministry of Education and the corporate sector also authors of the original Irish project.
Scope	National
Type	Establishment of specific partnerships between educational, industrial and economic authorities to promote actions addressed to schools and/or teachers.

Name	Taasileda
Country	Israel
Description	Taasileda is a cluster of initiatives of the Israel Manufacturers Association focused on industry school partnership. One of the programs deals with advanced technologies, The generation of the future in industry's hi-tech described below.
Scope	National
Type	Establishment of specific partnerships between educational, industrial and economic authorities to promote actions addressed to schools and/or teachers.

Name	Perah Tutorship program
Country	Israel
Description	PERAH pairs up needy children from underprivileged backgrounds with university students who act as their tutors, giving the child personal attention (often sorely lacking) and serving as a role model. The care that PERAH children receive from their mentors helps them realize their potential and blossom into motivated individuals. They deeply collaborate with TEVA how, among other, supplies science centres for children enabling them to experience in a variety of scientific areas, to play games and run guided experiments in laboratories

Scope	National
Type	Establishment of specific partnerships between educational, industrial and economic authorities to promote actions addressed to schools and/or teachers.

Name	Schools' Business Partnerships
Country	Ireland
Description	The Schools' Business Partnerships (SBP) assists the Department of Education by partnering top companies in Ireland with almost 100 targeted schools in disadvantaged regions and communities at post-primary level. The SBP is governed by a multi-stakeholder Task Force that includes representation from both the business and education sectors. It meets quarterly to advice on policy and strategic direction.
Scope	National
Type	Support the formal and informal STEM educational environment through the establishment of focus groups and networks of stakeholders, business corporations among them, either directly or indirectly involved in science education

Name	TechNet
Country	Netherlands
Description	TechNet is a joint venture of Dutch companies and vocational schools in the Netherlands. Schools and companies join together in communities, in which companies provide schools with projects, workshops etc. About 1900 companies and 227 vocational schools participate in TechNet.
Scope	National
Type	Establishment of specific partnerships between educational, industrial and economic authorities to promote actions addressed to schools and/or teachers.

Name	Science for the Future
Country	Norway
Description	The National Forum for Mathematics, Science and Technology brings together the main organisations and participants in education and working life in Norway. The Forum is established is an advisory body for the Ministry of Education and Research regarding all matters related to the status and development of MST. The National Forum for Science aims to implement measures to establish high-quality science education at all levels and to improve recruitment to education and careers in science. With policy concerns regarding decreasing numbers of MST graduates and skills shortages in these areas, the 'Strategy for Strengthening MST 2010-2014' aims to increase the number of MST students by 15 %. The National Centre for Mathematics Education plays an important role in promoting mathematics education. A number of measures for strengthening students' skills before they enter higher education have been adopted and the National Centre for Recruitment in MST plays a vital role in the implementation of these measures. The Ministry of Education and Research has established a working group to

	look into how mathematics can be made more relevant and engaging for students at all levels of education. In addition, the National Centre for Recruitment in MST has initiated the establishment of a national agency to promote MST role models in the form of ambassadors from a variety of educational pathways and professions. Lower and upper secondary schools can book visits from role models and may also visit them at their workplace.
Scope	National
Type	Support the formal and informal STEM educational environment through the establishment of focus groups and networks of stakeholders, business corporations among them, either directly or indirectly involved in science education

Name	Program around the learning pathway
Country	Lithuania
Description	The main project goals: to provide wider possibilities for choosing learning pathway for students aged 14-19, by individualising and differentiating curriculum; to expand student options and make the curriculum more attractive according to the demands of modern trade market; to develop project participant professional competences. The development of model guidelines for modular programs, methodological recommendations for enterprise and employment development will lead to wider possibilities for 9-12 grade students' choice, individualisation of training and applying their knowledge into practice, career planning and decreasing training loads. The newly created methodological tools will enable to adjust and improve the process of education, increase access to training for students with various interests, needs and skills. The project products are developed in cooperation with industry enterprises, some video clips of people working there are created. Their professional skills, personal qualities needed in the work, and career opportunities are emphasised. The innovative project products will be used by teachers, school administrators, education specialists, counsellors. Results of the project will indirectly affect the students, their parents, social partners, employers, professional and academic experts, textbook authors. The project will seek to take advantage of advanced experience of foreign countries; foreign expert (s) will be invited to join international cooperation networks.
Scope	National
Type	Supply information about STEM career opportunities in collaboration with industrial corporations.

Name	Training for VET teachers and college professors
Country	Lithuania
Description	The aim of the project: to provide vocational teachers and college professors with technology competence in order to enable them to work in a new sectorial practical training centres. Technology competency development model will be created (training system, its elements, financial support, etc.); almost 100 current technology competency training programmes for 650 participants will be applied in 12 industry sectors. VET teachers and college professors will teach the company employees to work with up –to-date technology. The training will be carried out by the companies which developed the training programmes. If necessary, sectorial practical training centres technology equipment suppliers will be involved. Training will be conducted in sectorial practical training centres. 650 Vet teachers and college professors will be taught to work with up-to-date technology. Average training duration is 3 months. At the end of the training

	each participant's technological competence will be assessed in accordance with the requirements set out in the Action Plan and the certificate of skills' development / acquisition will be conferred.
Scope	National
Type	Establishment of specific partnerships between educational, industrial and economic authorities to promote actions addressed to schools and/or teachers.

Name	Educational project
Country	Portugal
Description	DGIDC (Ministry of Education) support several institutions, including industries with educational projects, that apply for that support (e.g. Bayer educational project)
Scope	National
Type	Establishment of specific partnerships between educational, industrial and economic authorities to promote actions addressed to schools and/or teachers.

Name	Partners in Learning
Country	Slovakia
Description	Partners in Learning is a program that is dedicated to enabling access to technology, supporting leadership and building community in Slovak schools. It is global initiative with more than 85 field-based staff covering 114 countries; the initiative has so far trained over 8.8 million teachers and school leaders, and reached 198 million students. The Ministry of Education of the Slovak Republic and Microsoft recognize the need to improve access to, and use of, information and communications technology (ICT) in primary and secondary schools, recognize the value of technology in schools and seek to jointly improve the access to and to support the use of ICT in teaching. The Microsoft Partners in Learning is available in three actions: • Innovative Teachers: Providing teachers with tools, forums and resources that build communities of practice, support collaboration and access to quality content, and support teachers in integrating ICT into teaching and learning in a meaningful way. The peer learning of teachers is organized in 50 clubs. Regular events are also: an annual conference, road shows and competition for teachers. • Innovative Schools: Providing schools, governments and partners with resources, training, expertise and technology blueprints that help create schools to better prepare students for life and work in the 21st century. There are several schools testing 1:1 computing pilot project, 8 schools are supported by Microsoft: www.notebookprekazdehoziaka.sk • Innovative Students: Empowering students to use ICT in their schoolwork and learning. Students are informed about cyber security on internet, on social networks in one day f2f discussions in particular schools or by resources provided on the website www.bezpecnenainternete.sk With the help of its partners, Microsoft will firstly invest into the following areas of research: (a) benefits of teaching with the use of ICT; (b) uses of ICT by teachers; (c) changes in curricula; (d) increases in the use of ICT; (e) contribution to the economy, based on the needs and priorities of the Ministry of Education of the Slovak Republic

Scope	National
Type	Supply of ICT tools, some of them by technological enterprises, to support teaching innovation

Name	MEGEP
Country	Turkey
Description	As a result of the studies carried by the Ministry of Education, the Ministry of Industry and The Ministry of Energy in the 90s of Turkey, some important evaluations have been recorded with the help of the Ministry of Education, TUBİTAK, the Educational Communities and the Universities. These results are really outstanding because Turkey has great potential in terms of not only young population but also graduated students from the industrial schools; however, the most important problem is about the employment of these young people because of the deficient education, out-of-date methods of teachers, and being away from the innovations of present day. Therefore, an important process is started with the inclusion of not only the Educational partners such as The Ministry, Universities and Communities but also partners from the Industrial World come together and this process has led the Ministry of Education to a EU Project named MEGEP DG1A-D/MEDTQ/04-98. http://megep.meb.gov.tr/indextr.html Shortly, MEGEP is an important project for Turkey because of its context in which students are educated not only through their cognitive skills but also psychomotor skills. Both these provide these students to think critically, creatively, and help them to gain the qualification about solving problem by linking their daily world. This EU Project has opened a new door for the education of these students in the Industrial School with innovative methods and updated curriculum in 2000. Since the beginning of the project, Turkey has been going on its studies on developing of the vocational education system in order to increase the number of the students in all sectors of Industrial World and labour quality.
Scope	National
Type	Establishment of specific partnerships between educational, industrial and economic authorities to promote actions addressed to schools and/or teachers.

Name	Facilitate sustainable development in STEM education by coordinating local schools and local enterprises.
Country	United Kingdom
Description	Communities of schools linked with local industries through workshop aimed at primary 7 pupils. The aim is to allow pupils to explore the world of work in their local area. Not exclusively STEM industries but many are represented in this forum.
Scope	Local
Type	Small Business partnerships

Name	STEM Ambassador Scheme
Country	United Kingdom
Description	Secondary schools utilize the services of STEM Ambassadors who are people involved in STEM industries. These people serve as role models and support a number of events in the school.
Scope	Local
Type	Facilitate sustainable development in STEM education by coordinating local schools and local enterprises.

Name	Young SET Ambassadors
Country	United Kingdom
Description	Many secondary schools involved in this scheme which is competition based but allows young people to engage with major issues of the day and to research haw the STEM industries are meeting the challenge.
Scope	Local
Type	Facilitate sustainable development in STEM education by coordinating local schools and local enterprises.

Name	Work Experience
Country	United Kingdom
Description	Every pupil in S4 (15/16 year old) is involved in a week's work experience over a range of industries. Work experience is also organized for other individuals on request and as the need or opportunity is identified.
Scope	Local
Type	Facilitate sustainable development in STEM education by coordinating local schools and local enterprises.

Name	Positive Destination Agenda
Country	United Kingdom
Description	The Council is committed to ensuring that every young person who leaves schools transfers to a positive destination which leads them to the world of work. This is supported by a number of projects and partnerships which involve a range of businesses and industries.
Scope	Regional
Type	Facilitate sustainable development in STEM education by coordinating local schools and

	local enterprises.

Name	University and Business Links
Country	United Kingdom
Description	Many schools have built up strong links with local businesses and universities which allow pupils to 'tap in' to a variety of activities and opportunities which raise their awareness of the range of possibilities across STEM and other related industries.
Scope	Local
Type	Facilitate sustainable development in STEM education by coordinating local schools and local enterprises.

Name	Evenings around STEM
Country	United Kingdom
Description	Seven day long events for 14 year olds and 3 evening events are organised on a geographical basis to inform students of opportunities in STEM. Students are given a fifteen minute introduction to the importance of STEM and then allowed to visit the stands of employers and providers. Each employer is selected to match the breadth of the sectors in the region and is asked to bring a product they use or manufacture to act as a starting point for discussion. Where possible a session is arranged to facilitate parents.
Scope	Regional
Type	Organisation of fairs involving local companies and educational institutions where students can interact with different companies around STEM topics

Name	STEM network
Country	United Kingdom
Description	A number of opportunities for teachers to meet and network around specific foci. E.g. STEM NETWORK, Heads of Technology, Diploma Support Groups plus a package of support aimed at those areas where there is greatest need for development e.g. electronics & CAD. This is delivered and co-ordinated by the Engineering and Manufacturing co-ordinator
Scope	Regional
Type	Create STEM networks where teachers can interact with STEM professionals and find opportunities for collaboration.

Name	STEM Camp

Country	United Kingdom
Description	An annual event where students present their STEM outcomes to panels of employers. The event is also an opportunity for employers and providers to meet with school staff and students. This event is a daylong activity and has been run for the last 11 years. It usually attracts 250 + entrants. There are also CPD activities run during the day and there are opportunities for teachers to network with others.
Scope	Local
Type	Organisation of fairs involving local companies and educational institutions where students can interact with different companies around STEM topics

Name	Employer Engagement
Country	United Kingdom
Description	This action allows for employers to engage with schools and colleges in a structured way. This ensures that: • Employers are clear about their role and are able to specify the number of opportunities that can be offered. • All activity is co-ordinated by the Engineering Co-ordinator to ensure that companies are not inundated by requests • Activity can be directed at specific groups of staff (e.g. visits) or students. • Students carry out projects that are set during the visit to the company and completed at school or college.
Scope	Local
Type	Facilitate sustainable development in STEM education by coordinating local schools and local enterprises.

Name	South Yorkshire STEM Strategy Group
Country	United Kingdom
Description	This programme of activities has been drawn up and agreed through the South Yorkshire STEM Strategy Group which consists of: • Schools • Colleges • Employers • Universities • Local Authorities

	• STEMNET Contractor – South Yorkshire (2011-15) • Business Education South Yorkshire • Other interested parties This group meets together on a regular basis with the common aim of raising the profile of STEM, improving attainment and promoting progression within the sector. A key element will be the development and delivery of the new Diplomas in Engineering and in Manufacturing & Product Design. Although we recognise the need to accept new challenges and to take advantage of opportunities when they arise, we also understand that schools need to be able to plan for activities and to ensure that these can be incorporated into school plans.
Scope	Local
Type	Focus groups formed by different stakeholders in the society, including people from the business community, to plan a strategy to stimulate a positive science culture

Annex II.

CATALOGUE OF PRACTICES OF SCHOOL - INDUSTRY COLLABORATION

Name	EDUSAP
Organisation	BMUKK
Country	Austria
Description	SAP, the German software provider for enterprise solutions, has a cooperation with the Technical University Vienna to support schools in Hard- and Software Solutions for SAP enterprise products. The aim is to provide students with SAP user certificates which help to compete for better job opportunities. ACME is a special "virtual" enterprise developed by SAP, MoE and partners to fit into the Austrian Curriculum and represent the enterprise reality for the future job. Students have the possibility to get an impression of the future work and to learn how to administrate and organise within an enterprise. With a partner (CCIT) teachers get the possibility to learn how to administrate, use and organise the virtual enterprise for their lessons. This education is free of charge for the teachers.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Awareness of whether the personal characteristics and interests fit with those required for STEM careers
Target group	Teachers, Upper secondary, Vocational school, University
Duration	Hours
Place	School
STEM discipline	ICT
Approach	Transmissive
Role model	Yes

Name	XPERIMANIA1
Organisation	CEFIC
Country	Belgium
Description	XPERIMANIA. From molecules to materials (year I 2007-2008)

	Faced with the lack of scientifically-educated young people, the major petrochemical producers in Europe decided to support the development of an educational programme geared at raising awareness of how petro chemistry contributes to the development of modern materials and motivating young people for scientific education. It aimed to help European teachers and students to explore the properties of materials and understand some of the processes involved in creating materials used in everyday objects. Xperimania was launched in September 2007 in the 27 EU member-states and was available in 2 languages. Secondary schools students aged 10 to 20 years old were invited to take part in a series of activities including: A) “hands on fun and easy experiments” competition: students to design and try out an experiment in the fields of materials and petro chemistry. Students could also choose to conduct one of the experiments proposed on the portal. B) “timeline of petro chemistry discoveries” competition: explore scientific discoveries in the field o materials from 1800 to the present day. C) Online chats giving the students an opportunity to “talk” with industry experts on specific topics related to petro chemistry. The Xperimania activities were supported by inquiry-based methods, which have proved their efficiency in increasing pupils’ interest and teachers’ motivation
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially, related to the company (materials, ambassadors, courses, etc.) Establishing personal communication of STEM professionals with students
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools STEM professionals go to schools to give a talk or to establish some dialogue with students about job/academic background
Factors addressed	Students’ engagement in the study of STEM in school. Social perception of the work related to STEM careers.
Target group	Secondary, Vocational
Duration	Days
Place	School
STEM discipline	Physics, Chemistry, ICT
Approach	Constructivist
Role model	No

Name	XPERIMANIA2
Organisation	CEFIC
Country	Belgium
Description	XPERIMANIA. From molecules to materials- Year II 2008-2009 Check out the property. Faced with the lack o scientifically-educated young people, the major petrochemical producers in Europe decided to support the development of an educational programme geared at raising awareness of how petro chemistry contributes to the development of modern materials and motivating young people for scientific education. It aimed to help European teachers and students to explore the properties of materials and understand some of the processes involved in creating materials used in everyday objects. Xperimania was launched in September 2007 in the 27 EU member states and was available in 22 languages. In year the number of languages was cut down to 13. Secondary school students aged 10 to 20 years old were invited to take part in a series of activities including: 1)"Check out the property" competition whereby students investigate the chemical and physical properties of materials, their use in everyday life through easy and fun experiments. 2) Multilingual (English, German, French, Spanish) online chats giving the students an opportunity to "talk" with industry experts on specific topics related to petro chemistry. Year activities: 1) "hands on fun and easy experiments" competition related to petro chemistry and materials 2) "timeline of petro chemistry discoveries" competition providing further insight into scientific discoveries in the field of materials from 1800 to the present day. The Xperimania activities were supported by inquiry-based methods, which have proved their efficiency in increasing pupils' interest and teachers' motivation
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially, related to the company (materials, ambassadors, courses, etc.) Establishing personal communication of STEM professionals with students
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools STEM professionals go to schools to give a talk or to establish some dialogue with students about job/academic background
Factors addressed	Students' engagement in the study of STEM in school. Social perception of the work related to STEM careers.
Target group	Secondary, Vocational
Duration	Days
Place	School

STEM discipline	Physics, Chemistry, ICT
Approach	Constructivist
Role model	No

Name	XPERIMANIA3
Organisation	CEFIC
Country	Belgium
Description	XPERIMANIA. From molecules to materials - year III 2009-2010 Science Ambassadors Workshops Faced with the lack of scientifically-educated young people, the major petrochemical producers in Europe decided to support the development of an educational programme geared at raising awareness of how petro chemistry contributes to the development of modern materials and motivating young people for scientific education. It aimed to help European teachers and students to explore the properties of materials and understand some of the processes involved in creating materials used in everyday objects. Xperimania was launched originally in September 2007 in the 27 EU member-states and was available in 22 languages. The number of language was cut to 6 in year III. In year I and II, Xperimania consisted in competitions and online chats. In year III, Xperimania consisted in Science Ambassadors Workshops. The purpose was to show teachers and students easy and fun chemistry and physics experiments, and thus boost young people's interest in science. Each of the workshops started with a short discussion about students' preconceptions of science and whether they like it or not. Then, to get a step deeper into the topic, the students were asked to name petrochemical products from their everyday life and their properties. The ambassadors had prepared six hands-on experiments, of which 3-4 were carried out in each workshop. The experiments followed a real scientific method, the OHERIC method of Observing, making Hypotheses, Experimenting, getting Results, Interpreting the results and drawing Conclusions.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry promotes STEM education through science ambassadors
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Upper primary, Secondary
Duration	Hours
Place	School
STEM discipline	Physics, Chemistry, ICT
Approach	Constructivist
Role model	No

Name	XPERIMANIA4
Organisation	CEFIC
Country	Belgium
Description	XPERIMANIA. From molecules to materials - Year IV 2011 “Equality” Faced with the lack of scientifically-educated young people, the major petrochemical producers in Europe decided to support the development of an educational programme geared at raising awareness of how petro chemistry contributes to the development of modern materials and motivating young people for scientific education. It aimed to help European teachers and students to explore the properties of materials and understand some of the processes involved in creating materials used in everyday objects. Xperimania was launched originally in September 2007 in the 27 EU member-states and was available in 22 languages. The number of language was cut to 6 in year IV. In year IV, Xperimania “Equality” was supported Cefic (European Council of the Chemical Industry) and was coinciding with the International Year of Chemistry under the theme “Chemistry. Our life, our future”. Several activities were proposed to the students: 1) Portrait of a lady scientist in the students’ country of origin who has a career in chemistry (13-21) 2) Create an Awareness campaign on women and chemistry to increase the interest of female students in chemistry (13-21) 3) Poster on women and chemistry expressing young students (6-12) vision
Category	Engaging of STEM professionals with students’ work
Initiative	STEM industry proposes a research project or study in depth around certain topic and in collaboration with th professionals working in the industry
Factors addressed	Social perception of the work related to STEM careers.
Target group	Primary, Secondary
Duration	Days
Place	School
STEM discipline	Physics, Chemistry, ICT
Approach	Transmissive
Role model	No

Name	FuturEnergia
Organisation	PlasticsEurope
Country	Belgium
Description	The aim of the program is to establish contact with students, show them innovative possibilities around advanced engineering, innovative materials and solar energy and increase their interest in STEM.
Category	Establishing personal communication of STEM professionals with students
Initiative	STEM professionals go to schools to give a talk or to establish some dialogue with students around industrial applications STEM industry offers an expert for a debate with students around topical and controversial subjects
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Upper secondary
Duration	Hours
Place	School
STEM discipline	Technology
Approach	Technology
Role model	No

Name	EsbjergGymnasium_Science day
Organisation	Dansk Naturvidenskabsformidling
Country	Denmark
Description	This High School (pupils aged 16-20) once every year organizes a science day (as part of the Danish Science Week) at the high school, where classes from secondary schools (pupils aged 13-14 years old) are invited. Pupils from the high school as well as local industry present different science topics. The programme consists of: • Visiting session 1: 08.30-11.00 • Chemistry Show: 11:15-12 • Visiting session 2: 12.15-14.45 • Each visiting session can include 10 school classes. The special things about this initiative:

	We create contact between different age groups of the educational system – 7th grade pupils (aged 13-14) from secondary schools and pupils from high schools (aged 18-20). The pupils from the secondary schools experience a science event designed for them, but taking place in a different environment/school, which they have to ”go for” if they want to educate themselves in this directions. Pupils from the high-school gets special teaching about a science topic by guest speakers from local industries and universities. Pupils from the high school are guiding the visitors from the secondary schools and communicate about science topics. Preparation of the science day brings about great contacts to the local industries which the high schools later uses for creating work experience-visits, guest lectures and cooperation for assignments. Esbjerg Gymnasium have made this initiative 3 times so far. Among others they have cooperated with Industries like Esbjerg Institute of Technology, Mærsk, Rambøll, Lego, Viking, COWI og Danisco. Last year 21 classes from secondary schools visited the event.
Category	Establishing personal communication of STEM professionals with students
Initiative	STEM professionals go to schools to give a talk or to establish some dialogue with students around industrial applications
Factors addressed	Information about careers and jobs in industry.
Target group	Lower primary, Upper secondary
Duration	Days
Place	School
STEM discipline	Physics, Chemistry, Life Science, Technology
Approach	Physics, Chemistry, Life Science, Technology
Role model	Yes

Name	ISI 2015
Organisation	Dansk Naturvidenskabsformidling
Country	Denmark
Description	ISI 2015 – “innovation, Science and Integration” is a project aimed at improving ethnic minority students’ skills in science. Numbers show that the talented youth in this group of students is more likely to choose specific scientific and technical programs e.g. engineering than their Danish peers, when it comes to further education. In order to make science more authentic, teachers are encouraged to collaborate with local public and private enterprise. The project operates with a synergy between the three elements: innovation, science and integration: The synergy between science and innovation is creative science that may lead to innovative inventions. It is the combination between academic and professional relevance. It is process skills – from idea to product. The synergy between science and integration is using science as a steppingstone to further education and job market. The synergy between integration and innovation is personal

	responsibility and ownership students take of innovative processes, it is commitment, and control of her/his own life. In an effort to establish authenticity for the students between classes taught and 'real-life science', the project encourages collaboration between participating schools and local enterprises. This year, the organization Welfare Tech Region has presented the students with an assignment that deals with welfare technology. The students have to come up with solutions to how staff that works with lifting handicapped people may avoid damages to their back. The participating schools are all located in a region where welfare technology is both high on the political agenda and a strategic area of focus. Students will have to approach the assignment in an innovative way. Their point of reference will be science. They will be introduced to new method of: - Collecting data/knowledge about the people involved (nurses/helpers, patients/clients), and existing technology. - Synthesizing their findings. Idea generation. - Prototyping. - Testing.
Category	Engagement of STEM professionals with students' work
Initiative	STEM industry proposes a technological challenge to be surmounted for students
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Lower secondary
Duration	Weeks
Place	School
STEM discipline	Physics, Chemistry, Life Science, Technology, ICT
Approach	Constructivist
Role model	Yes

Name	VIAUC
Organisation	NVHUS
Country	Denmark
Description	The purpose of the project "Cooperation between education and industry" is to develop and document initiatives that makes the region's children and youngsters aware of the the applicability of STEM in industry, and to demonstrate the broadness of relevant jobs involved. During ordinary lessons the reality of the companies is demonstrated for the pupils. They make desk research about the company, meet with the employees, work on real problems and challenges presented by the company and present their solutions to the companies. The experiences of all teachers, pupils and companies are documented in a film, manuals and other material, which will publicly published on the homepage www.projektsamspil.dk to inspiration and use by other teachers and companies.

	Companies and schools which have participated in the pilot project can in the future make similar activities with much lower expenditure of resources. The pupils realise the uncountable number of jobs which are related to STEM and experience that some of the big challenges of the society (environment, climate and health) can be solved by scientific-technical skills.
Category	Giving accessibility of the company premises to schools/to students Engaging of STEM professionals with students' work
Initiative	STEM industry offers its premises to be visited by students with the possibility of including some activities STEM industry proposes a research project or study in depth around certain topic and in collaboration with the professionals working in the industry
Factors addressed	Students' engagement in the study of STEM in school. Information about careers and jobs in industry. Awareness of whether the personal characteristics and interests fit with those required for STEM careers. Social perception of the work related to STEM careers.
Target group	Primary, Secondary, Vocational, University
Duration	Trimester
Place	School & Industry
STEM discipline	Physics, Chemistry, Life Science, Mathematics, Technology, ICT
Approach	Constructivist
Role model	Yes

Name	C.A.S.E.
Organisation	NVHUS
Country	Denmark
Description	Projekt C.A.S.E. (Center for Applied Science in Education). The purpose of the Project is to develop concrete suggestions to how teaching can become more application oriented (age 5 – 18 yrs) with basis in real problem from the Private companies. The way of teaching shall stimulate the creativity and urge to create. The teaching must give the pupils real and positive pictures of the value of STEM, and of the possibilities the students have themselves in choosing a STEM education and career. Another purpose with the Project is to change the academic way of thinking within science teaching. We want the students to learn not only the theory, but also how to apply it. We hence develop 30 application oriented study programmes. which are devoted to teach the pupils

	both the theory but at the same time demonstrate how the theory is applicable to problems of the private companies. The study programmes will be developed in a manner so they at the same time increase the interest and the skills of the pupils. The study programmes will be used by primary and secondary schools and high schools as a supplement to the traditional teaching and contribute to an increased understanding of the utility value of STEM. It is also an aim in this Project that the teachers will act like ambassadors. the Project has as a goal that the STEM teachers themselves will change their point of view on the utility value of STEM and become inspired to how the teaching can become more interesting and give more value to the pupils. The material result of the Project will be 30 applications oriented teaching programmes from elementary school (5 yrs) to high school (18 yrs). Those programmes will demonstrate the application potential of the subjects for pupils and also assure that the curriculum is covered. It is our aim that the result of the Project is an increased degree of application oriented study programmes used by the teachers. We also expect a higher degree of interest and knowledge in those subjects amongst children and teenagers in Denmark. The Project is expected to have a significant effect on the STEM teachers own motivation and attitude towards STEM subjects as being useful and relevant to the pupils. The 30 developed application oriented study programmes are intended to inspire the teachers to use the particular themes in other subjects. In this way the programmes shall contribute to a changed way of teaching in STEM subjects.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry contributes to update teachers' knowledge about certain STEM-related industrial topic
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Primary, Secondary, Vocational, University
Duration	Trimester
Place	School & Industry
STEM discipline	Physics, Chemistry, Life Science, Mathematics, Technology
Approach	Transmissive
Role model	No

Name	NatPlus
Organisation	NVHUS
Country	Denmark
Description	Project: NatPLUS. 3 yrs collaboration between private company (Grundfos A/S) and a science class of high school (Favrskov Gymnasium, Favrskov municipality). The collaboration took place as a sequence of visits, where the theoretical subjects, chosen by the

	maths and physics teachers of the high school, was dealt with and explored from a practical, production wise point of view. The theory of the high school was made practical. After the visits the class continued working with the data collected and obtained a deeper degree of understanding of the subjects. The project NatPLUS managed by House of Natural Sciences (Naturvidenskabernes Hus) . The collaboration was between a 2nd yr technical high school class and the private company Samson Agro A/S.
Category	Engagement of STEM professionals with students' work
Initiative	STEM industry proposes a research project or study in depth around certain topic and in collaboration with the professionals working in the industry
Factors addressed	Students' engagement in the study of STEM in school. Information about careers and jobs in industry. Awareness of whether the personal characteristics and interests fit with those required for STEM careers. Social perception of the work related to STEM careers.
Target group	Upper secondary, Vocational
Duration	Weeks
Place	Other
STEM discipline	Physics, Chemistry, Mathematics, Technology, ICT
Approach	Constructivist
Role model	Yes

Name	Chats/Interviews to a STEM professional
Organisation	Tigerleap
Country	Estonia
Description	Not available
Category	Establishing personal communication of STEM professionals with students
Initiative	STEM professionals go to schools to give a talk or to establish some dialogue with students about job/academic background
Factors addressed	Information about careers and jobs in industry.
Target group	Teachers, Primary, Secondary
Duration	Hours
Place	School

STEM discipline	Chemistry, Mathematics, Life Sciences
Approach	Transmissive
Role model	Yes

Name	Talk by a STEM professional
Organisation	Tigerleap
Country	Estonia
Description	Not available
Category	Establishing personal communication of STEM professionals with students
Initiative	STEM professionals go to schools to give a talk or to establish some dialogue with students about job/academy background STEM professionals go to schools to give a talk or to establish some dialogue with students around industrial applications
Factors addressed	Students' engagement in the study of STEM in school. Information about careers and jobs in industry.
Target group	Primary, Secondary
Duration	Hours
Place	School
STEM discipline	Physic, Mathematics, Life Sciences, Technology
Approach	Transmissive
Role model	Yes

Name	Toijala Center
Organisation	Nokia
Country	Finland
Description	Nokia Corporation and Päivölä School of Mathematics offer mathematically talented upper secondary school students an opportunity to do their upper secondary school studies with special emphasis on STEM and a long internship at Nokia in parallel. The students study upper secondary school curriculum in Päivölä boarding school and at the same time, for 12 hours a week, work as interns at Nokia during the semesters. About half of the students get to work also full-time during

	the summer. The work time is integrated into students' curriculum. The students do their upper secondary education in two years, instead of the Finnish three year norm and have the opportunity to take university-level classes in math and CS. The work assignments during the internship are small-scale R&D (research and development) projects. Usually the projects produce prototypes and demonstrations of given technologies. Although the majority of the students work on software design, they can also select projects related to, for example, graphical design, sound design, electronics and new media. About half of the executed projects are collaboration projects with other Nokia units and external collaborators and the rest are projects initiated by the students themselves or their instructors.
Category	Engagement of STEM professionals with students' work
Initiative	STEM industry offers the possibility of an Internship for some students
Factors addressed	Students' engagement in the study of STEM in school. Information about careers and jobs in industry. Awareness of whether the personal characteristics and interests fit with those required for STEM careers. Social perception of the work related to STEM careers.
Target group	Upper secondary, Vocational
Duration	More than an academic year
Place	School & Industry
STEM discipline	Technology, Mathematics
Approach	Constructivist
Role model	Yes

Name	Scratch Programming
Organisation	Nokia
Country	Finland
Description	This practice provides older students with structured instructions on how to organise a programming club on Scratch computing for younger students. Scratch is a programming language that makes it easy to create your own interactive stories, animations, games, music, and art – and share your creations on the web.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)

Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Upper primary, Secondary
Duration	Days
Place	School
STEM discipline	Technology
Approach	Transmissive
Role model	No

Name	Innovation Contest
Organisation	STMicroelectronics
Country	STMicroelectronics
Description	"Innovation Contest" proposes to teachers to enrol their students in an innovation contest proposed by an industrial on a theme chosen either by the school or by the industrial (example in 2010: "Real Sense Interfaces", "Energy") in which case the best 3 proposals of the school are rewarded (prizes financed by the industrial). This initiative aims at getting the students involved in work groups on a practical case of innovation, meaning for given industry and on a given theme, thus making them more familiar with the industrial work challenges in terms of innovation. The school teacher is free to use approaches from the program to guide the students to generate a proposed innovation. This activity is run by the professor(s). The industrial is present at the beginning to launch the contest, provide contextual information about the industry's challenges and answer students' questions. The industrial also comes at the end to be part of the jury who evaluates the proposed innovations from the students.
Category	Engagement of STEM professionals with students' work
Initiative	STEM industry proposes a technological challenge to be surmounted for students
Factors addressed	Students' engagement in the study of STEM in school. Information about careers and jobs in industry.
Target group	Primary, Secondary, Vocational
Duration	Months
Place	School
STEM discipline	Physics, Chemistry, Life Science, Mathematics, Technology, ICT

Approach	Transmissive
Role model	Yes

Name	Class in the Company
Organisation	STMicroelectronics
Country	France
Description	Students and their teachers run their classes for 3 days within the Industrial company premises “ST3E - Class in the Company” (in French, “Classe en Entreprise”) proposes to high school teachers to host their class (14 year old students) for 3 full days within the premises of the company. The students still have their “history” or “maths” class but the lessons taught during these 3 days are adapted in order to have a link with the company’s history or its industrial and technical activities. This initiative aims at getting the students more familiar with the industrial work environment; inform them on the scientific and technological challenges. It also gives them some ideas of the jobs offered in the industry (in our case semiconductor and electronics) and develops their desire to develop a professional project in a scientific and technical domain.
Category	Giving accessibility of the company premises to schools/to students
Initiative	STEM industry offers its premises in order that teachers perform some lessons relating students’ curriculum with activities of the company
Factors addressed	Information about careers and jobs in industry.
Target group	Upper secondary
Duration	Days
Place	Industry
STEM discipline	Physics, Chemistry, Mathematics, Technology, ICT
Approach	Transmissive
Role model	Yes

Name	C'est pas Sorcier
Organisation	STMicroelectronics
Country	France
Description	“C’est pas Sorcier” is a TV program deployed in France, Belgium and Switzerland since 1993. Each program addresses a scientific topic in 30 minutes in a practical manner showing to students the sites and labs, interviewing specialists and introducing questions students might have about the topic. These

	questions are answered in a visual and dynamic manner thru prototypes and experiments conducted inside a truck. Teachers can use these programs available as a support for their lessons and/or with the live intervention of some industrials under conditions defined on http://c-est-pas-sorcier.france3.fr/?page=enseignants which are basically of 2 types: - a subscription by the schools or teachers to use extracts of the programs from http://www.lesite.tv/ - sale of DVD including the rights to diffuse in the class for the programs which are not sold as DVDs www.dvode.com/cestpassorcier_enseignants ST participate in the programs concerning the nanotechnologies in which the students get to discover the semiconductor industry, its achievements (miniaturization, its applications (transparent sun screen, self-cleaning windows, removing bad smell from dirty socks, fresher food, tires that last longer, etc.) and its future challenges. This initiative aims at getting the students knowledgeable about science and advanced technologies topics, also getting them to see practical application of the lessons learnt in class, to develop their interest for technology and science and to show them professionals working in technical domain and industries.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Social perception of the work related to STEM careers.
Target group	All targets
Duration	Hours
Place	School
STEM discipline	Physics, Chemistry, Life Science, Mathematics, Technology, ICT
Approach	Transmissive
Role model	Yes

Name	C'Genial
Organisation	STMicroelectronics
Country	France
Description	Engineers and Technical Professionals in the ClassRoom The C.Genial foundation proposes to high school teachers to welcome in their classes engineers and technical professionals who come to talk to the students about their job. Meeting an engineer or a technical professional and exchange with her/him on her/his experience and curriculum show to youngsters that they can have an exciting job linked with sciience and technology, regardless of

	gender. The presentations show them the diversity of careers, inform them on the future scientific and technological challenges and develop their desire to develop a professional project in a scientific and technical domain.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM professionals go to schools to give a talk or to establish some dialogue with students about job/academic background
Factors addressed	Information about careers and jobs in industry.
Target group	Lower secondary
Duration	Hour
Place	School
STEM discipline	Physics, Chemistry, Mathematics, Technology, ICT
Approach	Transmissive
Role model	Yes

Name	Innovation Challenge
Organisation	STMicroelectronics
Country	France
Description	"Innovation Challenge" proposes to teachers to run a structured creativity session with their class aiming at generating an innovation of interest for an industrial. This can be part of an innovation contest organized by an industrial on theme (example in 2010: "Make Life Easier and Better") in which case the best 3 proposals of the school are rewarded (prizes financed by the industrial). This initiative aims at getting the students involved in a practical case of innovation under constraint, meaning for given industry and on a given theme, thus making them more familiar with the industrial work challenges in terms of innovation. It clarifies the difference between creativity and innovation. It also gives them some methodology to generate ideas, select the best one and teaches them how to sell and idea. This activity can be run by the industrial and/or by the professor. It involves 4 steps: - Creativity session and brainstorming techniques – 3:30 hours – - Convergence session – 1:30 hour – - Team work to prepare presentation – 1:30 hour – - Presentation to the jury – 15 minutes per group – The material needed for this session is paperboards and post-it notes

Category	Engaging of STEM professionals with students' work
Initiative	STEM industry proposes a research project or study in depth around certain topic and in collaboration with the professionals working in the industry STEM industry proposes a technological challenge to be surmounted for students
Factors addressed	Students' engagement in the study of STEM in school. Information about careers and jobs in industry. Awareness of whether the personal characteristics and interests fit with those required for STEM careers. Social perception of the work related to STEM careers.
Target group	Primary, Secondary, Vocational, University
Duration	Hours
Place	School
STEM discipline	Physics, Chemistry, Life Science, Mathematics, Technology, ICT
Approach	Constructivist
Role model	No

Name	Maths Olympics
Organisation	STMicroelectronics
Country	France
Description	International Web Maths competition for students (14-25) organized by STMicroelectronics, Gemalto and the Education Department of Moscow and Foreign Languages Studies Department. "Maths Olympic Games" (in French, "Olympiades de Mathématiques") are accessible via internet http://UchiMatematiku.ru « Let's learn Maths » in different languages (French and in Russian). Participants are divided in categories by age (14-15, 16-17 and 18-35) and compete on internet thru 2 rounds. The second round occurs 3 weeks after the first one. 3 winners are designated for each category and for each country (thus a total of 9 French winners and 9 Russian winners in 2010). "Maths Olympic Games" aims at increasing the interest of youngsters for maths and its scientific and industrial applications, strengthening the bonds between different countries (was done with France and Russia in 2010) and identifying talented young mathematicians whose skills are very much needed by industrials. The winners travel to Grenoble to receive their price which gives them the opportunity to discover this beautiful and high-tech region and furthermore to visit STMicroelectronics' site which is one of the most advanced research and

	manufacturing centre for semiconductors in Europe.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Secondary, Vocational, University
Duration	Hours
Place	School
STEM discipline	Mathematics
Approach	Transmissive
Role model	No

Name	HTU
Organisation	STMicroelectronics
Country	France
Description	High Tech U is a 3-day immersion program for 1st-year senior High School students (before choice of specialized curriculum) in companies and universities, to provide them with a fun, interactive experience that exposes them to potential careers in the semiconductor and microelectronics industry. A session will enrol 36 students from 2 high schools and 10+ classes, 50/50 Boys/Girls, reflecting the diversity of the community. Students attend on a voluntary basis, but no requirement to be an "A" student in MST. A typical curriculum will be : - Team Building: Lost on the Moon – demonstrate that a group comes up with better answers than individuals - Math and Measurement: The Statapult – students throw various objects with a catapult and derive abacuses linking throwing distance with the catapult setups. - Atoms and Materials: Matter Matters – including a quiz - Nano Technology: students present to their peers examples of where nanotechnology can be found in everyday elements - Electronics and Gates: Human Calculator – two teams compete on giant mats representing a circuit, each member being a logical gate - Lab visits - Clean room fabrication - Introduction to CAD - Solar module

	- Working in Industry & Educational Pathways – professionals' testimonies - Graduation – parents are invited to attend
Category	Giving accessibility of the company premises to schools/to students
Initiative	STEM industry offers its premises to be visited by students with the possibility of including some activities
Factors addressed	Information about careers and jobs in industry. Social perception of the work related to STEM careers.
Target group	Upper secondary
Duration	Days
Place	Industry
STEM discipline	Physics, Chemistry, Mathematics, Technology, ICT
Approach	Constructivist
Role model	Yes

Name	Multimedia teaching materials for ammonia synthesis
Organisation	BASF
Country	Germany
Description	Multi-media teaching materials for ammonia synthesis. These multi-media teaching materials represent the evolution of the ammonia synthesis, which is considered one of the greatest achievements in chemistry. The material includes information about some scientists who were involved in the synthetic production of ammonia instrumental (Justus von Liebig, Fritz Haber, Carl Bosch, Alwin Mittasch), detailed information on manufacturing processes, current information on the economic importance as well as the products of ammonia be won. The technical challenges in the synthesis are also highlighted. The unit concludes with a learning target control in the form of an online quiz. The core of the material forming the animations (with sound), which represent the process of ammonia synthesis in a total of 6 steps. The animations can be stopped at any time or repeatedly, until declared is actually understood. In parallel with the animation, the information is of course also available in text form and deepened with the corresponding chemical formulas. Target group of this multi-media teaching materials are both teachers and students (high school). Before media can be integrated as easily as possible into the classroom, are available in the download area of the unit all the content in multiple file formats: whether individual animation ppt as a wmv file, photo material as jpg files, scripts as pdf or finished presentation charts as files. From this block box can serve both for the design of teacher education students as well as to prepare a presentation.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials,

	ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Upper secondary
Duration	Hours
Place	School
STEM discipline	Chemistry
Approach	Transmissive
Role model	No

Name	NaWi
Organisation	Wissenfabrik
Country	Germany
Description	NaWi- how science works is a project by which children in elementary school can do their own experiments in the field of air, water, food, recycling, fire and fire security, elements and their characteristics. The school gets the material which is needed for the experiments and a teachers manual. The children can formulate their own questions what will happen during the experiment and describe what they have seen after that. For example the experiment: air-rocket. Children fill a balloon with air. Then they stick a drinking straw to the balloon and put through this straw a string. Two children hold the string and stand about 3-5 meters apart from each other, another child holds the balloon in the middle of the string. Now the question is, in which direction the balloon will fly and why. By this experiment the children learn that air is something and that it can move something.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools STEM industry contributes to update teachers' knowledge about certain STEM-related industrial topic
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Teachers, Primary
Duration	Days
Place	School

STEM discipline	Physics, Chemistry, Life Science
Approach	Constructivist
Role model	No

Name	KiTec
Organisation	Wissenfabrik
Country	Germany
Description	With the project KiTec – Children discover techniques elementary schoolchildren learn about techniques by using wood, tools and other material and for example building a bridge, a tower or a whole city. Before they start they have to organize themselves in groups of 3-5 children and plan what they want to build. The schools get the materials boxes from the member companies of Wissensfabrik which not only sponsor the boxes but where a member of the company trains teachers in the companies region on the project so that it can be used in the classroom.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools STEM industry contributes to update teachers' knowledge about certain STEM-related industrial topic
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Teachers, Primary
Duration	Trimester
Place	School
STEM discipline	Physics, Chemistry, Technology
Approach	Constructivist
Role model	No

Name	Orientation internship
Organisation	Wissenfabrik
Country	Germany

Description	Orientation Internship goal: Backup to junior engineering students. Prospective high school graduates have an opportunity in the form of a Orientation internship 4 weeks during the summer holidays, KSB Mechanical engineering companies as well as specific tasks within the company as 3 Design Engineer o Sales Engineer o Production Engineering o Engineer in procurement and logistics, to know. Program: - Preliminary Gymnasium - Candidates apply at KSB - Selection of a defined number of trainee positions - Use in predetermined locations of the company - Once a week, ½ day - About the Company - Young engineers learn about their career and their role in KSB - Feedback session at the end of the internship and, if necessary aftercare - Pay € 500
Category	Engagement of STEM professionals with students' work
Initiative	STEM industry offers the possibility of an Internship for some students
Factors addressed	Students' engagement in the study of STEM in school. Information about careers and jobs in industry. Awareness of whether the personal characteristics and interests fit with those required for STEM careers. Social perception of the work related to STEM careers.
Target group	Upper secondary
Duration	Weeks
Place	Industry
STEM discipline	Technology, ICT
Approach	Constructivist
Role model	Yes

Name	Erlebe it
Organisation	Wissenfabrik
Country	Germany

Description	"Experiencing it" informs students about training opportunities, courses and internships in the ICT industry and tries to counter the lack of skilled workers to work. "Experiencing it" offers schools the opportunity to request nationwide IT specialists and personnel managers of ICT companies for the school. "Experiencing it" makes the schools offer to meet with companies, and build partnerships with companies in the high-tech industry. We achieve this with the help of "IT-Scouts" that can be used at the school. IT scouts are experienced entrepreneurs or employees of the ICT industry. The concern is to show students the variety of work opportunities, the topic of work and career to make it transparent and to show a realistic, authentic professional image of the ICT industry. The curricula of the schools can be a useful supplement with a strong practical orientation. IT scouts look for the contact with young people in order to facilitate their way into the ICT sector. IT scouts visit schools, learn about industry trends, training opportunities through in-house, about studying in the ICT sector, about jobs and career paths
Category	Establishing personal communication of STEM professionals with students
Initiative	STEM professionals go to schools to give a talk or to establish some dialogue with students about job/academic background
Factors addressed	Information about careers and jobs in industry.
Target group	Upper primary, Secondary, Vocational
Duration	Days
Place	School
STEM discipline	Physics, Chemistry, Technology
Approach	Transmissive
Role model	Yes

Name	From Silicon to Wii
Organisation	STMicroelectronics
Country	Italy
Description	“From Si to Wii” is a one day exhibition that is showing to the students the technology involved in making some applications they enjoy like the Wii. The students have the opportunity to see and touch the material, prototypes and demos that illustrate the selected applications. ST ran an exhibition for a school of 600 students in one day with the support of teachers and parents. This exhibition allows students to connect the scientific knowledge and the micro-sciences with day-to-day life. It increases their motivation to learn about science by using technical gizmos they like and know from a user’s standpoint and take them to the other side of the mirror, the design and elaboration of a prototype.
Category	Giving accessibility of the company premises to schools/to students
Initiative	STEM industry offers its premises to be visited by students with the possibility of including some activities

Factors addressed	Social perception of the work related to STEM careers.
Target group	Primary, Secondary, Vocational
Duration	Day
Place	Other
STEM discipline	Physics, Chemistry, Life Science, Mathematics, Technology, ICT
Approach	Transmissive
Role model	Yes

Name	Robotics Exhibition
Organisation	STMicroelectronics
Country	Italy
Description	"Robotics exhibition" organized by Mondo Digitale is a 3 days-exhibition gathering industrials, schools and labs on the theme of robotics. Students have the opportunity to present their inventions and projects, see and touch the technology and discuss with the engineers of the companies who work around robotic applications. They see videos but also actual demonstrators; they touch prototypes but also finished products. Best students projects participate to a worldwide competition with their robots ST participates actively to such an exhibition in Italy ran (next is scheduled in March 2012) with a booth on which many things can be seen including a video of a common project of ST and a university in Japan. This exhibition allows students to connect the scientific knowledge and the micro-sciences in a fun manner. It gives them an opportunity to exchange with professional on this highly motivating topic which is for some of them a hobby; encourages them to get into more complex programming in order to implement more sophisticated things with the robots they have in their "Clubs of Robotics" at school. ST also sponsors the awards for the National competition of robotics, "Rome Cup".
Category	Engagement of STEM professionals with students' work
Initiative	STEM industry proposes a technological challenge to be surmounted for students
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Primary, Secondary, Vocational
Duration	Days
Place	School
STEM discipline	Technology, Mathematics
Approach	Constructivist
Role model	Yes

Name	Guest lecture
Organisation	Beta Techniek
Country	Netherlands
Description	Interactive presentation by a STEM educated industry worker. Explaining his/her arguments of studying STEM, experience during study period and in present (and past) career path. Underlining that a STEM study is not a single street with half-way a roadblock to swap to other work disciplines. Shows examples of present work + circumstances and gives a glance of his private life (showing that he/she is not a nerd). Students active part: Interactive, could come with brainstorm, quiz and even excursion. Method: Presentation (power point + products if possible) Schoolteachers: Necessarily present. Material: Products, power point presentation. Budget: No additional costs for the school. Preparations for students: None. Didactical: Show the daily “practical” role in work fields as biology, physics, mathematics, chemistry and engineering. Bridge between theory and praxis. Remarks: Easy to organize, guest lectures are trained in basic didactics
Category	Establishing personal communication of STEM professionals with students
Initiative	STEM professionals go to schools to give a talk or to establish some dialogue with students about job/academic Background
Factors addressed	Information about careers and jobs in industry. Social perception of the work related to STEM careers.
Target group	Primary, Secondary, Vocational
Duration	Hour
Place	School
STEM discipline	Physics, Chemistry, Life Science, Mathematics, Technology, ICT
Approach	Transmissive
Role model	Yes

Name	Girlsday
Organisation	Beta Techniek
Country	Netherlands
Description	Girlsday is a European initiative that aims to create inspiration and enthusiasm among young girls for science, technology and ICT. Girlsday takes place yearly on the fourth Thursday of April. At Girlsday, young girls participate in an wide

	range of activities that are held in companies and organizations. They meet role models and learn the insights of working in a technological environment. Students' active part: 80-20 rule. We try to achieve a balance of 20% listening and 80% of doing. Method: Girls (and mothers) are invited. The day starts with an introduction about the company. After that the activities take place with female role models and guided tours. Budget: No additional costs for the school, except maybe the costs for travel. Preparations for students: The teacher decides the time spent on preparation in the class. Didactical: The female role models are crucial in this activity. They show the variety of jobs in STEM, especially for women. Remarks: The VHTO organizes the Girlsday in the Netherlands. Details: Organized on the 4th Thursday of April
Category	Giving accessibility of the company premises to schools/to students
Initiative	STEM industry offers its premises to be visited by students with the possibility of including some activities
Factors addressed	Information about careers and jobs in industry. Awareness of whether the personal characteristics and interests fit with those required for STEM careers. Social perception of the work related to STEM careers.
Target group	Upper primary
Duration	Hours
Place	Industry
STEM discipline	Physics, Chemistry, Life Science, Mathematics, Technology, ICT
Approach	Transmissive
Role model	Yes

Name	Meet the Boss
Organisation	Beta Techniek
Country	Netherlands
Description	Top managers from companies receive students from various per-college schools in their region. They discuss industry and technology with the students. This allows students to think about technological subjects, to form opinions about them and then punt their ideas into word. Preparation in the class in necessary to take active part in the debate. During the debate students are very active. 2 – 4 classes participate in the debate. The contest has several rounds, where

	the students have different roles (judges, opposition, coalition and favours. Schoolteachers: Have an important role in the preparations. Material: Besides a suited conference room, a beamer, microphone and sound. Budget: No additional costs for the school, except maybe the costs for travel. Preparations for students: The student need to prepare because of the several thesis and roles (judges, opposition, coalition and favours). Didactical: Debating skills and awareness of the role of technology in society. Details: To make it a compatible contest, you can organize regional round and a national final.
Category	Establishing personal communication of STEM professionals with students
Initiative	STEM industry offers an expert for a debate with students around topical and controversial subjects
Factors addressed	Students' engagement in the study of STEM in school. Social perception of the work related to STEM careers.
Target group	Upper secondary
Duration	Hours
Place	School & Industry
STEM discipline	Physics, Chemistry, Life Science, Mathematics, Technology, ICT
Approach	Transmissive
Role model	Yes

Name	BluRayDisc
Organisation	Philips
Country	Netherlands
Description	Content: Mixture of maths , optical, mechanics and electronic theory engineered in a DVD player. Physics of laser light and explanation of Hemming correction code. All physics and math theory in booklet. Active part: Decoding data with Hemming code. In NL: changing the mechatronic steering loops controlling the laser beam and predicting/checking the results on PC Monitor) To be replaced for EU SchoolNet by video examples. Method: Own teacher (in NL trained by Philips) or industry engineer. Material: Theory lesson of Philips, worksheets. Budget: No additional costs for the school. Preparations for pupils: Knowledge necessary about electrical current/magnetic power, binary coding and basics about optics Didactical: Inside view how math is used by error free coding. Teach the students that a combination of several engineering disciplines is necessary for a product

	development. Multi disciplined working in the industry: team work working with people. Remark: In revision of autumn 2011, align the theory material in a way that the enlarged scale model is not necessary to have available in the classroom.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Vocational
Duration	Days
Place	School
STEM discipline	Physics, Chemistry, Mathematics, Technology, ICT
Approach	Transmissive
Role model	No

Name	E-Dice
Organisation	Philips
Country	Netherlands
Description	Content: Multi level approach possible. Package contains 25 set with electronic material to understand/build/test an electronic dice. Intended as appetizer for electronic technology but can be extended with explanation of functional electronic parts and principles of binary coding. Some school have added an extra dimension by letting the student design/make a housing. Even math lessons (arithmetic models) find inspiration in this product: How many can you sell for which price and what your profit Active part: Solder and test dice, design main switch and housing Method: Depending on teacher (focus on theory or on praxis). School teachers Present for guidance and instructions Material: Available against cost price, approx 100,- per 25 pieces Budget: Costs for the school: package + soldering tin and equipment Preparations for pupils: None Didactical: Bringing the work of an electronic designer closer to pupils. Electronic engineering and testing in practice, maths theory (fairness proof) and the basics of digital coding.

	Remark: Package price in NL include theory booklet (€75,-) but are sold lower than cost price , subsidized by Philips and Platform Beta Techniek.(CSR)
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Upper primary, Lower secondary
Duration	Days
Place	School
STEM discipline	Physics, Chemistry, Mathematics, Technology, ICT
Approach	Transmissive
Role model	No

Name	Streetlighting
Organisation	Philips
Country	Netherlands
Description	Content: Calculate illumination level and power costs for street lighting. Assignment for an individual student (2hrs) followed by a teamwork assignment (1hrs) on the computer. Active part: Spreadsheet manipulation (excel). Method: Students work in twins due to hands-on part (tests with light variations). School teachers Present for guidance and instructions, no guest teachers. Material: Downloadable on website of Jet-Net Budget: None Preparations for pupils: none Didactical: Lesson made by didactical external experts, level and validity again checked in 2010 and found ok. This lesson can be found entirely on the Jet-Net Dutch website: http://www.jet-net.nl/?pid=189
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools

Factors addressed	Students' engagement in the study of STEM in school.
Target group	Upper secondary
Duration	Days
Place	School
STEM discipline	Physics, Chemistry, Mathematics, Technology, ICT
Approach	Transmissive
Role model	No

Name	Energy!
Organisation	Shell
Country	Netherlands
Description	ENERGY! is a teaching method developed and produced by Twinstone – Educatie in the framework of Jet-Net under the authority of Shell. ENERGY! consists of two lessons and a homework activity around energy and climate: two well-known but yet rather unknown subjects. ENERGY! causes the students to get amazed and shows them that many things enter into energy & climate. This education material is to enlarge the involvement and passion of the students regarding energy & climate and to stimulate them to work on this later on (e.g. via a follow-up education involving STEM) The education material comprises: a. 1st lesson: a power point presentation, to be presented by the teacher, and a film introduction. This lesson gives the student a bit of a 'fright' by showing what is of importance in the area of energy. And that is more than we would expect. Also underlined: the complexity and choices to be made involved in the increasing demand of energy. Furthermore, the relationship between fossil and new energy is demonstrated. b. Homework activity (working folder), with questions for the student that make him/her think about the energy aspect in his/her own life. c. 2nd lesson: "Yes we can": Showing technical improvements and new technologies. The aim is to rouse, to inspire and to inform about the latest developments in the Netherlands and world-wide. It is shown what is being done to organize the everyday surroundings and energy consumption in a different way. It is much, diverse, unknown, broadening one's horizon, problem solving and exciting. Also this lesson contains a power point presentation, to be presented by the teacher, and a film introduction d. Teachers' manual, guiding the teacher through the presentations. In addition, it gives back-ground information per slide and answers to questions brought up during the presentations and from the homework activity.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)

Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Upper secondary
Duration	Days
Place	School
STEM discipline	Physics, Chemistry, Life Science, Technology, ICT
Approach	Transmissive
Role model	No

Name	Its all aboot Energy
Organisation	Shell
Country	Netherlands
Description	The material covers three main subjects (chapters): Energy scenarios, Exploration & Production of oil/gas and the CO2 issue. The teaching material is modular and contains 13 modules divided over the 3 chapters. The teaching material is aiming at awakening to the energy challenge. Chapter 1: The future of energy (An introduction; using energy scenarios a gloomy picture but also an optimistic picture of the future is made) Chapter 2. Exploration and production of oil/gas (origin of oil; how is it found; how do we extract and produce it from the earth?; the future of oil. Chapter 3. Solutions for the CO2 issue (CO2 emissions, climate effects, carbon capture storage (CCS) A teachers manual is delivered comprising: 1. A justification of the teaching material 2. A summary 3. Model answers to the questions of the three chapters
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Students' engagement in the study of STEM in school.

Target group	Lower secondary
Duration	Days
Place	School
STEM discipline	Physics, Chemistry, Life Science, Technology, ICT
Approach	Transmissive
Role model	No

Name	Analytical Techniques
Organisation	Shell
Country	Netherlands
Description	Content: Workshop / guest lesson given by industrial experts (role models) explaining the various analytical techniques and an exercise applying them in a realistic case. Pupils active part: The case puts the student in the role of trainee at a analytical laboratory. He/she discovers a pollution in a Rhine water sample: 1. Explanation on how the pollution was discovered (sample treatment and first indicative analyses (Extraction, HPLC, Massa Spectroscopy and NMR) 2. Exercise 1: What is the pollution? Gaining knowledge/data of the products of the five companies along the river + spectroscopic information 3. Exercise 2: Again, what is the pollution? Now only using NMR. 4. Final exercise: Which company caused the pollution? How much was spilled? What should be he fine? Information is given about the properties of the flowing river, geographic positions of the industrial companies etc. Method: Students are introduced into the analytical groups within Shell worldwide. They get a step-by-step introduction on the various analytical techniques. Subsequently they are working in groups on the exercises. The workshop is normally lead by two company experts (role models) assisted by a teacher. School teachers: Presence of 1 teacher is obliged Material: Materials are provided by the company experts. At school: presence of analytical equipment is not needed. Budget: Reproduction of paperwork, reader and spectrograms. Preparations for pupils: Students have already knowledge of Massa Spectroscopy and not of NMR. Didactical: Getting acquainted with the various analytical analysis techniques and their application in real practice. In NL this workshop matter is part of the exam syllabus. Remarks: None Details: Education material is in the Dutch language
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials,

	ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Students' engagement in the study of STEM in school. Information about careers and jobs in industry. Awareness of whether the personal characteristics and interests fit with those required for STEM careers.
Target group	Upper secondary
Duration	Weeks
Place	School & Industry
STEM discipline	Physics, Chemistry, Life Science, Mathematics, Technology, ICT
Approach	Transmissive
Role model	Yes

Name	TeachFirst
Organisation	Shell
Country	Netherlands
Description	The TeachFirst Nederland programme (Eerst de Klas - EDK) is an initiative involving the education sector, the business community and the national government. It is being implemented to respond to various needs, including the need for more and better teachers, as well as the need for more and better leaders. The programme offers excellent students the opportunity to teach at a secondary school and complete a teacher training programme (trainee teacher) four days a week and to take part in a leadership programme one day a week.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry contributes to update teachers' knowledge about certain STEM-related industrial topic
Factors addressed	-
Target group	Teachers
Duration	-
Place	Industry
STEM discipline	-

Approach	-
Role model	Yes

Name	Educared
Organisation	Telefonica
Country	Spain
Description	The Educared International Award for educational innovation is a project promoted by the Telefonica Foundation http://www.educared.org/premiointernacional - Objectives: The aim of the initiative is to award the work of teachers that integrate technologies in the learning activities of the classroom. - Categories: collaborative projects between teachers, projects with teachers and students, collaborative projects between teachers from different countries, projects that use cellular technology, projects for students with disabilities, technological tools developed by teachers to be used In the classroom. - Some examples of the types of projects awarded: augmented reality, blogs, social networks, geocalization, etc. - Scope: Spain and Latin America - History: 12 editions so far. - Participation: 3.826 teachers and 9.906 students.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry contributes to update teachers' knowledge about certain STEM-related industrial topic
Factors addressed	-
Target group	Teachers
Duration	-
Place	School
STEM discipline	-
Approach	-
Role model	No

Name	Tech Scouts
Organisation	Teknikföretagen
Country	Sweden
Description	Tech Scouts: a program to stimulate and enhance technology for students ages 10-12 as well as their teachers. Each semester 3-5 young engineers are hired as tech scouts to travel around to schools all over Sweden. Their task is to perform an exciting and stimulating 90-minute technology lesson as well as give a lesson to teachers in the area. In practice this means that the tech scouts give two 90-minute lessons per day, plus 1-2 teacher sessions per week each city they visit. The lessons are based on the curriculum of technology in middle school but are enhanced with games, experiments and a lot of creative activities to get the children to "see" and understand the role of technology in society. An important role of the tech scouts is also to tell their own stories to the students and the teachers, thereby posing as real live role models. With their own interesting stories about school, graduate school, etc, they are serving as positive and visible examples of STEM-careers. The tech scouts program has an annual budget of approx 1 million Euro, paid in full by the Swedish Association of Engineering Industry. Hereby the program is backed by the 3500 industrial companies that are members of the Association.
Category	Establishing personal communication of STEM professionals with students
Initiative	STEM professionals go to schools to give a talk or to establish some dialogue with students about job/academic background STEM professionals go to schools to give a talk or to establish some dialogue with students around industrial applications
Factors addressed	Information about careers and jobs in industry. Awareness of whether the personal characteristics and interests fit with those required for STEM careers.
Target group	Teachers, Primary
Duration	Hours
Place	School
STEM discipline	Physics, Chemistry, Mathematics, Technology
Approach	Constructivist
Role model	Yes

Name	Annual Chemistry Day
Organisation	Teknikföretagen
Country	Sweden
Description	The Annual Chemistry day is organized every year to highlight the importance of chemistry in our society as well as the possibilities of careers in the plastic and

	chemical industry. Each year a new chemical experiment kit is put together by the association, with help and support by Sweden's Science Centres. These kits are aimed for class room teaching, mainly pupils ages 10-13. Information is spread to schools and teachers can order kits for their class. 4500 kits where distributed last year - reaching over 100 000 pupils. Although this kit only last for one day - it has an impact on the students. The experiment-kits enhance the classroom teaching.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Primary
Duration	Hours
Place	School
STEM discipline	Physics, Chemistry, Life Science
Approach	Transmissive
Role model	Yes

Name	Matena
Organisation	Teknikföretagen
Country	Sweden
Description	Matena is a national teacher training program based on teacher interactions with technology oriented companies. The program is composed of various activities in collaboration with local tech companies as well as seminars and workshops. The program is set up on a municipal level. A Matena coordinator, often a teacher in math, science and/or technology is assigned to lead the training program. The group of teachers, mainly teaching grades 5-9, meet once per month. Besides visiting and preparing for specific company visits, the teachers are also taught new practical and theoretical ways of teaching math, science and technology. The content of the Matena teacher training program has been developed by pedagogic researchers together with the top technology teachers in the country. Matena is mainly a program for teachers already teaching math, science, technology, but it can be open for other types of teachers to enhance collaboration. The tech companies collaborating with Matena are very supportive - they love to teach the teachers and find it much more rewarding to interact with teachers compared to having kids running around.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry contributes to update teachers' knowledge about certain STEM-

	related industrial topic
Factors addressed	-
Target group	Teachers
Duration	-
Place	Industry
STEM discipline	Physics, Chemistry, Life Science, Technology, ICT
Approach	Constructivist
Role model	Yes

Name	Technology Leap
Organisation	Volvo
Country	Sweden
Description	Teknikspråget (Technology Leap): All graduates from STEM programs in high school will via Technology Leap be offered a four-month internship at a Swedish technology-intensive company. Volvo Group will offer 50 graduates the possibility to do an internship during Autumn 2012. The purpose with this initiative is to increase the interest for the engineering field.
Category	Engagement of STEM professionals with students' work
Initiative	STEM industry offers the possibility of an Internship for some students
Factors addressed	Students' engagement in the study of STEM in school. Information about careers and jobs in industry. Awareness of whether the personal characteristics and interests fit with those required for STEM careers. Social perception of the work related to STEM careers.
Target group	Vocational students
Duration	Trimester
Place	Industry
STEM discipline	Physics, Chemistry, Life Science, Technology, ICT
Approach	Constructivist
Role model	Yes

Name	Strong Truck
Organisation	Volvo
Country	Sweden
Description	In this practice, your challenge is to manoeuvre Volvo's FH16 700 all the way to finish with a combination of power, precision and balance. If you don't drive smartly and safely you will lose your precious load and get loads of minus points.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Upper primary
Duration	Hours
Place	School
STEM discipline	Mathematics, Technology
Approach	Transmissive
Role model	No

Name	Deforestaction: web page
Organisation	Microsoft
Country	USA
Description	The overall pedagogical aims and objectives of DeforestACTION are to: - Collaborate on a global platform to solve global problems. - Review and evaluate the causes, impacts and politics of deforestation at the local - and global level. - Analyze, using deforestation as an example, how to plan and organize for global issues - Using collaborative technology. - Prepare action plans by engaging in interactive activities and taking part in valuable discussions with peers and mentors.
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials,

	ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Students' engagement in the study of STEM in school. Social perception of the work related to STEM careers.
Target group	Primary, Secondary
Duration	Hours
Place	School
STEM discipline	Physics, Chemistry, Life Science, Technology, ICT
Approach	Transmissive
Role model	No

Name	Mathematical tools
Organisation	Intel
Country	USA
Description	This practice is composed of two resources, providing a range of tools designed to assist students in improving their mathematical skills. The Sprint Tool with its interactive capabilities enables students to explore the concepts of time, distance and speed. The Maths Tool includes four (4) different sub-tools covering: • 2-D shapes • Coordinates and graphing • Charting online • Numberline online
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Upper primary, Lower secondary
Duration	Hours
Place	School
STEM discipline	Mathematics

Approach	Transmissive
Role model	No

Name	Sensor adventure
Organisation	Intel
Country	USA
Description	Each mission involves a series of three science experiments which are designed to enhance students' understanding of various science principles. These experiments are conducted in such a way as to promote investigative thinking, and are based on the correct selection of a number of sensor technologies. These are presented in various real-world scenarios. Students are encouraged to experiment using various sensors and are required to select the best sensor for the task in hand. The following virtual sensors are used in the Adventure: • Temperature • Soil moisture • Infra-red light thermometer • Light • Wind
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Upper primary, Lower secondary
Duration	Hours
Place	School
STEM discipline	Physics, Chemistry, Life Sciences
Approach	Transmissive
Role model	No

Name	Skoool Football
Organisation	Intel

Country	USA
Description	Skoool football contains a range of exciting and engaging teaching and learning activities designed to improve Maths and Science skills. Skoool™ football activities are embedded in two main modules: • Develop Your Team – focuses on getting the players healthy, fit and ready for the game • Play Football – activities embedded in the actual playing of the game: speed, angles, velocity
Category	Putting at schools disposal resources to promote the improvement of scientific or technological knowledge potentially related to the company (materials, ambassadors, courses, etc.)
Initiative	STEM industry collaborates in the design and elaboration of material to be used as a support for schools
Factors addressed	Students' engagement in the study of STEM in school.
Target group	Upper primary, Lower secondary
Duration	Hours
Place	School
STEM discipline	Life Sciences, Mathematics
Approach	Transmissive
Role model	No

Annex III.

Success stories: organizations linking school and industry.

a) Public-private organizations

Platform Bèta Techniek (The Netherlands)

Establishment / creation of the organisation

Year of creation: 2004

Motivations: In 2004, the Netherlands formulated their ambition to become a prominent knowledge economy, a leader in the areas of education, research and innovation in the Deltaplan Science and Technology. For the strategy to be followed, a national Platform (Platform BètaTechniek) was set up, commissioned by the government, education and business sectors to ensure sufficient availability of people who have a background in scientific or technical education.

A part of the approach was to promote the intake into and graduation from STEM programmes, with the aim of increasing the number of STEM graduates by 15% in 2010 compared to 2000.

The approach, which was a chain policy specially focused on the "links in the chain" (i.e. the junctions between different types of education and between education and the labour market), consisted of four interrelated points of focus:

1. Attractive Education (making education in STEM more attractive and reducing the number of students dropping out of education).
2. Attractive Jobs (providing attractive jobs with future prospects). This point was
3. Attractive Choices (giving extra measures to persuade young people to make a positive choice for STEM, closely co-ordinated with the previous two points of focus.).
4. Attractive Settlement (attracting and keeping knowledge workers from foreign countries).

With this Delta plan, in addition to making an analysis of the shortages in knowledge workers, a framework for an integral approach to these shortages was also provided.

Promoters: The Dutch Government. Background: the National Platform AXIS settled by the government – Ministries of Education, Culture and Science (OCW) and Economic Affairs (EZ)–.

Funding of the organisation

The Dutch Government has empowered this platform by allocating a vast investment in its programmes, and the investment has been gradually growing, reaching 60 million Euros per year.

Involvement of private companies in the organisation

In order to address one of the four main points of the Delta plan approach which is focused on Attractive Jobs, private companies are actively involved in this national strategy through employer engagement activities. There is a high interrelation between all the programmes promoted by the Platform BètaTechniek, and the contribution of Jet-Net companies, as part of the bigger picture, represents an enhancement effect of the overall strategy (75% of schools which collaborate with Jet-Net also participate in other programmes of the Platform BètaTechnkiek).

Types of actions carried out by the organisation according the target group addressed

Educational Chain approach (from primary to higher education):

Primary education/Elementary

VTB Programme (Broadening Technical Education in Primary Education) – designed to help primary schools integrate science and technology in to their teaching. During a three-year period, schools receive financial, organisational and subject-specific support to put this into practice in their own way.

VTB-Pro Programme – provides teachers (and prospective teachers) with training and guidance on how to integrate science and technology into their lessons to deepen their knowledge and become competent in the fields of science and technology for primary education.

Curious Mind Programme – aimed at finding ways to map, preserve and developed talented young children, so as to prevent them from withering away.

Secondary education (havo and vwo)

Universum Programme – helps science & technology oriented schools (havo–higher secondary education– and vwo–pre-university secondary education–) to pursue their own technical aspirations and educational ambitions. The Universum Programme is working closely with Jet-Net, a joint venture of larger Dutch companies and pre-college schools in the Netherlands. Jet-Net companies help schools to improve the appeal of their science curriculum and to allow people to gain a better understanding of their future career prospects in industry and technology.

Through the teacher upgrading programme Dudoc, secondary teachers can combine their teaching with academic research regarding didactical innovations of STEM subjects.

Vocational education (vmbo and mbo)

Ambition Programme – aligning the educational offerings of VMBO-schools (pre-vocational education) and MBO (intermediate vocational education) participating in the programme with young people's preferences and the labour market demands. Attractive education programmes, which are characterised by strong collaborations with other organisations, are offered for both VMBO and MBO.

Higher education (hbo and wo)

Sprint Programme – focused on universities and higher vocational institutions with science and technology courses, this program supports and stimulates the building of regional partnerships aimed at covering the entire education path and the strengthening of the ties between higher education and businesses (linking up with the key areas or sectors of the Innovation Platform).

Through the mobility programme Sprint-Up, secondary and higher education are exchanged in a regional context through pre-existing networks of secondary schools and universities.

Relation Education and job market

Programmes of innovation are formulated for those sectors in which the Dutch knowledge and industry flourishes and where chances are greatest to reinforce the competitive position of The Netherlands. To stimulate these innovation programmes, the Platform BètaTechniek has introduced the concept of Human Capital Roadmaps: an in depth analysis of the sector-specific shortages on the labour market linked to a long-term plan on attracting and retain people in the sector.

Scope of the actions

The Platform approach is developed at National level, and its mission of increasing in 15% the number of graduates that arrive on the labour market in The Netherlands is translated to the different educational level schools. In this sense, the Platform does not revolve around project plans or subsidize projects, but participating schools and institutes earn their grants by successfully innovating their STEM-education resulting in more youngsters choosing STEM. The formulated ambitions (of schools and institutions) form the foundation for the performance-innovation-agreements. The grants are conditional on reaching their own set ambitions and goals, and schools and institutes are free to use the grant for anything they feel is appropriate or useful.

Impact assessment and results

In the performance-innovation agreement the schools agree to participate in a system of monitoring and auditing, both to:

- establish whether the ambitions and goals are reached
- learn from the chosen innovations

Each year external experts visit the participating schools and institutes (to audit) and interview management, teachers and students on the innovations and results.

The Platform then uses the outcomes of the system of monitoring and auditing to decide whether schools and institutions can continue in the programme and/or earn their grant for the year.

An extensive network analysis study has shown that the networks between higher education and secondary education (mostly regional) and between secondary and primary education (mostly local) are growing fast. On a large scale innovation in educational content and didactics are designed and implemented, and the knowledge on what works and what doesn't is increasing.

Other important remarks

The Platform BètaTechniek follows an integral approach: one organisation, working throughout the whole educational chain, in close relation and collaboration with the schools and institutions, using an innovative model of change.

An organisation like BètaTechniek has a lot of schools involved, which allow having a monitoring system in order to collect results from which recipes of the right ingredients for a good practice can be obtained.

The main added value of the existence of this Platform is that, since all schools participate, it is possible to prove which the routes to success are (business based evidence).

More info:

Platform BètaTechniek – A European Good Practice in search of exposure and cooperation

http://cms3.dynaweb.nl/users/platform_summit2010_en//docs/Publications/platformaneuropeangoodpractice2009.pdf

Delta plan science & technology. Action plan for tackling the shortage of scientists and engineers

http://www.platformbetatechniek.nl/publicaties.html/publication/8-deltaplan-b-ta-techniek/title/deltaplan

b) Public organizations

STEMNet (United Kingdom)

Establishment / creation of the organisation

Year of creation: 2006

Motivations: STEMNET aims to be a recognised leader in enabling all young people to achieve their potential in STEM by ensuring that all young people, regardless of background, are encouraged to understand the excitement and importance of science, technology, engineering and mathematics in their lives, and the career opportunities to which the STEM subjects can lead.

Promoters:Department for Business, Innovation, and Skills (BIS), the Department for Education and The Gatsby Charitable Foundation.

Funding of the organisation

STEMNET gets funding and support from the central government -Department for Business, Innovation, and Skills (BIS) and Department for Education-, although it was originally set up with funding from The Gatsby Charitable Foundation.

Involvement of private companies in the organisation

Employers can help schools and colleges bring STEM to life for students through involvement in classroom projects, talks, visits, work placements or helping with STEM Clubs.

STEMNET works with thousands of UK employers to inspire young people in STEM, helping them to spread the word about how they value STEM skills, and to demonstrate how “cutting-edge” STEM is being used in the world around us.

Over 3,000 employers, from large and small companies, are already involved through the STEM Ambassadors Programme, with many more supporting STEM in other ways.

Employers value the STEM Ambassadors Programme, first and foremost for the support it offers to schools and colleges, but also for the opportunities it gives to employees to develop their own skills. STEM employers are also key to STEMNET’s other activities – developing the STEM Clubs Network, providing the STEM Challenges for London 2012, and encouraging better partnership working across STEM E&E as a whole.

Employers can contact STEMNET for free advice on how best to link with schools, and assistance in making these links happen. They can also obtain guidance on getting involved in STEM E&E including:

- The case for businesses getting involved
- How to achieve impact
- Which existing activities may meet their requirements
- What gaps exist
- How employers can best contribute

Types of actions carried out by the organisation according the target group addressed

STEMNET works principally with schools and colleges, helping young people and their teachers access a

range of STEM Enhancement & Enrichment (E&E) opportunities including STEM Clubs, links with STEM Ambassadors and activities featured in the STEM Directories.

STEM E&E provides contexts for learning, bringing people with STEM skills and support activities into the classroom. Teachers can contact STEMNET for free advice on STEM E&E, and assistance in identifying what STEM E&E can most benefit them and their students.

STEM Ambassadors Programme: enables young people, teachers and schools to interact with thousands of people working in any area of STEM (marine biology, transport engineering, cytogenetics, medical physics, statistics, financial modelling, architecture and aerospace engineering, among others).

More than 29,000 people have volunteered through the STEM Ambassadors Programme since it was established in 2002.

STEM*Networking:* is a new web-based platform launched by STEMNET which enables schools and colleges, Ambassadors, employers and other partners to understand better what they can gain from working with STEMNET, share information more easily and help boost our collective impact in STEM.

Individual teachers, Ambassadors, employers and other partners are able to post their questions, offers of help, information about what they can offer and suggestions for how to improve the programme.

STEM Clubs Network: launched in 2009, coordinated by STEMNET and funded by the Department of Education, the STEM Clubs Network provides schools with ideas, resources and links to enable them to set up a club, or continue to run an existing club. Clubs allow students to explore, investigate and discover STEM subjects in a fun, stimulating learning environment away from the constraints of the school timetable.

As Network Members, schools and colleges have access to a range of support including:

- Exclusive access to special features on the Network website
- Guidance on how to set-up and run a Club
- Sharing of resources
- Project ideas and experiences
- Access to free of charge Continuous Professional Development for teachers and others involved in running the Club.

Employability Skills Guide: during summer 2009, STEMNET worked with some of the UK's leading companies on an "Employability Skills Guide", helping explain to young people what "employability skills" potential employers are looking for and how they might be able to demonstrate them. The guide was well received and distributed to young people through many channels including the Association for Careers Education and Guidance (ACEG), various teachers' subject associations and websites.

Schools STEM advisory network: STEMNET advised more than 90% of secondary schools and colleges in UK during 2009/10.

Scope of the actions

By working with local experts, STEMNET can provide tailored advice and assistance quickly and easily to schools and colleges across the UK.

As part of the STEM Cohesion programme, STEMNET works closely with the Network of Science Learning Centres, the National Centre for Excellence in the Teaching of Mathematics, the Royal Academy of Engineering, SCORE, ACME and the National STEM Centre to ensure that efforts are coordinated wherever possible.

More info

http://www.stemnet.org.uk/uploads/D1305213338.pdf

http://www.stemnet.org.uk/uploads/D1288607038.pdf

http://www.stemnet.org.uk/assets/files/STEMNET-support-for-BIS-Plan-for-Growth.pdf

c) Private organizations

NVHUS (Denmark)

Establishment / creation of the organisation

Year of creation: 2006

Motivation: NVHUS was born from the wish of two school's principals, one from a high school and the other from an elementary school, to build a science centre that could be used by the students of both schools. The reason for its establishment was de declining interest in science among children and adolescents and the lack of young people in Denmark following scientific and technical disciplines.

Promoters: NVHUS was created in cooperation between public and private actors, with a first investment from the Municipality and several founding companies:

- Viborg Municipality 17,886,920 DKK
- Realdania 18,800,000 DKK
- Poul Due Jensen Foundation 17,500,000 DKK
- Nordea Foundation 1,800,000 DKK
- Industry Foundation 1,500,000 DKK
- Otto Monsteds Fund 50,000 DKK

Funding of the organisation

NVHUS is a NGO organisation, and it is funded by the projects it works on.

Involvement of private companies in the organisation

Different industries are actively involved in projects on School-Industry partnerships such as NatPlus, C.A.S.E., etc.

Types of actions carried out by the organisation according the target group addressed

Projects in NVHUS:NVHUS is a project manager on a number of projects dealing with various issues related to the development of more interesting-generating science education with all that implies in terms of new methods, new materials and new forms of cooperation, both within and outside the school.

NVHUS prepares project proposals in close cooperation with teachers and facilitates a transformation of ideas for good, relevant and achievable projects. The investigative work can concentrate on more of the following elements:

- Course content and organization
- Selection of teaching materials

- Methods for the involvement of business and informal learning environments
- Teacher qualifications and motivation for science
- A framework for teaching (local and municipal)
- Physical framework for teaching
- Natural Vocational culture at the school / high school
- Pupils' qualifications and motivation for science
- Parental interest and support, especially in science

Technology in the classroom: (for primary schools) NVHUS offers school classes different modules of 3-4 modules in which they have the opportunity to work with the engineering part of the natural Sciences.

Educational Day: NVHUS facilitates a day of collaboration, including practical exercises, presentations, group work and discussions on topics of their choice:

- Innovation and creativity
- Entrepreneurship in education
- Business cooperation – how to make it so it works?
- Shared values
- Culture – today and how we can consciously work with it?
- Team collaboration
- How do we achieve the goals we set for ourselves?
- Nature Professional Development = school development – why and how?

D Day for Science Team: addressed to science teams at schools, a D day in the House of Natural Science is offered for Professional Development in the following areas:

- Working methods in science education
- Data logging
- Cooperation between geography, biology and physics/chemistry
- The common thread in science subjects
- Problem-oriented teaching
- Innovation in science education

Space Adventure Race: addressed to secondary schools, it is an exciting, interdisciplinary teaching about space where students have to undergo astronaut training, which offers both science, technology and practical challenges. Space Adventure Race is organized so that it covers part of the curriculum in the science subjects in secondary-school level.

School camp in NVHUS: in cooperation with the Energy Museum and Nature School in Viborg, NVHUS offers a concept for camp with natural academic content for local schools

Science Marathon: NVHUS disseminates this innovative educational initiative for nature and technology education in primary schools and vocational schools in Denmark. Science Marathon is the country's largest science competition, and includes an introduction course for teachers and students, a 10-week prepare detailed period in which students work with 10 open tasks, and a final competition day. It allows students to apply science in the classroom rather than just learn about it, and at the same time, work is creative and results-oriented subjects, which greatly appeals to students.

Scope of the actions

NVHUS runs projects at national, regional and at local level.

In the frame of the NTS Centre, (a centre focused on coordinating activities regarding STEM education promoted and funded by the Danish Government), NVHUS is in charge of the School-Industry

partnerships.

Impact assessment and results

The projects are implemented with research association to ensure quality.

Danish Science Communication (Denmark)

Establishment / creation of the organisation

Year of creation: 2001

Motivations: to engage children and young people in science.

Promoters: Ministry of Education and Ministry of Science, Innovation and Higher Education

Funding of the organisation

DSC is funded through government grants, fundraising and projects.

Involvement of private companies in the organisation

The Confederation of Danish Industry is represented in the board. Various companies are involved in our activities as sponsors, co-organisers and -creators, speakers etc.

Types of actions carried out by the organisation according the target group addressed

The mission of DSC is to stimulate enthusiasm for science among children and teenagers (literacy + recruitment). It is an innovative and creative project organisation working with development projects in schools and upper secondary education, whose goals are:

- To inspire teachers and communicators in their work with children and young people within the educational system.
- To create synergy between various initiatives.
- To find new ways to engage children and young people in science.

Activities for a broad audience:

Danish Science Week: a nationwide annual campaign with activities for schools and upper secondary education programmes. Among the offers for schools from the Danish Science Festival are inspiration and the opportunity to seek financial support for local school company cooperation.

Young Scientists: annual competition for primary schools (Young Researchers – Junior) and secondary schools (Young Researchers – Senior) especially focused on science talents. Companies are involved as sponsors and are invited to formulate business challenges for the young scientists.

ISI 2015: a six-year project (2009-2015), carried out in five multicultural schools in Odense, whose main elements are the training of teachers, school cooperation with society and industry, annual exhibitions and networking activities. The aim of the project is to improve skills in science subjects among young people from multicultural schools and thereby encourage more people to choose a natural academic, secondary school.

The project is collaboration between Industry Foundation, Odense Municipality and the Danish Science Communication, and is evaluated regularly by the University of Copenhagen, Department of Science

Education.

Scope of the actions

DSC runs projects at national, regional and local level in order to promote enthusiasm for science.

Impact assessment and results

Users and participants in the above activities are invited to evaluate them and a report is produced for the sponsors. The activities are considered to be so wide that no specific impact assessments have been conducted.

As an example of impact assessment of the activities of Danish Science Communication it can be mentioned, that the Danish report on TIMSS 2011 (http://edu.au.dk/timss/ - in Danish) has a specific chapter about the results of the project Danish Science Municipalities (http://www.formidling.dk/sw53745.asp).

Other important remarks

The organisation develops a capacity of understanding schools and industry, which makes it able to establish sustainable structures and cultures stimulating local school-industry partnerships.

Wissensfabrik (Germany)

Establishment / creation of the organisation

Year of creation:2005

Motivations: take action in the context of demographic change and shortage of skilled personnel, foster competencies relevant to tackle future challenges

Promoters: Dr. Hambrecht (BASF), Mr. Fehrenbach (Bosch), Prof. Kormann (Voith), Prof. Leibinger (TRUMPF) and others.

Funding of the organisation

Member companies of Wissensfabrik, which must be based in Germany, pay the membership fee according to the turnover of the company (from 1,000 € to 100,000 €). Moreover, the company must be engaged within Wissensfabrik.

Although it is privately funded, there is a dialogue with the Government.

Involvement of private companies in the organisation

108 Member companies of Wissensfabrik (by 2012)

Types of actions carried out by the organisation according the target group addressed

The main target group are kindergartens, day care centres and primary schools, and recently started to address secondary school as well. The main fields of action are Education and Entrepreneurship:

Support of education system through all age groups in the following areas:

- Basic competencies (reading, writing, calculating)
- STEM
- Entrepreneurship education

Support of start-ups through mentoring programmes and a start-up competition called WECONOMY.

Companies build up partnerships with kindergartens/schools in their regions or with start-ups as mentors.

The portfolio in the field of education includes:

Lighthouse projects:

- Projects in the field of reading and writing, entrepreneurship education and STEM. Examples:
  - KiTec – Kids discover technology
    - Scientific partner: ZNL, Ulm (brain research) and Institute for teaching technology, University of Dortmund.
    - Target group: primary schools, 5th and 6th grade
    - Content: encourage basic technical understanding and skills by doing construction work in small teams, and building technology, electrical engineering, vehicle engineering.
    - Costs: 750 € (material – 150 € further material) + 600 € (training)
    - Time required (per 10 schools): 10% - 15% FTE for 3-4 months
    - Project content: Kit developed for a group of 30 kids, teachers manual, and 3-day training for company representatives followed by teacher training.
  - NaWi – Kids discover natural sciences
    - Scientific partner: Institute for teaching chemistry, Univ. Frankfurt
    - Target group: primary schools
    - Contents: 36 experiments, topics: water, air, food
    - Costs: 200 € (kit for experiments) + 300 € (training)
    - Time required (per 10 schools): 10% - 15% FTE for 3-4 months
  - KIEWIS – Kids discover business?
    - Scientific partner: Institute for teaching economics, Univ. Duisburg/Essen
    - Target group: primary schools
    - Content: Elementary school children learn business the hands-on way by creating their own product from scratch, including design, planning, modelling, and production.
    - Costs: depends on the product
    - Time required (per 2 schools): 15% FTE for 3-4 months
- Scientifically substantiated
- Didactically thought through
- Directly integrated in the curriculum
- Focus on primary and secondary schools
- Project costs: 60 € - 1,500 €

Pool of ideas:

- Projects of member companies
- About 300 projects for different age groups and on different topics

Scope of the actions

Member companies of Wissensfabrik become actively involved in their regions by establishing partnerships to implement Wissensfabrik projects, which are developed with scientific partners and evaluated.

2,400 partnerships with schools, 10,000 teachers trained and 600,000 children reached (by 2012).

Impact assessment and results

Short-term and long-term Evaluation on a regular basis ensures the positive impact on education in the field of stem and also in school industry partnerships.

Other important remarks

Due to private funding Wissensfabrik can act independently, hence the projects are close to the pulse of time.

Jet-Net (The Netherlands)

Establishment / creation of the organisation

Year of creation: 2002

Motivations: The main purpose of Jet-Net is to assist secondary schools in making science subjects more appealing to students aged 12-18, and to clarify future career prospects in the industry.

The immediate objective is to substantially increase student enrolment in higher science and technical education.

Promoters: Jet-Net (Youth and Technology Network Netherlands) was set up as a joint initiative of Industry, Education and the Dutch government.

Funding of the organisation

Budget Jet-Net € 6.750.000:

1. Manpower € 6.000.000
2. Platform BètaTechniek € 500.000
3. Fee Jet-Net companies € 250.000

Involvement of private companies in the organisation

Jet-Net companies help schools enhance the appeal of their science curriculum by using a great variety of activities and also allow students to gain a better understanding of their future career prospects in industry and technology.

Jet-Net participants represent the major part of Dutch industry, covering a wide variety of industry and technology sectors such as petrochemicals, defence, food, ICT, metals, electronics and instrumentation.

Types of actions carried out by the organisation according the target group addressed

Jet-Net companies organize a wide variety of programmes for students attending higher-general secondary (havo) and pre-university (vwo) education schools, as well as for teachers.

Regarding the actions that are imbedded in schools, Jet-Net activities are designed to be compatible with, and enrich, schools' curriculum, and to include Role Models (especially women).

Jet-Net participants offer a broad range of inputs which constitute the main ingredients of tailormade programmes set up jointly with schools:

- General introduction and familiarization (company excursions, presentations)
- Subject support (assistance to teachers in specific parts of the curriculum)
- Career orientation support (assistance to students in their individual choices).

Students support offered can be both in classroom and in one-on-one guidance.

Companies organize regular teacher workshops to allow for feedback and further familiarization on both sides with the possibilities and methods to enhance students' understanding of science and technology in the "real world".

Scope of the actions

In addition to programmes between individual companies and schools, Jet-Net also develops general programmes which are particularly geared to help students make better choices in respect of their future studies and careers.

Jet-Net organises actions in different ways, e.g. 1-on-1 school-industry relationships as well as national or regional events:

- Regional approach: 6 regional coordinators act as mediators between Jet-Net and the educational world.
- National office: lobby for STEM together with Platform BètaTechniek.

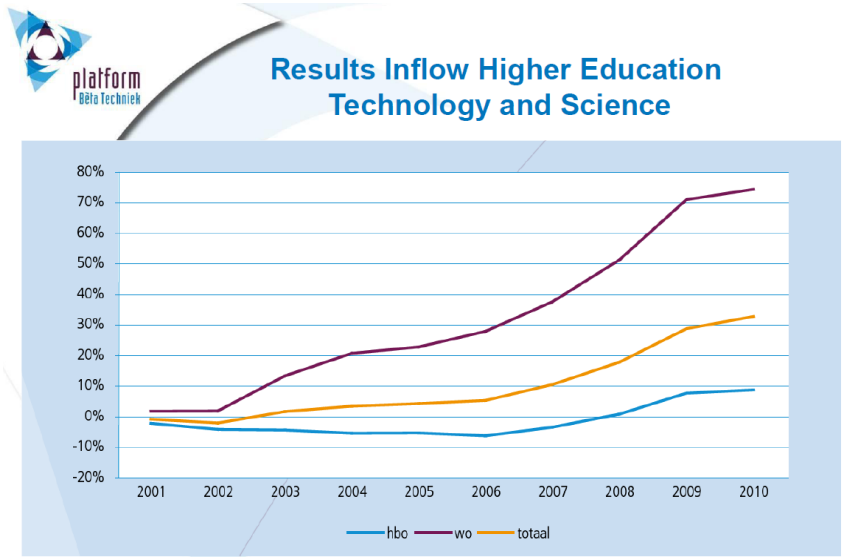
Impact assessment and results

Jet-Net growth in over 10 years:

- 85 Jet-Net companies, 25 partners
- >600 activities per year
- 170 active Jet-Net schools
- 60.000 students per year
- 80 schools on the waiting list

At schools participating in the programme, 56.4% chose technical subjects in 2007, compared to 50% in 2000. At schools that did not participate in the programme, 50% chose technical subjects in 2007 compared to 49.5% in 2000, according to figures from the Jet-Net organisation.

Jet-Net does not claim a one-on-one correlation between Jet-Net activities and the increased student enrolment in higher science and technology education. However, it is a fact that enrolment in higher science education has improved in the last years, as shown in the figure below, and Jet-Net contributes to this growth.



Relative share of students entering higher education in Technology and Science compared to the number of students entering in 2001 (data from the monitoring analysis performed by Platform BètaTechniek).

Other important remarks

Co-operation between schools and companies has become more structured (the signal of a contract involves commitment).

Through the work of Jet-Net:

- STEM has been put on the social and political agendas.
- School-industry collaboration is no longer a taboo (role models can show what kinds of careers are possible)
- Context rich learning environment is offered.

Conditions for success:

- Commitment of the school and company: human power, recourses, time and initiative.
- Direct link school and company.
- Embedding activities in theschool's curriculum.
- Convert enthusiasm to professional approach.
- Let students experience by doing-it-themselves.

Jet-Net and the Science and Technology Platform (BètaTechniek) contribute to talent development and promotion of Excellence.

More info:

Do we have a roadmap? – Feany News, 2008.

http://www.jet-net.nl/docs/jetnet_engels/200801-feani-news-kivi-niria---do-we-have-a-roadmap.pdf

Teknikföretagen (Sweden)

Establishment / creation of the organisation

Year of creation: Teknikföretagenwas established in 1896 and has been working with education and STEM-issues since early 2000.

Motivations: Teknikföretagenhas 3500 member companies, all of them associated to industry, from electronics and med tech to automobile and aircraft industry(www.teknikforetagen.se)

As global competition increases it is vital that Swedish industry has access to knowledge and research that is first rate. Therefore Teknikföretagen is very much focused on STEM, from primary school to higher education. The board of Teknikföretagen represents large and small companies, which are very supportive of our mission in these areas.

Teknikföretagen also represent their member companies and back them up when it comes to labour law and employment terms. This includes working for more efficient research and development, supporting cooperation between educational institutions and industry, and giving young people the opportunity of interesting careers in the country's most important sector.

Promoters: Teknikföretagen is an employers' organisation with 3,500 engineering companies in Sweden, which joint together in a network that created the organisation.

Funding of the organisation

Teknikföretagen is a private National Platform, independent from the political authorities, and it is entirely funded by a network of companies.

Involvement of private companies in the organisation

The member companies are private companies, with manufacturing and/or R&D in Sweden. Together, the 3500 member companies represent more than 50% of all R&D in Sweden. The member companies also represent 50% of the export.

Types of actions carried out by the organisation according the target group addressed

Teknikföretagen established a national network for vocational training (Tech College) which promotes STEM – especially technology (which is compulsory in primary school), annually through a series of projects and initiatives (Tech Scouts 2002-2012; Problem Solvers, Matena, etc). involving primary and secondary students and several industries.

MATENA: teacher training program based on collaboration with technology-oriented companies, which includes field trips and activities of companies in the local area but also seminars and practical exercises. It was developed to encourage and support effective collaboration between schools and business to increase interest in STEM education and careers. The target group is teachers in elementary school and high school, and the program is supported by several Swedish companies.

The aim of MATENA is to encourage more teachers to uses the company as a learning environment in teaching, involving project work, guest lectures, problem solving or product development and design projects in the classroom.

MATENA is based on the idea that active and meaningful collaboration with companies can give much back to learning:

- Study on technology-oriented companies gives teachers insight into the activities, work

environment and work tasks.
- Lectures and presentations, to meet the company's employees, give insight into the professions and career opportunities based on a technical-scientific training.
- Problem solving and project assignments for the schools are a practical way to use the business of teaching.

A MATENA coordinator, who is on hand as a course leader and resource for both teachers and businesses, is responsible for the implementation of training and contacts with schools, teachers and businesses.

MATENA also relies on STEM pedagogues, involved in research and/or STEM-development on a national level. Sweden has a handful of such persons; many of them are involved in MATENA. MATENA also has close collaborations with Science Centres, as these also contain STEM/Pedagogues which are used in MATENA's teacher training networks.

Tech Scouts: program to stimulate and enhance technology for students aged 10-12 as well as their teachers through technology lessons given by young engineers. The lessons are based on the curriculum of technology in middle school and are enhanced with games, experiments and other creative activities. Moreover, the tech scouts also tell their own stories to the students and the teachers, acting as real live role models.

This program has an annual budget of approximately 1 million Euro, paid in full by the Swedish Association of Engineering Industry.

Scope of the actions

Teknikföretagen runs projects at national level.

Impact assessment and results

In the framework of Teknikföretagen, MATENA is evaluated through questionnaires to teachers. It is difficult, however, to assess the real impact on the number of students going to STEM careers.

Other important remarks

Teknikföretagen is a strong lobby organization and has influence on policy, education, enterprise issues and it is involved in new policy. This is only possible through our strong support from our member companies, such as Volvo, Scania, ABB, SKF, etc.

Teknikföretagen works closely with many other organisations and NGO's: like Metal Workers Union (IF Metall), Ministry of Enterprise, Ministry of Education, Research funding agencies, Higher education, universities, Research Institutes, regional Development Centres, etc.