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Identification and dissemination best practice in science mentoring and science ambassador schemes across Europe

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The results and opinions presented do not necessarily correspond with those of the European Commission.

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EXECUTIVE SUMMARY

Attaining the Lisbon and Barcelona objectives in terms of boosting investment in research will increase the demand for researchers. A key issue is, therefore, how to increase the number of young people entering science, engineering and technology careers. Studies shows that children's lack of interest in science is already manifest at schools (primary as well as secondary). Science Mentoring for children in primary and secondary schools aims to reverse that trend. By stimulating scientific interest of children from a young age, it hopes to ultimately increase the number of those choosing scientific training at university and pursuing scientific careers.

Key concepts

A **mentor** is a scientifically trained person providing advice and personal coaching to a student on a one-to-one basis or to relatively small groups of students in a highly interactive manner that is tailored to specific individual needs;

A **science ambassador** is a scientifically trained person who works with groups of students possibly within a classroom setting to stimulate and inspire their interest in science and to share his/her practical experiences of working in science as a fulfilling career;

Young people are defined as children attending primary and secondary school.

This study's first objective was to generate an overview of science mentoring and science ambassador initiatives across 33 countries in Europe through an inventory of existing mentoring and ambassador initiatives which responded to the minimum requirements of a) addressing school-age children b) involving direct interaction between children and scientists.

The second objective was to analyse the various forms of science mentoring being implemented across Europe through case studies of schemes selected for their exemplary value and draws lessons and propose guidelines for possible future developments.

The first phase of the survey identified 107 schemes potentially including activities of a mentoring or ambassador nature, involving the scientific sector and addressing school children. After reviewing these schemes, those not (or not yet) involving direct contact between scientists and children were eliminated. This left ***56 relevant schemes in 26 out of the 33 countries surveyed****. Further research was conducted through direct contacts with the organisers to build a more detailed picture of activities. A fact-sheet on of each of the schemes was compiled at the end of this phase.*

Five main types of activities tend to act as vehicles for delivering mentoring and ambassador initiatives: science days/ festivals; science centres; science promotion events; science clubs/camps; class room projects.

Most of the schemes offered more than one of these types of activity, with the ***most common activity being science-promotion and science days/festivals****. In most cases, this refers to a science-week event-taking place either in the spring (April or May) or the autumn (October/November), or, for a smaller number of cases, a one-day initiative. Science promotion involving, for*

example, visits to R&D departments or labs, and class room activities, lasting several days to several months are also frequently found. Only a few science centres were found which offered direct contact between scientists and children as part of their programmes of activity.

*The **gender dimension** is in important in science as in other areas of society. All schemes address both genders except for two schemes, which address girls only. Most schemes, however, take the gender dimension into consideration either in the design, or promotion stage of their activities or collect data on participation differentiated by gender.*

The launch dates of these schemes show that few are older than half a decade with most having been launched in or after 2000. Out of 56 schemes, 43 were launched between 1997 (one of the peak years) and 2005 and 30 between 2000 and 2005. No significant difference could be found between eastern and western Europe in the pace of development of mentoring activities.

*In terms of **resources**, most schemes rely heavily on volunteers and only employ a small number of administrative staff on a salary. Most have limited regular source of funding, which largely originate from the public or academic sector. Private sector contributions are not frequent and only a minority of organisers seek such support.*

Only two schemes are truly 'nation-wide' in their impact with most being small scale or at pilot stage. None have a regular formal evaluation procedure in place though most collect feedback from participants and contributors. The common opinion of those interviewed from the schemes is that, on the whole, the satisfaction level is high and the demand is often greater than what they can provide. Schemes run by universities with strong commitment at high level within the institutions appeared to be the most successful and more viable. The impact on the longer term objective of increasing the proportion of new students choosing science subjects is difficult to measure, in part because many schemes are too recent for participants to have reached that stage in their education. Despite the lack of evaluations, there is some evidence that mentoring and ambassador schemes have a positive impact on participants' attitudes towards science – steadily growing numbers of participants in science festivals is one of the indicators supporting this.

*Based on the case study evidence amassed by this study, **the structure of successful schemes is built around three key features**:*

- *a direct participation and personal commitment of the highest authorities in the academic institutions bringing direct access to policymakers and to their counterparts in the education sector and the regional or national administration necessary to quickly finalise co-operation agreements and remove administrative hurdles.*
- *a core team with the know-how, the expertise and the seniority level necessary be simultaneously a creative lab, a sounding*

board, and a management team along with the skills to network and mobilise others.

- *Locating this core management teams of science mentoring or ambassador schemes in geographic, if not institutional, proximity to the research, educational or industrial partners from which mentors or ambassadors are drawn appears also to favour more active involvement of such 'volunteers'.*

The music tutor analogy for science mentoring and ambassador activities

A clear basic principle for successful science mentoring can be proposed using the analogy of different approaches to teaching music:

One option for stimulating children's interest in learning music is to avoid at an initial stage to force them to learn how to read music but rather involve them in playing with different instruments under the guidance of a seasoned musician;

In a similar way, in science mentoring or ambassador, the aim should be to awaken the interest of children in the wonder of scientific discovery and the potential of science as a career path, without submerging them with scientific facts.

Any future policy aiming at supporting these initiatives should focus on the means of making these sustainable in the long term including securing funding for administrative and other running costs, formally acknowledging and rewarding volunteers and supporting the set-up of a formal appraisal and evaluation process.

Based on the findings, the study authors proposed ***three key strategic guidelines***

- *The need for a European level action plan for science mentoring and ambassador activities*

Science mentoring and ambassador concepts are poorly understood and codified to date. An action plan at European level (potentially in the form of a communication with a broader remit on science education and mentoring for young people) with the aim of setting a number of *common objectives for increasing the financial resources being devoted by public authorities to this area as well as stimulating a debate on key issues highlighted by this study.*

- *Avoiding reinventing the wheel by support for a European network of science mentor/ambassador practitioners and dissemination activities*

The opportunities for trans-national learning from existing good practice cases is large and should be exploited through either a network (part funded by the Commission) or the launching of specific pilot projects on themes or techniques related to science education and promotion for children where existing science mentoring/ambassador programme managers could in turn 'mentor' emerging schemes in other countries or regions.

- *Public funding for science mentoring and ambassador activities should be aimed at leveraging additional financial and human resources from the educational, research, charitable and corporate sectors.*

The experience to date of science mentoring and ambassador schemes suggests that this is a field where a relatively small public investment can result in the mobilisation of significant resources (not always financial but also the in-kind contributions through time of scientists and industrial researchers). Even large and fully funded schemes such as the UK example are now recognising that there is a need to attract additional funding from non-public sources if the scheme is to continue expanding and attracting qualified mentors and ambassadors. In regions eligible under the Structural Funds, the use of EU funds to extend successful pilot or local examples of science mentoring to less-favoured regions should be explored.

The study concludes by proposing a number of ***operational guidelines for implementation of future science mentoring and ambassador schemes:***

- *They should ideally be based on a partnership of equals between the various actors involved at the implementation level (scientists and teachers for activities focusing on schools for example). Equally, all actors should ideally be involved or at least consulted in the design of the activities.*
- *Schemes should be built around a combination of 'inspirational examples' (the ambassador technique) and 'active learning' (processes rather than 'exhibitions', experiments or activities leading to a practical outcome, explaining technologies in their form as useful everyday applications, etc.) through mentoring.*
- *Schemes should take appropriate account of the need to increase the number of female researchers and of their potential impact on disadvantaged groups (ethnic origin and socially).*
- *Similarly, the social dimension needs to be reinforced in order to avoid focusing uniquely on 'best performers' (schools or children).*

- *Integration of mentoring activities by 'real scientists' into 'science exhibition centres', which tend to be staffed by non-specialists, could be another road to follow creating stronger links between these important tools for awareness on science and the actual scientific community.*
- *A European Code of Conduct for Science Mentoring and Ambassador schemes is required to ensure that children and young people participating to schemes as well as the adults acting as mentors or ambassadors are not placed at risk personally or professionally.*
- *Mechanisms for 'rewarding' mentors and ambassadors for the time they, generally, volunteer need to be included in schemes (e.g. a national prize for the 'most inspirational scientist for children'.*

1 Introduction

This report is the outcome of a study aiming to identify and disseminate best practice in science mentoring and science ambassador schemes across Europe. The study focused exclusively on those schemes involving direct interaction between children and scientists. The terms of reference defined three objectives:

1. Produce an inventory of such schemes in Europe;
2. Propose a limited number of examples of good practice allowing a representative coverage of the different types of schemes and operational approaches to delivering mentoring and ambassador activities.
3. Formulate guidelines based on findings, notably from the qualitative information gathered on the existing schemes.

1.1 Key concepts and scope of the study

1.1.1 Definition of key concepts

From a conceptual point of view, the following definitions were used in this study:

- "Mentor" is a scientifically trained person providing advice and personal coaching to a student on a one-to-one basis or to relatively small groups of students in a highly interactive manner tailored to specific individual needs;
- "Science ambassador" is a scientifically trained person who works with groups of students possibly within a classroom setting to stimulate and inspire their interest in science and to share his/her practical experiences of working in science as a fulfilling career;
- "Young people" are defined as children attending primary and secondary school.

1.1.2 Scope

Schemes identified and analysed in the inventory met the following criteria:

- They were endorsed, initiated or funded by public bodies (local, regional or national) or organisations aiming at the development of science skills among young people,
- Implementation was carried out by public or private organisations, and
- The schemes involved contact between children and scientists, former scientists or people working or who have worked in science (both academic and business sector).

Geographically the study covered 33 countries: the 27 Member States of the European Union (EU), Turkey (one of the candidate countries) and the associated countries to the EU (Iceland, Israel, Liechtenstein, Norway and Switzerland).

1.2 Methodology

In addition to the more conventional challenges of a European wide study presented by a mix of resource constraints and the need to ensure a representative geographical coverage, performing this study required a methodology responding to the difficulties presented by the fragmented nature of the European education sector. Education is still almost exclusively a national or regional matter[1]. Its governance, its structure, its content are the products of a national or regional context and its stakeholders interact almost exclusively in that context. The practical repercussion of this is that an overwhelming majority of sources available are produced for internal consumption and therefore usually only available in the national language. Information gathering and interviews often require not only knowledge of the language but also an understanding of the country's education sector and its historical development. To account for this, a network of experts conducted the research and interviews and contributed their specific knowledge of one or more countries.

1.2.1 Literature review

Throughout the course of the study, a continuous effort was made by the contributors to understand the context in which the schemes identified had been developed. This meant, when available, sourcing statistics, key policy documents and related literature. References to these are included in the report and a specific search for contextual information was conducted in the case studies in annex to this report.

1.2.2 Inventory of existing schemes

In a first phase of the survey work, a short on-line questionnaire survey was carried out to identify the existence or non-existence of mentoring and ambassador schemes in each of the countries as well as points of contact for such schemes. Based on the results, an inventory of schemes meeting the criteria set by the study was drawn up. While this inventory is not exhaustive, the study has captured a representative overview of existing schemes in each country. A first phase of the survey identified over 100 initiatives involving the science sector and designed to stimulate children's interest in science across Europe. A filtering process excluded all those schemes which did not meet the fundamental criteria of direct interaction between scientists and schoolchildren. This led to the elimination of over half the schemes from the inventory.

A second phase followed using the inventory survey form to gather more detailed background information on the schemes identified and selected as relevant. In both phases, desktop research as well as interviews (mostly by phone) were used. Identification, synthesis analysis, completion and revision of the inventory continued throughout the period of the study.

The final version of the inventory consists of 56 schemes. For each scheme, background information was collected covering activities, structure, and operational

[1] A useful starting point is the list of ministries of education in all European countries (members of the council of Europe) with web and contact details can be found on the C.O.E. Education site: http://www.coe.int/T/E/Cultural_Co-operation/education/Ministries2.asp

details. The final version of this inventory, including all information collected per scheme and presented in the form of fact-sheets, is provided in annex. Part 3 of this report provides an overview and comparative analysis of the schemes in Europe.

1.2.3 The case-studies

Based on the survey information, and on the typology developed from the comparative analysis, case-studies were selected using two criteria:

- collectively they reflect the variety of approaches in the inventory;
- individually their results and/or features made them good practice in their category or provided interesting solutions to a shared problem.

The case studies were carried out through interviews (phone or face-to-face). The output of these case studies, including information on the context, is provided in annex to this report. Chapter 4 of this report provides a synthesis of the findings from the case-studies focusing on the transferability of the models they illustrate and the relevance of lessons learned for stakeholders in other national/regional education sectors.

1.3 Structure of the report

The rest of this report is structured as follows:

- Chapter 2 discusses the policy context for science mentoring;
- Chapter 3, provides an overview of the process of selection of schemes for inclusion in the inventory; and key findings on the full set of schemes;
- Chapter 4 provides a summary of key findings from the case studies including exemplary aspects and results
- Chapter 5 includes a synthesis of overall findings and guidelines for the development of science mentoring and ambassador schemes in Europe.

2 Brief reminder of the socio-economic context and relevant policy background

Science-mentoring for children is *one of the possible* answers to the need to improve:

- interest for,
- understanding of;
- trust in

scientific research among children and, ultimately, in the population at large. These three objectives are found either combined or individually in policies at European and national level in the areas of Education, Research and Employment.

The need for policy intervention in the relation of children to science is a recent development, barely a decade old, and stems from pressure to address three key issues

1. A shortage of professional researchers either current or forecast, together with disaffection for higher science and technology qualifications.
2. Different and sometimes opposing views and expectations of different social groups with respect to the content, purpose and objective of education touching on employability, social mobility, social inclusion and the acquisition of basic skills together with a belief treated as common knowledge that exams requirements are being lowered.
3. A public distrust of scientific experts and lack of confidence in the potential benefits of scientific and technological innovation raising difficulties for policymakers in promoting and funding research in some promising areas such as biotechnologies and genetic engineering.

Regular surveys of perceptions of science along with trends in higher education qualifications in scientific & engineering training and employment in of researchers published by Eurostat since 2000 show that these trends are European (or global) rather than national. These trends are one of the factors that led to the co-ordinated policy development process by Member States known as the Lisbon Strategy and to adjustments to the EU Research Framework Programme to include the structuring of the research sector as a priority alongside support to specific research fields.

2.1 The Lisbon Agenda & the RTD Framework Programmes

Since the mid-90's, a number of studies have converged to the conclusion that there is a relative decline of the EU in terms of economic growth compared to the other industrialised parts of the world. The economic boom fuelled by the information technology revolution chiefly boosted growth in the United States and a number of indicators (intellectual property, employment, investment) tend to confirm this trend and pointed to the 'knowledge sector' as a weak point of the European economy. By 1999, some of the, then, 'new' Member States, particularly Finland, provided a counter-example of successful knowledge economies in the EU. While their small size limits their influence on the EU economy and their impact on the relative performance of the EU in science and technology indicators, their results contrasted sufficiently strongly with the rest of the EU to reinforce the perception of decline felt by the others, including France and Germany. The rest of Europe and particularly the then candidate countries which were to join through the 2004 enlargement included a majority of former Eastern-bloc countries with their own structural adjustment problems of an altogether different scale. While these had among the most educated populations in the world, they also suffered the consequence of a brain-drain in science and technology research which mostly benefited the US. In the EU15, the shortage of specialised workers, and particularly researchers, was one of the factors identified as negatively affecting the growth potential of key sectors. These widely shared views in European policy circles led to the development of the Lisbon Agenda.

In March 2000, EU heads of state and government set themselves the goal of making the EU "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion". The Lisbon Agenda set a target for research spending at 3% of the GDP by 2010 as one of its objectives; including increasing the private sector share of spending and that solutions be found to increase the availability of researchers.

The ‘Spring Councils’ refined these objectives addressing specifically education on several occasions starting with the Barcelona council. The Kok report in 2004, pointing to failures and delays in the implementation of the Lisbon agenda put these socio-economic objectives back at the top of the EU policy agenda, where they had been momentarily displaced by international relations and security issues.

At the EU level, in parallel to the Lisbon Agenda, support to the structuring of the research sector was introduced in the RTD framework programmes (RTD FP), starting with FP5 and more significantly with FP6, focusing on stimulating the supply side with direct support for researchers and efforts to improve the terms employment.

The specific issue of the low participation of women in the sector also became a priority of the FP in line with the Lisbon Agenda’s objectives of raising women’s participation in the workforce and improving the supply of researchers. Furthermore, under the heading ‘Science & Society’ specific themes were included to allow support for the communication of science and youth and science addressing the problems with the understanding of and trust in scientific research.

During FP6, the emphasis was put on understanding the mechanisms at the root of these problems and launching comparative surveys of initiatives taken across Europe to address them. The present report is one of these surveys.

2.2 Education & the social dimension(s) of the ‘science & society issue’

While both the Lisbon Agenda and RTD framework programme touch on social issues, they mostly focus on the economic dimension. In the case of the RTD FPs at least, this is explained by the legal basis, which justifies their existence. The usefulness and relevance of science mentoring, however, is at least as much a matter for the education sector as it is a matter for the research sector and a quick reminder of the issues at play in the education sector is important to understand the context in which science mentoring has developed and could, potentially, further develop. In this respect, the relevant policy framework is the Education & Training 2010 work-programme, which is the core of the Lisbon agenda in terms of education. Increasing recruitment to scientific and technical studies is a key objective of this work programme[2]. Key issues identified by the work-programme include increasing interest in mathematics, science and technology from an early age; motivating more young people to choose studies and careers in these fields and notably scientific disciplines where there are shortages of qualified personnel, improving the gender balance among people following these subjects, etc.

Primary and secondary education is a matter for individual Member States but the issues being debated are increasingly similar across Europe. Of course, the new Member States, which were former members of the communist bloc, display specific features that are remnants of a system that placed a high value on scientific education.

In the western part of Europe at least, the debate on the primary purpose of education is ongoing since the introduction of universal access to primary education; and certainly over the last half century, which saw the successive democratisation of primary, secondary and university education and the introduction of mandatory minimum periods of schooling. This debate is regularly revived in periods of high social inequality and/or high unemployment, which produces additional pressure on policymakers to provide solutions.

Ignoring the philosophical position that considers education as good per-se (and opens a debate on its content which is not relevant here), leaves two major standpoints: that of the parents (de facto representing their children) and that of future employers of those being educated. To simplify, parents consider education as being primarily instrumental for social mobility (preferably upwards); while employers see education as primarily instrumental in providing adequately trained workers (preferably with a sufficient supply in the relevant sector at a given time to limit salary pressure). These two broadly defined standpoints are a major source of pressure on the education sector and policy makers.

That these legitimate individual aspirations on the part of employers and parents are allowed to become collective expectations, despite the logical impossibility that each represents[3], is a reflection of the fact that communication on education and education policy on one hand and is communication on science and science policy on the are confronted by the same problem. The over simplification of issues for short term political gains, in a highly sensitive policy area which touches every citizen. This is most obvious in the regular debate around the supposed 'lowering of exams requirements' and the assumed reduction in 'value' of the qualification or diploma granted. In this debate, the informative purpose of exam results and comparative education systems surveys is often lost. Even when they survive this debate, attempts to develop education policies coherent with long-term objective are then further threatened by immediate budgetary pressures.

Rather than a belated challenge to the democratisation of access to education, what is needed, it increasingly appears from sociological and pedagogical research, is a democratisation of access to knowledge. This is particularly obvious in science

[2] See the detailed work programme on the follow-up of the objectives of Education and training systems in Europe. Work programme of the Education Council in cooperation with the Commission (February 2002); http://europa.eu/eur-lex/pri/en/oj/dat/2002/c_142/c_14220020614en00010022.pdf

[3] No upward mobility could be achieved without downward mobility and matching tomorrow's skills closely with today's requirements is a sure recipe for obsolescence.

education, which, as is it is usually taught, presents science in a way that is of little relevance to children's lives. Science education remains mostly a transmission of scientific findings presented as facts. This has the major inconvenient of obscuring the process that generated those facts. These facts may even occasionally refer to obsolete findings simply because curricula cannot always catch-up with scientific developments.

It is often argued that **teaching the methods of science rather than the output of science would in effect not only reform the teaching but reform the learning with benefits in all other fields too**. This is a view often mentioned by stakeholders of science mentoring and ambassador schemes consulted for this study.

Finally, while education may not be an automatic passport for upward social mobility many hoped it was, **lack, or low quality, of scientific education increasingly places individuals on a path of social exclusion**. Promoters of science mentoring and ambassador schemes were very aware of this and often indicated that raising awareness in learning of those potentially excluded through non-conventional environments and approaches as one of the goals of their schemes.

2.3 Girls and women in science: a specific challenge

The gender issue is often bundled with the overall discrimination issue yet it is a much wider problem. Firstly, the discriminatory dimension affects inevitably and personally a majority[4] of the European population that is each and every member of that gender at some, usually crucial, point in their life. Secondly, these negative effects have ramifications extending to society as a whole and both genders. These dwarf the small advantage that members of the 'favoured' gender may momentarily have from the reduction of competition for gains. Policy design in matters of gender equality is still at its infancy in Europe, with the EU level, particularly the Commission and the Parliament taking the lead. In this respect, it is worth underlining that the 2003 Education Council adopted a set of European level benchmarks. In particular, the Council called for "the total number of graduates in mathematics, science and technology in the EU to be increased by at least 15% by 2010, while at the same time the level of gender imbalance should decrease[5].

The science sector is one of the key areas for intervention since it is one of the most overtly discriminatory sectors and simultaneously one that can least afford it. Moreover, according to the assessments which converged to generate the Lisbon Agenda, it is the sector on which the rest of European society depends for the sustainability of its mode of existence.

The under-representation of women in scientific and technological research was identified in 2000 as one of the key issues to be addressed to resolve the shortage of researchers. However, it is still far from the case in 2006. In fact, the Commission's own latest report on the matter 'She Figures 2006'[6] even points to a relative decline as

[4] And increasing if European women's advantage over men in life expectancy persists

[5] Source: European Benchmark on Maths, Science and Technology; Reference Levels of European Average Performance in Education and Training (Benchmarks); Council Conclusions (May 2003); http://ec.europa.eu/education/policies/2010/doc/after-council-meeting_en.pdf; (OJ C 134, 7.6.2003)

[6] http://ec.europa.eu/research/science-society/pdf/she_figures_2006_en.pdf

the share of women in science and technology research is actually lower than it was 1998 following a much slower increase than that of men. Horizontal and vertical segregation persists. A Eurostat report interpreting 2004 data on the gender dimension of Europe's knowledge workers found that while women represented over half (50.4% in 2004 for 25 to 64 years olds) of the science & technology workforce, a greater percentage than that of the overall part of women in the workforce, only 29% of the researchers were women.[7] While the share of women is nearly 50% of the science and technology (S&T) labour force in the EU, in 2002 they only represented between 17% and 35% of the researchers, depending on the sector in which they were employed and were most notably under-represented in the private-commercial research. Those trends are seen at European and national level although there are huge variation notably in the percentage of women among those employed in science & technology; indeed several eastern European countries tend to do better with the highest share (60%) for all EU countries found in Poland.

On the whole, women scientists are not making the most of their qualification and the research sector is not making the most of qualified female scientist since they are more likely to drop out of science, move to a non research post, be unemployed or work part-time. Those who remain in research are over represented in the less profitable fields and have slower promotion rate than men. This undoubtedly adds to the difficulties in portraying research as an attractive profession to female students.

As Eurostat data shows, women continue to be under-represented in the fields of S&E graduates. In 2003, 22% women represented 22% of recent graduates in S&E, well below their 55% to 60% share of graduates, all subjects included. Some countries show progress since 1997 while in other cases, the share of female graduate has actually decreased.[8] This indicates that the problem of attracting and retaining women in the science sector, at all stages, is far from being resolved.

As one of the representatives of the Belgian scheme sCite network noted, the democratisation of access to tertiary education, which generated a sharp growth in the number of students, including women. Unfortunately, the science departments saw little of this growth since female students went elsewhere in the higher education system. The drop in student numbers in science departments (in French-speaking Belgium) was not initially a drop in absolute numbers but in percentage share. The survival of this crucial part of the R&D sector, the university science department, depends on its success in attracting more students mostly by attracting young women and girls since these represent the single largest untapped pool of scientific talent.

2.4 Science mentoring as a policy response

Attaining the Lisbon and Barcelona objectives in terms of increased investment in research will increase the demand for researchers. A key issue is, therefore, how to increase the number of young people entering science, engineering and technology careers. Although this is a complex issue, European level surveys show that young people are loosing interest in science at schools partly because the content is not

[7] http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-NS-06-012/EN/KS-NS-06-012-EN.PDF
[8] Science & Technology in Europe, Data 1990-2004, Eurostat ; http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-EA-06-001/EN/KS-EA-06-001-EN.PDF

relevant to them[9] and partly because the teaching methods are inadequate. These are aspects that mentoring and ambassador schemes can address.

Given the challenge of increasing the number of young people entering scientific careers, the need for this inventory and initial study is reinforced by the current lack of literature that directly addresses the issue of science mentoring or science ambassadors for children in Europe. There are a number of publications on mentoring in general[10] but these do not address young people and science specifically. There are studies on factors influencing career choices or different national studies on the supply of science and engineering skills in general, but these tend not to address directly the issue of what sorts of measures increase the interest of young people in pursuing scientific careers.

From an international perspective, it can be noted that science mentoring is a well-established and widespread model of science education in the US and Canada. After school sessions where children have the possibility to come in contact with science through different activities are common. It has been argued that these kind of activities increase the in-school success of those participating[11] and specifically that after-school programmes offer an ideal setting for nurturing the potential scientist in every student, as well as for reinforcing the science taught during school hours[12].

In this context, the working hypothesis of this study was that direct contact between young people and trained and experienced scientists can be effective in raising the interest for science and its practice among young people. This study investigates the relative merit of the various forms of science mentoring and ambassador scheme being implemented across Europe and draws lessons.

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[9] Europeans, Science and Technology: Eurobarometer 55.2. December 2001

[10] Examples are David L DuBois, Michael J Karcher (ed. 2005) - Handbook of Youth Mentoring, SAGE Publications; and Todd Yuzuriha, The Importance of Mentoring Children, EEE-USA Today's Engineer. http://www.todaysengineer.org/2003/Mar/trends.asp

[11] The Robert Brown Foundation, Afterschool Matters, (Nr.4 Spring 2005), The Connection between Afterschool Programmes and In-School Success, pp. 19-34.

[12] Lucy N. Friedman & Jane Quinn, How After-School Programs Can Nurture Young Scientists and Boost the Country's Scientific Literacy, Education Week - Science by Stealth, February 22, 2006

3 Inventory of science mentoring and ambassador schemes

3.1 Overview of inventory

The first objective of the study was to identify whether, and to what extent, science mentoring and science ambassador schemes exist in each of the 33 European countries considered. This section provides an overview of the initial survey in the first phase and the inventory survey from the second phase.

3.1.1 Selection of relevant schemes

The first phase of the survey identified 107 schemes, involving the scientific research sector and addressing school-children, potentially including activities of a mentoring or ambassador nature. In the second phase, they were categorised into three groups ('A': relevant 'B': potentially relevant and 'C': not relevant to the study,) with 52 A category schemes directly relevant and the remaining divided roughly equally between those categorised as C schemes and hence eliminated as irrelevant (no mentoring or ambassador activity) and B schemes requiring further research.

Ultimately, 56 schemes were identified as directly relevant and further research was conducted through direct contact with the organisers to build a more detailed picture of their activities. The results of this second phase are summarised in fact sheets provided in annex to this report. The output is a good overview of science mentoring/ambassador initiatives across the EU operational in 2006[13].

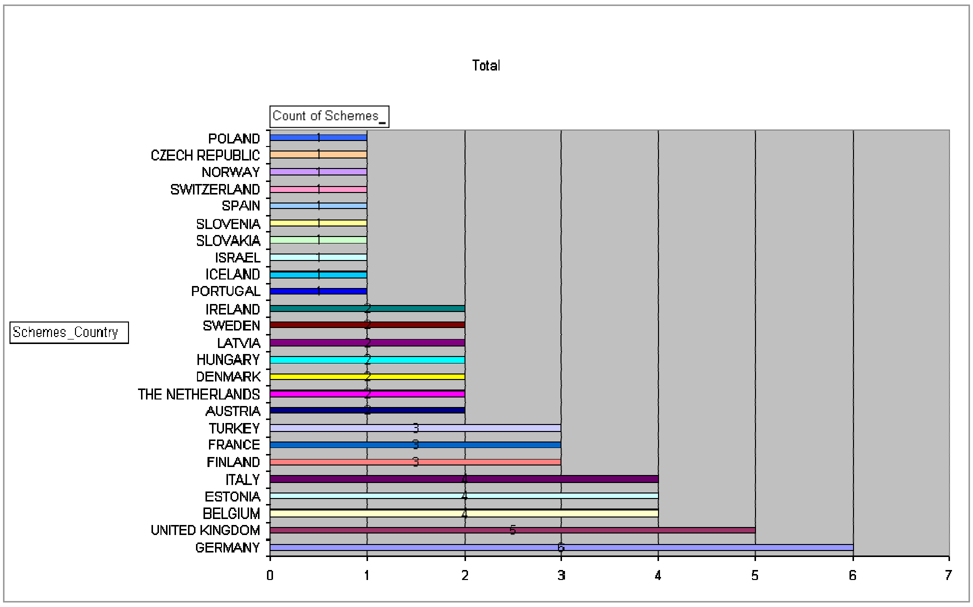

Exhibit 1: distribution of relevant schemes by country

[13] The entire group of initial number of schemes found (107) is relevant to the study since those schemes are among those best placed to develop mentoring/ambassador activities should such initiative be financially supported and specifically encouraged in the future.

It should be noted that no relevant schemes were found in the following countries: Bulgaria, Cyprus, Greece, Lichtenstein, Lithuania, Luxemburg and Malta.

3.1.2 Target groups of schemes

Education level: a majority of the 56 schemes addressed both children at primary and secondary education levels:

Both	37	66%
Primary only	6	23%
Secondary Only	13	11%

Gender: all schemes addressed both genders except for two schemes, both German, which addressed girls only. However, most schemes take the gender dimension into consideration either in the design, or promotion stage of their activities or collected data on participation differentiated by gender.

3.1.3 Activities supported by the schemes

The schemes identified were classified according to different types of activities. This gave an overview of what kind of schemes are most common. One scheme can include several different types of activities. Following types are given:

- Activity type 1: science days / festivals: visits by group of school children to specific science events or scientific institutions including direct contact with a scientist;
- Activity type 2: science centres: visits to or out-reach activities - road shows - including contact with a scientist;
- Activity type 3: science promotion: any form of ad-hoc workshops, seminars, and events involving a speech or presentation by a scientist;
- Activity type 4: science clubs/ camps: regular out of school activities during the school term time (clubs) - or during holidays (camps), where school children undertake projects / activities in direct contact with a scientist;
- Activity type 5: class room projects: projects developed by school children as part of their curriculum where a scientist is coaching or mentoring a project;
- Activity type 6: others: in case the scheme could not be typed or covered additional activities not covered according to above definitions.

All but three of the schemes offered at least one of the first five activities with most offering more than one. The most common activity types supported by the schemes are science-promotion and science days/science festivals. In most cases, this refers to a science-week event-taking place either in the spring (April or May) or the autumn (October/November), or, for a smaller number of cases, a one-day initiative.

The category ‘science centres’ included both initiatives set-up as part of universities or technology institutes and more ‘commercial’ initiatives of science parks or activity centres, in so far as the latter provided direct contact with scientists. Science centres often participate actively in science days and/or offer classroom projects and the same scheme is often identified as offering two of these types of activities. A number of science centres may have included in their science promotion activities, opportunities for direct contact between children and scientists but this was not the focus of the activity and was not a regular occurrence, and hence is not included in the inventory.

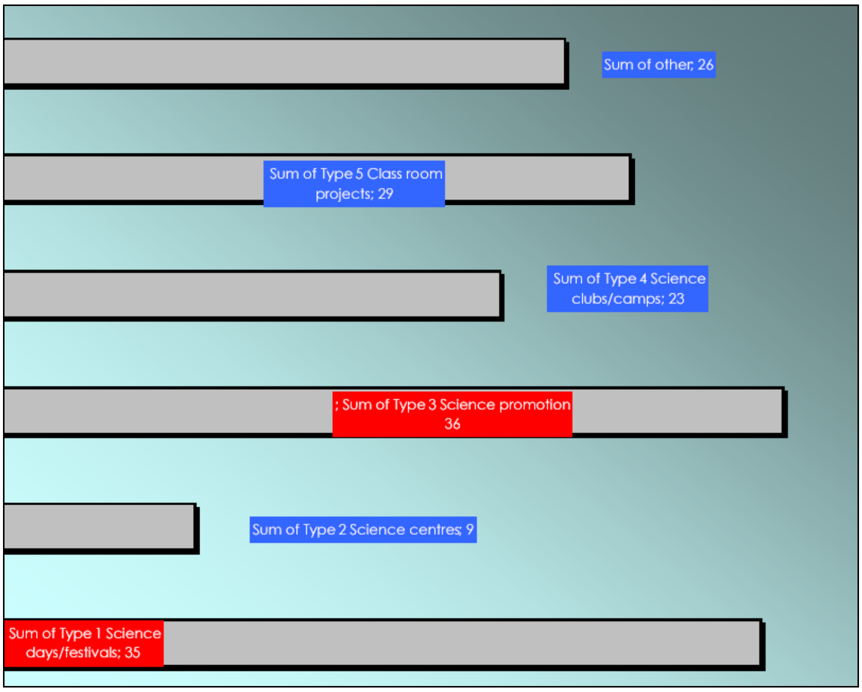

Exhibit 2: frequency of occurrence of activity type

Science promotion included activities like 'science lectures' organised for students of one age-group and 'open days' in universities for classes of school children. These do not focus on an active participation of children in a project as opposed to classroom projects sometimes taking place over several days, weeks or months.

3.1.4 Launch year and longevity of the schemes

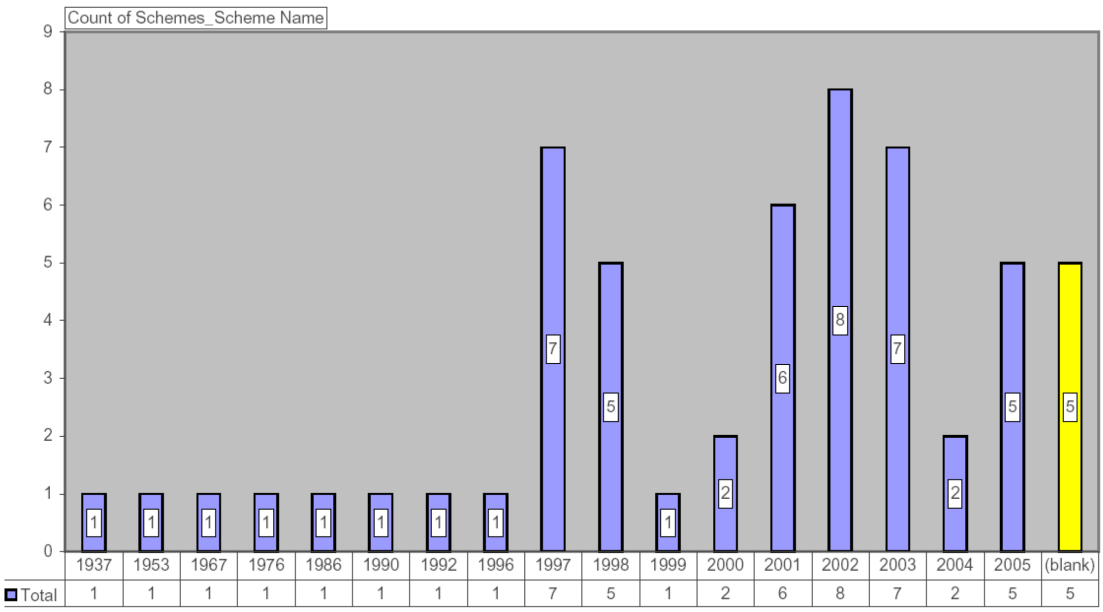

Exhibit 3: Timeline of launch dates of schemes

Out of a total of 56 schemes, five had unknown launch dates, five could not provide a launch date and five started prior to 1990; 46 started since the beginning of the 1990s of which 43 were launched between 1997 (one of the peak years) and 2005; and 30 between 2000 and 2005. No significant difference could be found between eastern and western Europe in terms of launch dates.

Exhibit 4: Schemes launched per country

Start Year	Country	Number	Start Year	Country	Number
1937	FRANCE	1	**2002**	GERMANY	1
1953	BELGIUM	1		ITALY	1
1967	LATVIA	1		NORWAY	1
1976	LATVIA	1		SWEDEN	1
1986	THE NETHERLANDS	1		TURKEY	2
1990	ITALY	1		UNITED KINGDOM	2
1992	FRANCE	1	**2003**	AUSTRIA	1
1996	TURKEY	1		ESTONIA	1
1997	BELGIUM	1		ITALY	2
	ESTONIA	1		POLAND	1
	FINLAND	1		SWITZERLAND	1
	FRANCE	1		UNITED KINGDOM	1
	GERMANY	2	**2004**	AUSTRIA	1
	UNITED KINGDOM	1		SWEDEN	1
1998	GERMANY	3	**2005**	DENMARK	1
	HUNGARY	1		ESTONIA	1
	THE NETHERLANDS	1		HUNGARY	1
1999	ESTONIA	1		IRELAND	1
2000	BELGIUM	1		SPAIN	1
	SLOVAKIA	1	**Un-known**	FINLAND	1
2001	BELGIUM	1		ISRAEL	1
	CZECH REPUBLIC	1		PORTUGAL	1
	DENMARK	1		SLOVENIA	1
	FINLAND	1		UNITED KINGDOM	1
	ICELAND	1			
	IRELAND	1			

3.2 Overview of schemes activities

3.2.1 Type of schemes

The exhibit on the following page lists all schemes for which the inventory survey has been completed. A full set of inventory survey forms is provided in Annex A. This section describes the different features of each type of activity with examples of schemes that fall under each type, although as noted above very few schemes have only one type of activity. On average there are 2.6 activities per scheme. Even if the title of a scheme indicates a certain type of activity, the scheme may contain other types of activities as well.

Activity Type 1 Science days / festivals

Country	Title of scheme
Italy	Science Festival
Slovenia	Science Festival
Sweden	Young speculates

The Italian 'Science Festival' is one of the larger schemes with a budget of 3 million Euros. The organisation is a consortium of universities, local and regional authorities, sectoral organizations, research institutes and private organizations. During the last edition it had more than 250 different events, targeting particularly schools. It included speakers, mentors and science ambassadors with different background and from all over the world. In addition, almost 400 young researchers are recruited as mentors.

The Slovenian festival by the Slovenian Science Foundation organizes workshops on different scientific questions and allows active participation in various experiments. Prior to the festival the organisation issues open calls for best drawing and best essay on how children view and think of scientists and their work.

'Young People Speculates' in Sweden is a co-operation between six different arenas (science centres, museums etc), with one main project leader, which is also the only part-time salaried person in the project. The scheme offers meetings with scientists through, e.g. thematic days, seminars, lectures, debates, and experiments.

Exhibit 5 List of schemes in the inventory

Country	Scheme Name	English Scheme Name
AUSTRIA	Kinderuni Graz	Children’s University Graz
AUSTRIA	Kinderuniwien	Vienna Children’s University
BELGIUM	Jeunesses Scientifique De Belgique	'Scientific Youths Of Belgium
BELGIUM	Reseau sCite - Inforsciences	Scite Network - Inforsciences
BELGIUM	Printemps Des Science	Spring Of Science
BELGIUM	Science Mentoring Activiteiten Vanuit De Universiteit Van Antwerpen	University Of Antwerp Mentoring Schemes
CZECH REPUBLIC	Otevřená Věda	Open Science
DENMARK	Dansk Naturvidenskapsformidling	Danish Science Communication (Dnf)
DENMARK	Forskningens Dogn	Research Day
ESTONIA	Energy Centre	Energy Centre
ESTONIA	Estonian Science Centre Ahhaa	Estonian Science Centre Ahhaa
ESTONIA	Innovation Awareness Programme	Innovation Awareness Programme
ESTONIA	Young Scientists Association (Ysa)	Young Scientists Association (Ysa)
FINLAND	Kids' Club	Kids' Club
FINLAND	Luma-Keskus	Luma Centre
FINLAND	Tiedesirkus	Science Circus
FRANCE	Palais De La Decouverte	Palais De La Decouverte
FRANCE	Actions Éducatives Et Innovantes À Caractère Scientifique Et Technique Et Ateliers Scientifiques Et Techniques	S&T Innovative Pedagogical Actions & S&T Workshops
FRANCE	Fete De La Science	Science Festival
GERMANY	“Mädchen Machen Technik”, Agentur "Mädchen In Wissenschaft Und Technik, Technische Universität München	Agency “Girls In Sciences.”- “Girls In S&T” Tu Munich
GERMANY	Tübinger Kinder-Uni	Children’s University Tübingen
GERMANY	Fehling Lab (Universität Stuttgart, Hohenheim)	Fehling-Lab (University Stuttgart , Hohenheim)
GERMANY	Der Girls' Day – Mädchen-Zukunftstag	Girls' Day – Future Prospects For Girls
GERMANY	Highsea-Projekt Des Alfred Wegener Instituts (Awi)	Highsea-Project Of The Alfred Wegener Institute ("Institute For Polar And Marine Research", Awi)
GERMANY	Mint - Mädchen In Mathematik, Ingenieur-, Naturwissenschaft Und Technik	Mint – Girls In Mathematics, Engineering Sciences And Techniques
HUNGARY	Mentorálási Program	Mentoship Program
HUNGARY	Országos Ifjúsági Tudományos És Innovációs Verseny	National Scientific And Innovation Contest For Youth
ICELAND	Vísindamadur Ad Láni	Scientist On Loan
IRELAND	Speakers For Schools	Speakers For Schools
IRELAND	Steps To Engineering	Steps To Engineering
ISRAEL	חינוך למדעים בקמפוס האוניברסיטה לידי בתי הספר בכל הרמות	Science Education For Youth People On University Campus

ITALY	Festival Della Scienza	Science Festival
ITALY	La Primavera Della Scienza	The Spring Of The Science
ITALY	Settimana Della Cultura Scientifica E Tecnologica	Week Of The Scientific And Technological Culture
ITALY	Le Meraviglie Della Scienza	Wonders Of Science
LATVIA	Jauno Zinatnieku Nometne "Alfa"	New Scientists' Camp "Alfa"
LATVIA	Skolenu Zinatniska Konference	Scientific Conference For The High Students
NORWAY	Nordnorsk Vitensenter Tromsø	Northern Norwegian Science Center
POLAND	Dzien Nauki	Science Day
PORTUGAL	Semana Da Ciência E Tecnologia	Science And Technology Week
SLOVAKIA	Detská Univerzita Ef Žu	Children's University Of The Faculty Of Electrical Engineering, Univerzity Of Žilina
SLOVENIA	Festival Znanosti	Science Festival
SPAIN	Programa Complementario Para El Fomento Y Comunicación De La Cultura Científica Y Tecnológica	Additional Plan For The Promotion And Communication Of Science And Technology
SWEDEN	Vetenskapens Hus	House Of Science
SWEDEN	Unga Spekulerar	Young People Speculates
SWITZERLAND	Kinder-Universität	Children’s University Zürich
THE NETHERLANDS	Jet-Net, Jongeren En Technologie Netwerk Nederland	Jet-Net, Youth And Technology Network Netherlands
THE NETHERLANDS	Weten Week	Science And Technology Week
TURKEY	Bilim Merkezi	Science Centre
TURKEY	Bilim Olimpiyatları	Science Olympiads
TURKEY	Uzay Kampı Turkiye	Space Camp Turkey
UNITED KINGDOM	Chemistry At Work	Chemistry At Work
UNITED KINGDOM	Enhancing Science Uptake	Enhancing Science Uptake
UNITED KINGDOM	Healthcare Science Ambassador Network	Healthcare Science Ambassador Network
UNITED KINGDOM	Science Engineering Ambassador Scheme	Science Engineering Ambassador Scheme
UNITED KINGDOM	Space School	Space School

Activity Type 2 Science centres

Country	Title of scheme
Turkey	Science Centre
Israel	Science Education for Youth People on University Campus
Sweden	House of Science

The Turkish 'Science Centre' is a foundation with partnership within the private and public sector funded mainly through sponsorship and donations. The scheme offers a wide range of activities. The staff work on other projects as well, but around 12 people work on the scheme, mostly coordinating specific mentoring activities.

The scheme from Israel is jointly established and financed by Jerusalem Municipality Educational Department and a foundation. As one type of activity, school classes can visit laboratories which are staffed by PhD students who work for science teachers in the national education system.

'House of Science' located in Stockholm offers demonstrations and experiments within several areas. Beside full-time staff of eight people, 12 coordinators work on part time basis parallel to conducting their own research. There are about 10-15 young researchers who work as science mentors for visiting school classes. The staff also presents their work elsewhere, e.g. in the EU, USA, Asia, as well as in other parts of Sweden.

Activity Type 3 Science promotion

Country	Title of scheme
Belgium	sCite Network – inforsciences
Denmark	Research day
Iceland	Scientist on loan

Under 'sCite', five French-speaking Belgian universities have linked their science diffusion activities and each one has a specific unit devoted to managing such activities and to mobilising personnel from throughout the institutions to participate in the scheme. A wide range of activities (see case study section) are run year round as well as during an annual science week, involving scientists, trainee scientists and children. The scheme focuses on the French-speaking community but the possibility of including institutions from neighbouring countries is being investigated.

The Danish 'Research day' invites researchers, research institutions and research-based enterprises to show how they work. Organizers of the events at local or regional level are responsible for the planning, funding and marketing of their activities. Scientists taking part in the event do this on a voluntary basis.

Under, the Icelandic 'Scientist on loan' scheme, scientists visit elementary schools to promote interest in science and technology. Individual teachers can 'order' a scientist that fit their need. All scientists are employed within either Icelandic Centre for Research **(**Rannís) or a research institute.

Activity Type 4 Science clubs / camps

Country	Title of scheme
Slovakia	Children's University
Hungary	Mentorship programme
Finland	Kids' Club

Slovakia's 'Children's University' is organised during one week in the summer holidays where children can actively participate in different activities. During the first year of its existence, parents had to pay a fee to have their children participating, but only to cover costs for the children. All staff and lectures work beside their normal job for free and the university equipment and facilities have been used in the programme. The organisation is looking for other sources of funding (e.g. sponsorship).

The Hungarian 'Mentorship programme' helps talented high school students to find mentors to introduce them to scientific research in Hungarian universities or research institutes. The scheme tries to foster mentoring activities to Hungarian speaking population in other countries including Austria, Australia, Canada, Italy, Romania, Serbia, Ukraine and the USA. For a scheme in a new Member State, it has a quite large annual budget (100,000 EUR).

Finland's 'Kids' Club' is a combined technology club and research laboratory where children (age 10-17) work together with university students and researchers in computer science. It offers children the opportunity to study topics and learn skills of their interests in a non-school like environment.

Activity Type 5 Class room projects

Country	Title of scheme
UK	Science engineering ambassador scheme
The Netherlands	Jet-Net, Youth and Technology Network Netherlands
Estonia	Young Scientists Association (YSA)

The UK scheme has a wide network across the UK, and works with the business and education sector. Science and Engineering Ambassadors can get involved in a whole range of activities and events, either organised and managed by local point of contacts or they work with other organisations and schemes aimed at enthusing school-age children.

Under 'Jet-Net', programmes are established between individual schools and companies, ideally covering the entire school period. They are both geared to add practical context to the science curriculum. Almost all of the funding comes through corporate sponsorship.

The Estonian scheme by the Archimedes Foundation helps students to find individual supervisors and to carry out their own research and present the results to other students and scientists.

Activity Type 6 Others

Country	Title of scheme
Austria	Children's University Graz
Latvia	Scientific Conference for High School Students
UK	Space school

In Graz four universities have jointly established a project funded through public money and the use of university budgets. The programme provides workshop weeks to children at primary level, where they can participate in discussions, carry out experiments and to philosophise as well as lectures with a specific theme during each semester.

The 'Scientific Conference for the High School Students' organised at school, regional and national level offers young people the opportunity to present individual research projects carried out under supervision of a teacher or scientist. Scientists are involved in the reviews of the more than 500 research projects.

The Scottish Space School initiative is run by the national (Scotland) education authority and invites young people to participate in scientific activities related to Space technologies. 3000 students take part in a competition and some 50 are selected to attend a Space Camp at NASA, Houston, USA. Astronauts and Scientists also visit primary and high schools assisting in science lessons.

3.2.2 Activities focused on girls

Country	Title of scheme
Germany	Girls and techniques
Germany	Girls' Day – Future Prospects for Girls
Germany	MINT – Girls in Mathematic, engineering sciences and techniques

Germany is the only country where schemes especially directed at girls were identified. This could be seen as a response to Germany's particularly low level of women in research. 'Girls and techniques' have been chosen as a case study (see section 4.2). The difference between the three is that 'Girls' Day – Future Prospects for Girls' is organised at national level and is more about career support, while 'Girls and techniques' and 'MINT' are regional and directed to increase interest of girls in natural sciences. There are other schemes, which include activities for girls like the House of Science in Sweden.

3.2.3 Summary of findings from the inventory survey

- **Budget**: One notable difference is that schemes from countries in the EU15 have better financing than the EU10 (new Member States) with annual funding ranging from almost only a few thousand Euros to three million EUR (of those schemes where data on budget was provided or could be identified). It follows the pattern of general lower R&D intensity in the new Member States. At the same there is awareness among the EU10 that there is a need to raise the interest for science careers and new schemes are being established. Even schemes in Western Europe have low budgets (Scientist on loan, Iceland) and many schemes started out without a budget before receiving funding (e.g. Children's University, Vienna).
- **Source of funding**: the most common source of funding is the public sector. There are some schemes where corporate sponsorship is the most important source (National Scientific and Innovation Contest for Youth, Hungary; Children's University Zurich) or private donations (Science Festival, Italy).
- **Human Resources**: probably as a result of the lower budget, discussed above, a large share of the work in the EU10 is carried out voluntarily by scientists in addition to their normal jobs. It represents a kind of 'hobby' for many. Accordingly the number of staff, either unpaid or paid varies considerably. For instance 100 employees of the Ministry of Education are fully involved in the implementation of 'the week of Scientific and Technological Culture' in Italy.
- **Evaluation**: To know if a scheme is effective it needs to be evaluated. Most of the schemes do not have a formal evaluation system in place although a number circulate feedback forms. Some have not been evaluated at all, often because the scheme is too new. Others do plan some sort of evaluation. A number of different tools and variables can be used to assess the success of the schemes:
    - <u>Surveys/feedback forms:</u> many use a feedback form given to children, parents, staff and ambassadors and mentors.
    - <u>Number of participants and visitors, activities and events</u>: is the most common variables measured. An increasing number of visitors or participants is usually considered an indication of success. For those schemes offering activities initiated at the users' request (Usually schools or classes), the number of activities ran during a given time-period relative to previous periods is also used as indicator
    - <u>Longevity of the scheme</u>: longevity can indicate a sustained interest on the part of users and a wide recognition of the merits of the scheme since in most cases, the schemes require external funding and the cooperation of volunteers;
    - <u>Promotion, popularity and publicity</u>. The success of one schemes can also be measured if it has been adopted by other institutions and countries or that interest from outside its zone of influence is demonstrated by media interest or references to the scheme in specialised publications
    - <u>External sources</u>: one scheme stated that they used an external consulting agency for evaluation (Additional plan for the promotion and communication of science and technology, Spain). This type of evaluation is least used, as it is probably the most expensive one.

- Education system 'stamp of approval': a formal recognition of its educational value by the education system is regarded as an indication of success. For example, in Israel evaluation is done by the national education system inspectors, backed by school headmasters and science teachers of those schools.
- Science Olympiads: some schemes used the success of students participating in international science Olympiads (Science Olympiads, Turkey) as an indicator of impact.

The majority of the schemes are too recently established to have produced results with regards to their long-term objectives. The older schemes are well established institutions for which length of existence is often regarded as a sufficient demonstration of continuous relevance. However, evaluation and particularly impact evaluation could be a very useful tool providing the cost to the schemes is reasonable.

4 Case studies

The aim of this study was not to conduct an impact assessment of specific schemes. However, the study has identified sources of expertise and competence and illustrates "good practice" through case studies that highlight and contrast different national approaches. A primary purpose of the case studies was to identify the possibility for promoting an exchange of information, sharing of experience and co-operation between scheme managers at the regional, national and European level.

Ideally, the selection of case studies from the 56 schemes would have been done by selecting those with the greatest impact (e.g. how many young people actually have chosen a science career or pursued studies in science and technology after they have participated in one of the schemes). However, as there was no evidence available to apply this criterion, a number of other factors were used to guide the selection:

- Geographical coverage: to have a representative sample across Europe;
- Schemes operating at local, regional and national levels;
- Number of young people participating in the scheme;
- Type of activity and frequency of activities per year;
- Longevity of schemes: schemes that have existed for a longer period versus newer ones.
- Size of budget /scale of the scheme.
- Number of activities/ staff employed/ volunteers in relation to budget.

The table below lists the case studies selected and a summary of the full case studies, which can be found in annex, is presented on the following pages.

	Country	Title	Type of measure
1	Belgium	sCite Network - inforsciences	Science promotion; Class room projects
2	Germany	Girls and technology	Science clubs/camps; Class room projects
3	Hungary	Mentorship programme	Science promotion / Science clubs/camps
4	Italy	Science Festival	Science Festival; Science promotion; Class room projects
5	Latvia	Scientific Conference for the High Students	Science clubs/camps; Class room projects
6	Slovakia	Children's University	Science clubs/camps
7	Sweden	Young People Speculates	Science days/festivals; Science centres; Science promotion; Class room projects
8	Turkey	Science Centre	Science days/festivals; Science centres; Science promotion; Science clubs/camps; Class room projects
9	UK	Science engineering ambassador scheme	Science clubs/camps; Class room projects

Case-Study 1 : Belgium -Reseau sCite

Created in	2000 (earlier for the science diffusion-units /this is the starting point of their action as a network)
Education level addressed	Both
Geographic area covered	Regional (Communauté Francaise /Wallonie)
Gender Dimension	Addresses both genders. The network includes the increase of female participation in science among its objectives but deliberately avoids gender specific activities and promotion preferring to pay particular attention to the relevance and interest for girls at the stage of designing activities.
Structure & Relationship to Education/Research sectors	Shared concerns of the French-speaking universities science departments and the Regional Authorities about the decreasing number of science students and the decreasing levels of interest, understanding and support for science in general led to the funding of a science-diffusion unit with a full-time coordinator within each science department. The sCite network is the network made of each of those science diffusion coordinators running what is known as a 'science-diffusion units'. Each institution has its own 'science-diffusion' unit as part of their science department. These are known as: - Inforsciences at the Free University of Brussels (ULB) Libre; - Réjouisciences in the University of Liège; - Scienceinfuse in the UCL (Université Catholique de Louvain); - Atout Sciences at the FUNDP (Facultés Universitaires Notre-Dame de la Paix à Namur); - Centre de Didactique des Sciences for the UMH (Université of Mons-Hainaut). The units work on science diffusion addressing the general public but with school-age children as a priority target. The units mobilise researchers who contribute on a voluntary basis. The network is chaired on a rotating basis by the Departments' chair.
Content of activities	"Printemps des sciences", a science festival, is the largest scale event with over 30,000 participants, two-thirds of them children participating through their school class. Smaller scale activities take place throughout the year thanks to funding from the regional authorities and are designed to fit the framework of policy objectives set by the region (language community) government. Examples include: - '*Demain mon enterprise*'? Involves a class, a researcher and an industrial partner and covers aspects of R&D such as careers and role. - '*Sciences au quotidien*' explains the scientific dimension of an industrial process to produce a daily-life item via an experiment - '*Café des Sciences*' – supported by funding from the 'King Baudoin Foundation' focuses on the epistemological issues and includes a 'junior' version for children.

Strategic Objectives and link to policy	The network is, in practice, an instrument of policy implementation for the region but it also initiates activities with other sources of support. Its strategic objectives are in line with those of the region, which in turned are coherent with those of the national 'Lisbon Agenda' reform programme.
Remarkable features	The units embedded in the departments of each of the five large higher education and research institutions of the French Speaking Community means that a team of five coordinators (some of whom with a scientific research background) can mobilise potentially almost all of the researchers of the academic sector and cover 100% of the territory with the full support of education and scientific authorities.

Case-Study 2: Germany – "Girls And Technologies"

Created in:	2002
Education Level addressed	Both (10-14)
Geographic Area covered	Regional (Bavaria)
Gender Dimension:	Addresses uniquely girls. The initiative is the collective brainchild of female staff and students of the Technical University of Munich.
Structure & Relationship to Education/Research sectors:	The agency is legally independent but closely linked to the TMU and the Max Plank institute.
Content:	The agency in partnership with schools has developed teaching tools and approaches that are now used as model by others. It also has a very elaborate programme of training and assessment for mentors. Mentors ("Referents") are in most cases former students/scientists from TUM or a woman who is by her curriculum vitae an example for the girls. All mentors should have a scientific background, but equally important is their awareness of the gender problem. At the start of the scheme, alumni from the university were invited to participate as mentors. Now the mentors are identified primarily in a wider way. They may be scientists, freelancers, employees in industry or on parental leave. While there are both female and male mentors, at present there are only three male mentors.) As a rule, two mentors work together with a group of 12 girls in a project. Mentors receive training by the agency in the educational approach called "Active Learning". This training lasts five days (three days general educational aspects, two days subject specific educational aspects). For "new" mentors, an experience exchange takes place after the first project. This lasts two days. Projects themes are

	rotated among teams of mentors so as to avoid it becoming repetitious.
Strategic Objectives and link to policy:	Objectives and links to policy - to bring girls in contact to sciences and give them the possibility to readapt their ideas about different scientific disciplines; - to stimulate and / or increase interest of girls in sciences and engineering and to let girls discover their attitude towards science and engineering disciplines; - to help them to understand complex scientific and technical thinking and to stimulate with this own scientific thinking; - to lower gender barriers that hamper the access of girls to scientific or technical careers and to provide a counter weight to suggestions in the social environment that girls do not "fit in" science and engineering; - to raise confidence of girls in their abilities from early age on (10 years old) and to support them in sustaining a positive self image; - to increase the share of women studying and working in scientific fields. The scheme preceded government initiatives but the regional and federal authorities are showing growing interest since several studies in 2003-2004 pointed to a shortage of 15000 engineers and growing on one part and lower than average achievements in math and science for German schoolchildren.
Remarkable features:	The scheme is both a buzzing 'creative lab' for the management of mentoring activities and a large-scale pilot project on the renewal of science teaching. As it has been operating for seven years and because some of the children chose to participate every year for as long as it was offered to them, the scheme should soon be able to collect feedback from young adults who participated as children.

Case-Study 3: Hungary - Mentorship programme

Created in:	1995
Education Level addressed	Secondary only
Geographic Area covered	National
Gender Dimension:	Addresses both genders
Structure & Relationship to Education/Research sectors:	In Hungary, there is no specific governance structure for science education. The Mentorship Programme is a separate charity is based on a wide range of stakeholders. Accordingly, because the programme is based on the determination of the stakeholders, the organisational chart is also rather flexible. The Hungarian Research Student Foundation, which manages the programme, is however well connected to the formal education sector and ensures appropriate co-ordination.
Content:	In 1995 a new programme was established in Hungary helping talented high school students to find mentors who introduce them to scientific research in Hungarian universities or

	research institutes. The programme gained an overwhelmingly positive response from the Hungarian scientific community. Among the eight hundred mentors George Olah is a Nobel Laureate, 118 are members of the Hungarian Academy of Sciences, and most are respected professors in their research field. The programme now has mentors in 37 Hungarian towns, in Austria, Australia, Canada, Italy, Romania, the USA and Serbia. The patrons of the programme are Lászlo Sólyom, President of the Hungarian Republic, Bálint Magyar, Minister of Education and Sylvester Vizi, president of the Hungarian Academy of Sciences. Beside the mentorship programme there are other joint activities: scientific student conferences where the students can make a lecture and a professional jury helps them to evaluate their research; summer camps where the best students can get together (sometimes they launch interdisciplinary research as well); conferences for students to develop their skills in different fields such as patents, leadership skills, etc
Strategic Objectives and link to policy:	The scheme did not evolve out of a national or regional political priority or major political programme. It was started by a single professor and it has drawn an unexpected, positive response from professors and researchers. Nevertheless, it clearly contributes to national priorities and in this sense to EU level policy objectives. The mentorship programme set a number of clear objectives from the start and these are still there above and beyond helping high school students to scientific research. These objectives are to provide equal chances to all participating students irrespective of their age, gender, location, financial position, field of research.
Remarkable features:	A key element in the success of the scheme is a step-by-step approach used to select the students interested in joining the programme. This enables the scheme managers to filter the applicants and ensures that the mentors get dedicated students. The different challenges the students need to complete is definitely one of the "to do" factors Another important element has been to include students in the governing body of the programme, ensuring the focus stays up to date. This is essential to satisfy all the "classes" of students for a long time. The third and last "to do" is the devotion of the mentors and high school teachers. Essentially, the scheme managers only have the task to look for the mentors, and indeed, mostly the mentors are pro-active in seeking to join the scheme. The main benefit of the programme is to show students a possible fantastic career pat, which they can seize as long as they are dedicated. The scheme is also a support to and benefits the mentors (in an academic and in a practical way). This means that all the stakeholders join the programme through self-interest, which makes the process a lot easier for everyone involved. The key messages are the following: - the scheme shows the wider society that high school

	students are able to perform high-level research, and this research is useful for both the student and society - It is important to establish a network of future researchers, which is beneficial in a number of ways. For instance, the organisers suggested that such bonds helps to ensure that students return from abroad (mostly America) after a successful grant which is essential to develop their skills.

Case-Study 4: Italy - Science Festival - Associazione Festival della Scienza

Created in:	2003 in its current configuration
Education Level addressed	Both
Geographic Area covered	Regional (Liguria)
Gender Dimension:	The gender dimension is a strategic objective
Structure & Relationship to Education/Research sectors:	The festival takes place in Genoa and in other locations of the Liguria region attracting visitors and participants from all over Italy and Europe. Last year, the third edition of the festival there were 216,000 visitors to the different events of the festival. The total number of events was 250 including conferences, laboratories, exhibitions, and multimedia workshops. The target of the festival is mainly made of students from primary and secondary schools and the themes of the events covered different fields of science and technology. The events of the festival are supported by scientists and researchers from Italian and foreign universities and research institutes. In addition, a large number of young researchers are involved during all the festival as tutors to group of students. The fame of the festival increased during the last three editions. In 2003, 180 events were organised with almost 100000 visits. In 2004, 250 events were organised with almost 165000 visits. In 2005, the 216,000 visits confirm the Science Festival as one of the main dates for the promotion of science and technology in Italy.
Content:	The different activities and exhibitions are run primarily by scientists and young researchers. The scientists and researchers received training and support during the preparation phase of the festival. In addition, groups of young researchers are available for them to help run activities. Young researchers have to attend a brief meeting before the beginning of the festival in order to have also some tips on how to engage with young people. The Associazione Festival della Scienza wants to transform this brief meeting into a school to train researchers as scientific explainers. In fact, the Associazione Festival della Scienza has launched the First Festival School for Students as Science & Society Explainers of Excellence. The school's mission is to train the scientific explainers of the

	future providing young researchers with the fundamental instruments and techniques needed to ensure a good interaction with people. The aims are to create a European team of trained science explainers, a network among festivals, museums, and research organizations, an opportunity for international exchanges of teachers and explainers, and a new sensitivity in the next generation towards science diffusion. The first edition will start in October 2006 involving 80 students (30% expected from elsewhere in Europe) and including seven days, eight hours per day, training in multimedia classrooms, plus 13 days in practical work based experience during the Science Festival. The link with the education system is ensured by formal partnerships with regional directorates of schools. Initially, this relation was only with the Directorate of Schools of Liguria region, but now the Associazione Festival della Scienza has formal partnerships with directorates throughout the north of Italy and with directorate of schools of Lazio region. These partnerships allow the Associazione Festival della Scienza to understand the need of schools in science and technology subjects and so organise events in order to fill educational gaps. On the other hand, schools participate in the design of the festival and also in the preparation phase of the festival. For instance, some events of the festival require a basic preparation for the students. The Associazione provides materials and tutors to schools in order to give this preparation. In conclusion, the relationship between the Associazione and schools is intense and continuous. Attending the festival is now part of the national curriculum and a special event in the school year activities.
Strategic Objectives and link to policy:	The overall aim of the Science Festival is to inspire young people about science and make careers in science and technology attractive for them. The festival operates in the context of growing problems in supplying the Italian research base with an adequate pool of scientists and researchers. These objectives are in line with those of the regional authority to which it is directly linked and those of the national government.
Remarkable features:	This scheme belongs to a well-established type which can be found in several countries of Europe as well as several other regions in Italy. This particular scheme is representative of the popularity of the model. It is also exemplary in two respects: - it is integrated in a nation-wide policy to update science teaching through its setting up of a school to train contributors to festivals - It has been remarkably successful in mobilising the business sector which contributes directly 70% of the budget (2005)

Case-Study 5: Latvia - Scientific Conference For The High School Students

Created in:	1976 (one of the oldest schemes still in existence)
Education Level addressed	Secondary
Geographic Area covered	National
Gender Dimension:	At first glance, Latvia appears to do better on the theme of women in research than most other countries in the EU. However, one of the explanations for a high and rising share of women researchers has been a very low R&D funding for the last 15 years, which incited many male researchers to leave science careers.
Structure & Relationship to Education/Research sectors:	The Conference similarly to most of other major science mentoring activities in Latvia (scientific competitions, camp for young scientists "Alfa", centres for creative technical learning) evolved out of the socialist time – specifically out of school activities for school children in 1970s to provide opportunities for school children to acquire their first scientific skills. The Conference has three main groups of stakeholders: Universities, high school students, and high schools. During the 1990s interest in the Conference increased among all three groups of stakeholders. Each group has a specific reason for increased interest. Universities (University of Latvia, Latvian Academy of Culture, and Latvian Academy of Art) participate in review and evaluation of research projects.
Content:	The main interest of the Universities in the conference is to attract potential students. As the number of higher education establishments increased during the 1990s, competition for the best students among universities has increased. High school students participating at national level in the Conference have better possibilities to learn about their potential field of studies and to establish contacts with professors. Many faculties offer free of charge study opportunities for the future studies of the winners of the Conference, which is important as most university students in Latvia have to pay for their studies. High schools provide different kinds of help for their students in preparing their research projects and participating in the Conference, e.g., supervision, travel costs. For high schools participation in the national level conference is important for their prestige as the results of the Conference are taken into account when ranking of the high schools is prepared. At the moment, the Conference is organised in 21 sections in humanities, social sciences and natural sciences. However, the expansion of the Conference has also led to new management problems. Management has become more difficult especially due to limited resources allocated to the scheme by the State budget. Moreover, due to high interest

	from the stakeholders it is not possible to cut back some parts of the conference (e.g. some disciplines). The ongoing management of the Conference in situation of limited resources is possible because of enthusiasm and personal contacts of the manager who has organised this conference since its beginnings in the 1970.
Strategic Objectives and link to policy:	Although the Conference has been running for three decades, it is in line with the key challenges set out in recent policy documents, e.g. the need to raise awareness of science and innovation among school children. However, the Conference is not included as an activity in the new research policy documents and the interest of policymakers in the scheme is rather fragmented, e.g. the Minister of Education and Science gave an opening speech in 30th Conference in 2006. In short, the development of the Conference is mostly determined by the manager and the stakeholders (professors and teachers at the Universities and high schools) with very little or almost no involvement of the policymakers who allocate limited budget for the scheme.
Remarkable features:	The fact that long established model survives the dire conditions of the R&D sector nationally and the quasi absence of funding available is a proof of the dedication and motivation of those involved from the education and the research sector. The national authorities should consider the opportunity to tap into this remarkable amount of good will and some support should be provided to ensure the survival of this well-established brand and allow it to evolve to better fit the current context wherever necessary.

Case Study 5: Slovakia - Children's University of the Faculty of Electrical Engineering of the University of Zilina

Created in:	2005
Education Level addressed	Primary
Geographic Area covered	Local/Regional
Gender Dimension:	Not explicitly covered
Structure & Relationship to Education/Research sectors:	This is a local scheme which is financially supported by all the stakeholders including lecturers, the University, the schools and the parents. The project manager is the Dean of the Faculty of Electrical Engineering.
Content:	The Children's university (CHU FEE) is organized during the summer holiday. The aim of the "holiday studies" is to attend lectures and laboratory exercises in natural sciences, which are delivered by university teachers in a way attractive to children. The topics of lectures are based on the professional activities of particular lecturers but they are tailored to the age and the interests of children. Contrary to the classical way of studying at the elementary school, children are active participants in these lectures and they work individually and creatively during laboratory exercises. Originally the scheme was planned and run in 2005 for children in the 6-10 years age group. It turned out to be tiresome and difficult for younger children therefore the age for participation was increased to 8–11 years. The Children's University is divided in two stages: the first stage is the study programme "Little Bachelor" for children in the 1st and 2nd years of basic school. After graduation from the 1st stage the children can continue in the following year in the study programme "Little Engineer", which is for children in 3rd and 4th year of basic school. For each stage, it is planned to edit individual colour textbooks, in which all lectures and exercises will be remarked. CHU FEE is based on popularisation of science and technology results through lectures and practical exercises, which are concentrated in one week in the summer holiday (run in the second and third weeks of July). The children are divided into study teams and they participate to both .lectures and experiments led by university teachers and researchers. The lecture themes are centred on the field of electrical engineering, engineering, finance, fire protection and so on, adapted to child's age and interest. In total, 20 lectures are planned, which will be completed by demonstrations in university laboratories. Here the children can test their skills, for example by constructing a crystal set, by creating models, by experimenting with forms. There will be also space for additional questions, so the participants can gain a full understanding about the themes of lectures. For children the field days will be provided in the Transport Laboratory and on

	ŽilinaHričov airport. The children are given a taste of the university atmosphere through a 'graduation' ceremony held at the end of the course.
Strategic Objectives and link to policy:	The scheme is a small-scale project at the initiative of local participants.
Remarkable features:	This type of grassroots initiative is an interesting pilot project testing a new teaching approach for young children (8-11) revolving around detaching technical skills and the understanding of the technology used daily from more conceptual knowledge in math and physics usually taught at a later age.

Case-Study 6: Sweden -Young Minds (Unga Spekulerar)

Created in:	2004
Education Level addressed	Secondary (13-19)
Geographic Area covered	National
Gender Dimension:	Not explicitly covered
Structure & Relationship to Education/Research sectors:	The Unga Spekulerar (US) project specifically aims at creating a dialogue with teenagers and creating a platform of debate and learning on technology and its role in society, inspire teachers to different ways of teaching, contributing to teenagers insight in ways of production and the physical surrounding and how that affects the every day life. A national initiative, the Swedish Technology Foresight, had as one of its objectives to describe and forecast the demand of science and technology competence in the future, and the US scheme evolved out of this initiative. It was noted that most of the experts taking part in the forecast exercise were themselves well into their 40s and 50s, and therefore would not be active when the time of the forecast arrived. It was this that inspired some players behind the technology foresight to set-up a consultation exercise where those who would then be active citizens and decision makers, that is, the young people themselves, contribute to the forecasting. This was the start of Unga Spekulerar. The KK Foundation oversees the scheme, which is made up of a number of initiatives spread over the country. The KK Foundation is the only stakeholder on a national level. The funding goes to 'arenas': local units set up to initiate activities and ultimately aimed at taking over the local management of the scheme in complete autonomy The KK has supported the US scheme since its start with a total of 19.150.000 Swedish kronor, with clear instructions to the arenas that they are expected to find necessary financing when the KK support ends summer 2007. The financing from the KK has, for this reason, diminished over time; full financing of the programme year 1, slightly less year 2, only for the main project

	leader year 3 (FTE until 2005, now 50%). The arenas seem up to the task, but it still remains to be seen to what extent they will be successful in finding alternative sources of income to continue the programme. The arenas are working with local municipalities, universities and companies to get financing. Another issue is whether the US programme will be able to maintain its status as a national scheme; the KK indicate that this is an important element of its success, but that the arenas only have expressed an interest in finding the compensatory funding they themselves need. The resources required to run the scheme as a coordinated, national initiative is for the main project leader. The costs of each arena's staff (educationalists, administrative staff etc) are not on the payroll of the project.
Content:	The key of the method is meeting with "inspiring individuals " (usually scientists) outside school at the "arenas", to inspire the children to start the thinking process. The method also involves face-to-face meetings between students (school classes from different centres), and these are considered as very valuable. There are "creativity sessions" with educationalists working at the arenas; these often include or start with some technology history. The researchers are normally contacted through the arenas, since US does not have the resources or contacts required. The main funder, the KK Foundation, argues that the quality management of mentors or ambassadors is up to the participating arenas. There have been ideas to use researchers from other KK programmes (such as the research profiles), but this has not yet been successfully implemented. At one of the arenas (Lund), a course for doctoral students in presentation techniques has been linked to the US programme – the finale of this course is held in front of the youngsters.
Strategic Objectives and link to policy:	The KK Foundation agenda in this project is to develop "informal learning". For this reason, the KK insisted strongly against the Unga Spekulerar developing into an exhibition– the Unga Spekulerar scheme was to be about processes, not objects. The link with national policy is not a direct one but the scheme may indirectly contribute to Lisbon type objectives.
Remarkable features:	The first unusual feature is the 'dynamic network' structure with a foundation, central at the initial stage but progressively disengaging while the structures created around the country become autonomous (including financially). A second feature is the focus on informal learning, the fact that the scheme is aimed at improving children's understanding and simultaneously giving them a voice and improving scientists and decision-makers' understanding of children's view on the future role of science in their society makes this scheme a revolutionary option. Its output and future results should be interesting to many, well beyond the science field or the national boundaries of the scheme itself.

Case-study 7: Turkey – Science Centre

Created in:	1998
Education Level addressed	Secondary
Geographic Area covered	National
Gender Dimension:	Not explicitly mentioned
Structure & Relationship to Education/Research sectors:	The Supreme Council of Science and Technology (BTYK), the Scientific and Technological Research Council of Turkey (TUBITAK) and the Ministry for Education are the three top government bodies with responsibility in this area. With BTYK involved mainly at a strategic level and policy design while the two others are responsible for implementation. The current scheme is an initiative of TUBITAK. The centre is a building hosting a number of initiatives aimed primarily at raising Children's and young adults' interest in science. Mentoring is one of its activities.
Content:	An average of 150 children participates in summer camps, winter schools and workshops per year. In addition, children visiting the centre directly interact with mentors. An average of 80,000 children visits the centre per year. Such visits take about two hours. Examples of topics covered and activities included: Summer camps, workshops, science fairs, seminars and winter schools cover a wide range of topics including electronics, genetics, space sciences, biology, etc. All activities are implemented in an interactive manner. Mentoring activities each year take place in a summer camp and a winter school; as well as weekend workshops during eight months; a children's festival; 12 science fairs; and four seminars. The target group is children between 7-14 years of age for summer camps and winter schools. Workshops are open to children and youngsters above seven. Each class is formed by an average of 10 children (maximum 15). Winter schools: 15 days/year (during school break); summer camps: 15 days to 1 month; workshops: every weekend between Oct-Jan and March-June. The minimum number of participants required for summer and winter camps and workshops is five and for seminars 10. As noted above, during visits to centres, children visitors and their families also interact with mentors individually. Summer and winter camps focus on more than one subject and centre management chooses them in consultation with advisors and depending on the interests of children. Activities listed above are stand-alone activities. Visitors can also do experiments with mentors during their 1-2 hours visit as part of the exhibition.

Strategic Objectives and link to policy:	The 'Science and Technology Strategy Implementation Plan' (2005-2010) approved by the Supreme Council of Science and Technology (BTYK) list "Increasing and developing S&T human resources" and "Increasing awareness on science and technology (S&T) and developing an S&T Culture" as two of the seven strategic objectives. The priorities linked with these objectives are to implement various programmes to raise awareness and interest in S&T (such as increasing the number of science centres, science camps, and organising S&T days at schools) - increase the number of researchers, - attract young people to studies and careers in S&T, - support young scientists, - design and implement new support mechanisms and awards The scheme is an instrument of the government's science promotion policy, itself based on the abovementioned objectives.
Remarkable features:	This example is representative of the science centre's type of initiative of which there are a number around Europe. Surprisingly, though, only a few were found to run mentoring schemes as a permanent feature.

Case Study 8: United-Kingdom - SETNET

Created in:	1997
Education Level addressed	Secondary
Geographic Area covered	National
Gender Dimension:	Raising female student's interest is a strategic objective. This is reflected in the choice of science ambassadors.
Structure & Relationship to Education/Research sectors:	The organisation responsible for the scheme is SETNET. Through its network of local SETPOINTs across the UK, SETNET works with businesses and education bodies to promote science and technology subjects among young people. A national manager is in charge of the overall management of the Science and Engineering Ambassadors programme and spends the 50% of the working time on science ambassadors programme. Regional managers, who are employees of the 50 SETPOINTS across the UK, manage the scheme. They also spend 50% of their working time on the management of the programme. Regarding financial resources, the total budget for the period 2005/2006 has been 2.7 million Euros. Roughly a quarter (23%) has been spent on staff and overheads, the remaining 77% for mentors, ambassadors, and overheads. This budget is completely covered by public money. In fact, the programme has received considerable support from the government. A 2002 report "Investing in Innovation" (HM Treasury, DTI, DfES) made a number of recommendations for improving science and technology awareness through SETNET. Empowering the role of science ambassadors in schools was one of these.

	The SETPOINTS and the regional managers promote relationships with the education system regionally. There are two types of relations. - The first type is with the primary and secondary schools. The SETPOINT has periodically exchanges with the schools of the region or area. The main aim is to involve headmasters and teachers in organising lessons, workshops, seminars, and laboratories experience with the ambassadors. - The second type of relations regards the recruitment of ambassadors from universities and colleges of further education. The "Science and Engineering Ambassadors Programme – Progress Report" published in 2004, at the beginning of third year of life of the scheme, is the only monitoring exercise developed in order to evaluate the output and the performance of the scheme. However, the report is based on a qualitative analysis of the scheme because it proved too difficult to give a quantitative measure of the impact of the programme.
Content:	The scheme consists of visits of ambassadors to classes. The main commitment of the Science and Engineering Ambassadors is to inspire and excite young people about the possibilities of science, technology, engineering, and mathematics subjects and careers. Scientists and engineers are sent into primary and secondary schools to share their enthusiasm for science, to enhance and enrich experiences of pupils in science, engineering, mathematics, and technology, and to break down stereotypes about researchers and scientists. Ambassadors are drawn from all walks of life, from the smallest owner managed businesses to the largest multinationals. They also include scientists, researchers, undergraduate and postgraduate students from universities and research institutes. The types of activities are numerous: young apprentices assisting at Saturday morning maths clubs, working with science clubs using practical demonstrations and experiments, mentoring students in different technologies such as IT, leading technology challenge days in primary schools throughout the UK. In the first two years of the programme life, over 6000 volunteers joined the programme. They were employees of almost 500 organisations. Considering the increased success of the programme, the current number of volunteers could have doubled.
Strategic Objectives and link to policy:	Directly connected to the Government for which it is an instrument of policy implementation. As such, it is also connected to the Lisbon Agenda
Remarkable features:	A textbook example of a national ambassador scheme with a very elaborate management structure

5 Conclusions and guidelines

This study has provided a first European wide survey of science mentoring and ambassador schemes at national and regional/local levels. The preceding sections of this report have identified a number of 'good' practice science mentoring and science ambassador schemes across Europe as well as collecting baseline data and information on as wide a number of existing schemes as possible.

5.1 Conclusions

While the strategic importance of science mentoring and science ambassador schemes is increasingly recognised...

The survey of 33 countries and the more in-depth case study analysis confirm that while the concepts of science mentoring and ambassador are not always well understood, the need at a strategic level to boost children and young people's interest in science (as a career) is being given increasing attention. The Commission's own estimate about the need to educate and make available in the European labour force up to 1.2 million additional researchers by 2010 in order to be match the additional financial resources fixed by the Barcelona (3% GDP on R&D) objective certainly contributes to this pressure.

Various survey participants pointed to the opportunity for a more comprehensive European policy intervention in this field and indicated their interest in receiving feedback on the result of the current study as a means of feeding into, supporting and stimulating a debate on developing or expanding mentoring and ambassador activities at national and/or regional levels.

The absolute number of such schemes remains very limited...

As noted in the introduction, the scope of the exercise has been limited to schemes, which bring school children in direct contact with practicing scientists or innovators, or with people who have worked in science. In an initial phase, the study identified barely 100 plus schemes. On average, the survey team were thus able to identify an average of only 3 schemes per country (across all 33 countries surveyed).

In a second step, the schemes identified were then tested using the key criteria of 'direct contact with practicing scientists or innovators, or with people who have worked in science'. This resulted in the retention of **only 56 schemes in 25 countries** on which detailed information was then collected (see inventory in annex). This amounts to on average only 1.6 schemes per country (retaining the full denominator of 33 countries).

And the public investment and scope of activities is sub-critical…

On the basis of the available evidence, only a very few schemes have reached a level of funding and a longevity of activities to consider that they provide reliable evidence on ‘best’ or ‘good’ practice. These would include the UK’s **Science Engineering & Ambassador scheme** and the **sCite network** in French speaking Belgium.

Most schemes have very low annual operating budgets and extremely limited human resources for management, depending on volunteers from the scientific or education sector to animate activities. The mobilisation of additional corporate or charitable resources is still under-exploited, although there is recognition that particularly for corporate donations there is a need to avoid conflict of interest.

There are few or no national level organisations providing a structured and organised promotion of science mentoring or ambassador activities. Again the UK and French speaking Belgium cases are significant exceptions to this rule. The competent national authorities in France are known to be studying the creation of a national programme. Otherwise, schemes identified tend to be either on the initiative of individual (notably educational) institutions or ‘pilot actions’, such as the Swedish KK Foundation’s support for **Young Minds (Unga Spekulerar**, US).

The potential impact of science mentoring and ambassador activities is significant…

There is a potentially large positive impact of science mentoring in terms of all three issues/ areas of concern identified in the introduction of this report, namely: interest for; understanding of; trust in scientific research among children and, ultimately, in the population at large.

The potential impact of increasing public support for science mentoring and ambassador extends to the education sector, the research sector, and influencing public opinion on the relevance and performance of these two sectors as well as on scientific activities and careers, in general.

Academia with its dual affiliation to the education sector and the research sector is central to any future development in science mentoring and ambassador schemes.

but very little is known about the success of schemes in boosting the popularity amongst young people of science as a career….

An initial difficulty in appraising the success of identified schemes is that the majority are relatively new (established since 1997-98 and notably since 2001). A second issue is that almost without exception the schemes have failed to put in place a ‘self-evaluation’ process allowing monitoring of the career paths chosen by children who have participated. At best, they enquire about the satisfaction of participants.

More positively, some clear guiding principles for establishing successful schemes can be identified…

Based on the case study evidence, the structure of successful schemes is built around three key features:

- a direct participation and personal commitment of the highest authorities in the academic institutions bringing direct access to policymakers and to their counterparts in the education sector and the regional or national administration necessary to quickly finalise co-operation agreements and remove administrative hurdles.
- a core team with the know-how, the expertise and the seniority level necessary be simultaneously a creative lab, a sounding board, and a management team along with the skills to network and mobilise others.
- Locating this core management teams of science mentoring or ambassador schemes in geographic, if not institutional, proximity to the research, educational or industrial partners from which mentors or ambassadors are drawn appears also to favour more active involvement of such 'volunteers'

The music tutor analogy for science mentoring and ambassador activities[14]

At the operational or content level, a clear basic principle for successful science mentoring can be proposed using the analogy of different approaches to teaching music:

- one option for stimulating children's interest in learning music is to avoid at an initial stage to force them to learn how to read music but rather involve them in playing with different instruments under the guidance of a seasoned musician;
- In a similar way, in science mentoring or ambassador activities the aim should be to awaken the interest of children in the wonder of scientific discovery and the potential of science as a career path, without submerging them with scientific facts.

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[14] "*When Subotnik looked at music students at New York's elite Juillard School and winners of the high-school-level Westinghouse Science Talent Search, she found that that Juilliard students generally realised their potential more fully because they had one-on-one relationships with mentors who prepared for the challenges they would face after their studies ended.*

Most of the Westinghouse winners, on the other hand, went on to colleges where they failed to find mentors to nurture their talents and guide them through rough spots. Only half ended up pursuing science, and few of them with distinction".

From 'How to be a genius'. David Dobbs New Scientist, 16 September 2006
Quoting the work of Dr Rena Subotnik,Director, Center for Gifted Education Policy at the American Psychological Association

5.2 Guidelines for promoting science mentoring & ambassador activities in Europe

The terms of reference asked the study to propose guidelines in support of the development of the Commission's work programme, notably with a view to future science & society actions in 7th Framework Programme. The following guidelines are based on the findings of this study and particularly on the case study analysis.

5.2.1 Strategic guidelines

- The need for a European level action plan for science mentoring and ambassador activities

Science mentoring and ambassador concepts are poorly understood and codified to date. An action plan at European level (potentially in the form of a communication with a broader remit on science education and mentoring for young people) with the aim of setting a number of common objectives for increasing the financial resources being devoted by public authorities to this area as well as stimulating a debate on key issues highlighted by this study.

- Avoiding reinventing the wheel by support for either a European network of science mentor/ambassador practitioners and dissemination activities

Whilst this study found only a limited number of directly relevant publicly funded and structured schemes, it is clear that mentoring or ambassador activities are also carried out on an ad hoc basis or as part of broader ranging science festival, science centre, or science awareness campaigns. It is important that a push at European level to incite public authorities at national or regional level does not result in a multiplication of sub-critical initiatives. Equally, the opportunities for trans-national learning from existing good practice cases is large and should be exploited through either a network (at least part funded by the Commission) or the launching of specific pilot projects on themes or techniques related to science education and promotion for children where existing science mentoring/ambassador programme managers could in turn 'mentor' emerging schemes in other countries or regions.

- Public funding for science mentoring and ambassador activities should be expressly aimed at leveraging additional financial and human resources into such activities from the educational, research, charitable and corporate sectors.

The experience to date of science mentoring and ambassador schemes suggests that this is a field where a relatively small public investment can result in the mobilisation of significant resources (not always financial but also the in-kind contributions through time of scientists and industrial researchers). All the sectors concerned have, or should be made aware of, an interest in motivating children to pursue scientific careers (the educational sector to improve teaching of science at school or increase numbers of young people pursuing scientific courses at third level, the corporate sector due to the increasing skills mismatches in certain technology fields, etc.). To date this has been pursued at a level of individual initiatives and rarely led to a sizeable commitment by the non-public sector. Even large and fully funded schemes such as the UK example are now recognising that there is a need to attract additional funding from non-public sources if the scheme is to continue expanding and attracting qualified mentors and ambassadors.

The ability to leverage the existing resources and mobilising the energies of the European academic and corporate sectors is central to future developments of mentoring activities. This ability is a subtle and fragile mix involving appropriate organisational structures allowing the rapid mobilisation of a large number of actors and a large amount good will (the Italian or Hungarian case studies underline this). In regions eligible under the Structural Funds, the use of EU funds to extend successful pilot or local examples of science mentoring to less-favoured regions should be explored.

5.2.2 Pre-conditions for national science mentoring and ambassador schemes

With a view to increasing the number of schemes operational, Member States should be encouraged, if not required, to draw up a national strategy based on a wide-ranging consultation with a view to promoting scientific careers amongst young children. As part of this strategy development, they should further review the existing schemes, individual initiatives, etc. identified through this study with a view to learning from experience and consolidating what exists before launching additional or competing schemes.

The analysis suggests the need to combat the ‘fragmentation’ of the current schemes without imposing over top heavy national structures which stifle initiatives at local level. Additional longer-term financial support is necessary in order to extend many current initiatives which are based on the voluntary efforts of ‘enthusiastic scientists’ shows which are vulnerable to individual choices or circumstances

Hence, science mentoring and ambassador schemes should have a national or regional level super-structure. This does not imply that all schemes should be highly centralised or dominated by national ministries. However, from a number of points of view (recruitment of mentors/ambassadors, exchange of experience, marketing and scale of events and activities), there are good reasons to favour at the very minimum a network coordinator of more local initiatives (the sCite network is a good practice example here).

Science mentoring and ambassador schemes should be established based on a multi-annual funding framework to avoid professional uncertainty, and hence lack of motivation, for the scheme managers; and incite scientists and researchers as well as participants to view the activities as a recurring rather than one-off exercise. This condition implies that the schemes should be set clear operational and strategic objectives with respect to the means allocated. It also implies that the schemes should be subject to a process of internal and external appraisal to allow adaptation or discontinuation of the scheme depending on performance.

The need to develop some quantitative baseline data on schemes to allow measuring both the level of real commitment of resources and the results achieved needs to be given due attention. Such indictors could include scientist-pupil contact hours as a measure of commitment, statistics on pupils (sex, ethnic or social backgrounds, returning students, etc.), number of children who have participated to a scheme pursuing third-level education science courses, etc.. The study was not able to collect a wide range of statistics, although the case studies do offer some insight into such quantitative issues. For instance, in the UK Science & Engineering Ambassadors scheme, over 6000 volunteers joined the programme, they were employees of almost 500 organisations. In the German case studies, the ratio of mentors to girls is one to six – two mentors typically working with a group of 12 girls.

5.2.3 Operational guidelines for implementation of schemes

Science mentoring and ambassador schemes should ideally be based on a partnership of equals between the various actors involved at the implementation level (scientists and teachers for activities focusing on schools for example). Equally, all actors should ideally be involved or at least consulted in the design of the activities.

Schemes should be built around a combination of 'inspirational examples' (the ambassador technique) and 'active learning' (processes rather than 'exhibitions', experiments or activities leading to a practical outcome, explaining technologies in their form as useful everyday applications, etc.) through mentoring. Awarding the children diplomas at the end of their participation or registering them as "university students" (following the example of the Children's University in Austria or Slovakia), should also be considered as forms of incentive which help children to be motivated.

Science mentoring and ambassador schemes should take appropriate account of the need to increase the number of female researchers and of their potential impact on disadvantaged groups (ethnic origin and socially). The study has highlighted that most schemes integrate the gender dimension without always applying appropriate mechanisms to ensure gender equality. Similarly, the social dimension needs to be reinforced in order to avoid focusing uniquely on 'best performers' (schools or children).

Integration of mentoring activities by 'real scientists' into 'science exhibition centres', which tend to be staffed by non-specialists, could be another road to follow creating stronger links between these important tools for awareness on science and the actual scientific community.

A code of ethics and practice is required to ensure that children and young people participating to schemes as well as the adults acting as mentors or ambassadors are not placed at risk personally or professionally[15]. This should cover a series of issues related to adaptation of health and safety codes of laboratories to account for presence of non-professional staff, vetting of backgrounds of mentors and ambassadors (with the risk as in the UK that the bureaucratic process dissuades some volunteers), etc..

[15] A working group of scheme managers, mentors and representatives of children's interests could be established to draft a European Code of Conduct for Science Mentoring and Ambassador schemes. The model of the European Charter for Researchers' Code of Conduct for the Recruitment of Researchers could be applied.

Mechanisms for 'rewarding' mentors and ambassadors for the time they, generally, volunteer need to be included in schemes. Acknowledging for instance the time spent mentoring as a valid activity of a researcher and taking it into account at the recruitment or promotion phase is important[16]. In the UK scheme, staff from companies were considered to be gaining important personal and professional developments skills while acting as mentors and ambassadors. Without over-formalising the recognition of this work, a national prize for the 'most inspirational scientist' as part of an annual science for children event, publications presenting cases of science mentors/ambassadors or specific media attention for participating scientists, etc., all offer ways of recognising and 'morally rewarding' the people who become involved.

[16] Again, this is fully in line with the European Charter for Researchers, notably whereas number 7 "*Enhanced and more visible career prospects also contribute to the building if a more positive attitude towards the researchers profession, and thereby **encourage more young people to embark on careers in research***" of the Commission Decision; and the general principle on Supervision and Managerial duties which calls on researchers "*to devote particular attention to their multi-faceted role as supervisors, **mentors, career advisors**, leaders….*".

European Commission

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This report is the outcome of a study aiming to identify and disseminate best practice in science mentoring and science ambassador schemes across Europe. The study focused exclusively on those schemes involving direct interaction between children and scientists. The terms of reference defined three objectives:

1. Produce an inventory of such schemes in Europe;
2. Propose a limited number of examples of good practice allowing a representative coverage of the different types of schemes and operational approaches to delivering mentoring and ambassador activities.
3. Formulate guidelines based on findings, notably from the qualitative information gathered on the existing schemes.

Geographically the study covered 33 countries: the 27 Member States of the European Union (EU), Turkey (one of the candidate countries) and the associated countries to the EU (Iceland, Israel, Liechtenstein, Norway and Switzerland).

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