ANNEXE

ANNEXE 1:
"WHAT YOUNG PEOPLE SAY"
SUMMARY OF AVAILABLE SURVEYS

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Outlook on scientific and technical professions - CSTI Grenoble – France - 2004

This recent paper (October 2004) is based on the quantitative part of a study conducted with young people between 14 and 18 years old in France (Grenoble area). This study used a questionnaire aimed at questioning young people vision of science studies and sciences careers. Moreover some questions were designed to understand what factors could constitute an obstacle in choosing science studies. 801 questionnaires were collected.

Main conclusion points

- The results show a large diversity in representations and opinions
- Science studies are often perceived as long and difficult.
- But these points do not seem to be the decision factor. The choice of non-science studies is generally linked to a lack of interest for science fields and/or a professional project that does not involve a need for science qualification. The reason for the expressed lack of interest remains an open question.
- The study shows that the surveyed people do generally not have a precise knowledge the careers opportunities offered after science studies

Dream :Youngsters and their professions: dream and reality – Belgium - 2002

Belgian survey conducted in 2002 on a thousand lower secondary students from both French-speaking and Flemish-speaking communities.

Main findings:

- Answers to what they want as a future profession are strongly gender-differentiated : girls chose sectors with more emphasis in contact and values while boys chose sectors where they can develop a specific know-how and acquire recognition for that
- They want their future job to give them autonomy for action, numerous and varied contacts and the opportunity to take responsibilities.
- 9 respondent out of 10 say that having passion for their profession is important to them. This is one of the four values most quoted by the respondents
- among the criteria for the choice of their future profession, they quote first the fact that it correspond to their abilities, second the fact that they are passionate about that, third the number and variety of contacts.
- More than half the respondents plan to be self-employed
- Their first fear in relation with their future profession is to experience unemployment while what they fear the least is the practical aspects of their profession such as hours, hierarchy, and workload.
- half the respondents say that what would influence their choice would be meeting with people working in the sector they are interested in.
- When asked about the actions they would like to be taken to help them choosing their future profession, the main actions quoted are, by rank of importance: meeting professionals out of the school, visiting companies, meeting tertiary education institutes and universities, internships, meeting professionals at school.

Choosing science at 16, *the influences of science teachers and careers advisers on students' decisions about science subjects and S&T careers* - NICEC project report - Munro, M & Elsom, D – UK - 2000

Methodology: 155 questionnaires filled by careers advisers (belonging to 7 private companies) and six 2-days visits in different schools.

Main findings:

- students' perception: biology is fun, chemistry is dull and physics is difficult". Maths are useful but difficult

- common, and not misplaced, perception that physical science subjects are more severely graded at A-level

- wider range of "new" A-level subjects now on offer (particularly those with apparent vocational connections) were also thought by science teachers to disadvantage the traditional science subjects

- The national curriculum was seen by science teachers in all the case-study schools as placing time pressures on GCSE courses and also as squeezing out extra activities designed to motivate pupils and increase their awareness of the applications of science in society and in the workplace. In addition, thsy suggested that stringent health and safety regulations, together with larger classes had decreased the opportunities for pupils to have hands-on experience in practical work. This, and the constant requirement of assessment, were thought by many staff to have removed some of the fun and interest from science classes.

- On the whole, science teachers did not feel able to keep up with the careers & employment in S&T: there was a "career person" to do this. The teachers were worried about giving incorrect information.

Public Opinion Survey on Science and Technology and Society, Cabinet Office, Government of Japan (2004, in Japanese),

Results of 2004 National curriculum achievement survey – elementary and lower-secondary schools, NIER (2005, in Japanese)

Results of survey on students' motivations toward science learning – national situation, Ogura (2005, in Japanese)

TIMSS 1999 – Japan - 2004

- Younger generations have less positive perception towards the social utility of S&T than older generations do. In a public opinion survey in 2004, 58% of 18-19 yrs responded affirmatively to question 'New problems in society will be solved by S&T', while 64% of 20-29 yrs, 69% of 30-39 yrs, over 70% of 40-69 yrs did so.

- However, school children recognize science as important for the development of nation. About two thirds of students at every grade from 5 to 9 responded affirmatively to question 'Science is very important for the development of nation'(NIER, 2005).

- Few students think that learning science relate to becoming wealthy. About 10% of students at grade 5-12 responded affirmatively to question 'Person become more wealthy by learning science.'(Ogura, 2005).

Scientist is not expected as the job of high income for youngsters.

- Young people have few chances to know about scientists and their life. Consequently they hold low level of interest in what scientists are. In a national survey in 2005 (Ogura, 2005), 70-80% of students at grade 5-12 answered that they have never had a science lesson in which a scientific expert come to your school and talk about science. 20-30% of students at grade 7-12 responded affirmatively to question 'I want to listen to scientists or engineers'.

Students who have had a lesson/lessons by a scientific expert tend to respond more affirmatively to the question than students who have not.

- Bright students in S&T courses often choose medical sciences or law and business courses at tirtially education level.

- In national surveys (NIER, 2004 and 2005), proportions of students who responded affirmatively to question 'Learning science is important regardless of entrance examination' were 59% at grade 6, 49% at grade 9. At grade 12, the proportions became lower; 34% in physics students, 24 % in chemistry students, 35% in biology students, and 29% in earth science students.

- In the TIMSS in 1999, the proportion of 8th grade Japanese students responded affirmatively to the question ‘I would like a job that involved using science’ was only 19% and the bottom among all the participated countries, while the international average was 55%. As for the question ‘Do you think that science is important to everyone’s life?’, the proportion of 8th grade Japanese students responded affirmatively was 40% and again the lowest of all participated countries, while the international average was 83%.

- More than 80% of Japanese 8th grade students answered science as a not easy subject, and this was the highest among 23 countries in the TIMSS 1999, while the international average was 50%.

- At high school level, 33%, 82%, 75% of students choose introductory physics, chemistry, biology course, respectively. Physics course is kept away the most among these subjects. Among the students who chose each introductory course, 32% of students in physics, 54% in chemistry, 15% in biology answered that they disliked the subject the most in all science subjects they learned. Chemistry course is disliked the most among three subjects. (Ogura & JST, 2005)

Talking about leaving - Seymour, E. & Hewitt, N. - USA - 1997

US National 1990’s data show that students who started in SME programs switched to non-science majors within two years of taking their first college science or mathematics course to the tune of 40 % in engineering, 50% in biological and physical sciences and 60% in mathematics. In order to understand why students of above-average ability are leaving SME programs, the authors conducted a three-year (1190-1993) seven-campus study of college juniors and seniors.

According to the authors, the most common reasons for leaving the sciences stem from the "structure of the educational experience and the culture of the discipline." They cite poor teaching, and a pedagogical style dictated by "weed-out objectives" as the primary reasons that above-average ability students lose their motivation and morale for S.M.E. programs. Their data show that improving the quality of the learning experience is also the most important factor in retaining women and students of color in S.M.E. programs. They found no evidence to support the common contention that attrition is the result of class size, inadequate lab and/or computer facilities, poorly-trained teaching assistants, or foreign-born faculty and teaching assistants with poor language skills. Interestingly, the data show that inadequate high school preparation cannot be used as a criterion to distinguish the above-average ability students who leave S.M.E. programs from those who complete S.M.E. programs. (see table below)

The authors offer precious few solutions to the problem, but this is understandable since their findings are predicated upon complex interrelationships between our academic and societal systems. Their most compelling proposal is a fundamental change to the "weed-out" culture common to S.M.E. programs. They argue that faculty should shift the objectives of introductory courses from selection to education. They also propose that S.M.E. faculty draw upon the pedagogical and program evaluation knowledge of education faculty to improve S.M.E. courses. Although collaboration with education faculty can be of great value, the current system of promotion and tenure at most colleges and universities does not provide the incentive to pursue these relationships.

Selected Extracts:

“about one third (29%) of switching decisions from S&T to non S&T subjects and 43,1% of all switchers’ concerns reflect reservations about the kinds of work that will be available, and the lifestyles that these careers may imply. 21,1% of SME seniors students also expressed anxiety about these issues.”

What students are rejecting?

“A dominant (and growing) concern among SME undergraduates was that the work available to graduates – particularly to those without a higher degree – would not be fulfilling, enjoyable, or have a worthwhile purpose. They worried that the only work available to them would be at low levels of responsibility and autonomy, or would demand time and commitment at the expense of other valued life interests”.

“ For switchers, these thoughts often came late in the process of discovering the actual nature of the majors and the careers to which it seemed to be leading. Their projections were not necessarily well-founded, but they were often powerful enough to prompt or reinforce the discussion to leave.”

“Some of these conclusions were reached as a consequence of student work experience, including internships; some were influenced by contacts with working professionals; and some were derived from observation of the work of academics.”

“ However, S&M switchers generally had much less clear ideas about the nature of the work they might do – other than academic work- than did the engineering majors. This was particularly true of switchers from mathematics, whom we consistently found to have least sense of direction about their careers. Both current and former mathematics majors complained that, from high school onwards, their advisors promoted mathematics as a flexible major which would open doors to a variety of careers. However, they had found difficulty in getting concrete information about career options, either from career counsellors or from mathematics faculty. On every campus, we encountered a number of mathematics switchers (predominantly female) who were high achievers, both in high school and in college, but had been unable to find satisfactory career goals in mathematics”

“S&M switchers, whose reasons for rejecting their majors included career and lifestyle concerns, gave more complex, diffuse reasons for their decision than did engineering switchers. They described their search for a balanced lifestyle, in which work was an important (but not the dominant) factor. They valued work for its intrinsic satisfactions and the social purposes it served, rather than for its material rewards. Some rejected the lifestyle that careers in corporate science (included those in the defence industry) connoted for them”

“In describing the nature of the work available to graduates, switchers in all SME majors drew upon a set of myths and stereotypes. We found the same set of beliefs strongly represented on every campus and across all SME disciplines. The mythology included images of scientific workers as automata doing solitary work in confined, sterile, prison-like surroundings. Work was imagined to be intellectually dull, repetitive (“brain-numbing”) and defined by unknown others in a remote organizational hierarchy. Working conditions were conceived in terms of long hours under stressful conditions with little job security. Metaphors of entrapment, life sentences and solitary confinement permeate the descriptions”.

“students imagined that, in order to pursue SME careers, they would have to embrace a persona which was alien to their own personality. They portrayed engineers, especially, as dull, unsociable (often materialistic) people who lacked a personal or social life and were unable to relate comfortably to non-engineers. They were also portrayed as uncreative people, who avoided or decried the idea of a broader education. Some thought the science tended to attract people who already had these personality traits. They also saw themselves and their peers beginning to develop these undesirable characteristics as a consequence of the lifestyle they were constrained to adopt in order to survive in the major.”

“The truth, or otherwise, of these perceptions and projections is not the issue. However distorted they may seem to SME faculty or field professionals, they matter in so far as they contribute to the loss of students whom SME departments might prefer to retain.”

“What students are looking for?”

“First, they sought work which was intrinsically interesting, and where often prepared to settle for lower material rewards in order to do it".

"second, they looked for work that served a social purpose of which they approved"

"teaching was consistently portrayed as an "alternative or "deviant" career, which a handful of switchers and non-switchers pursued despite the disapproval of faculty, family and peers"

"We have consistently observed that women find it easier to give themselves permission to reject a conventional, materially-focused career path in favor of an 'alternative' career based on intrinsic interest, self-development, altruism, or the need for social interaction.(…) However, here it is important to reflect that one reason why SME majors seem to be less attractive to women and to many students of color, is that they are seen as offering an insufficiently congenial (or worthwhile) career or lifestyle."

"As we intimated in the previous section, switchers are also looking for what seems to them to be a healthy balance between their work and the rest of their lives"

"We commonly heard that more people would follow their inclination to teach were the pay or prestige of the profession better, or were it less time-consuming and expensive to undertake an education qualification on top of a baccalaureate degree."

"students frequently made invidious comparisons between the enthusiasm and good pedagogy of their former high school teachers, and what they viewed as the poor skills of many college faculty and their failure to inspire students interest. They quickly learned that teaching was viewed as an inferior form of professional activity by SME faculty, though not necessarily by faculty in other disciplines."

"students also saw teaching as a form of professional activity that was undervalued by the wider community. It seemed to pay poorly compared with other options, and family and peers tried to dissuade them from choosing to teach"

"There was no doubt in the minds of that fifth of our overall sample who had considered teaching as a career that their ambition was regarded as deviant by most of the significant people in their lives"

"Profit-to-grief ratio"

The author concludes it is very difficult to come through the complexity of the reasons as this is a mix of pro and cons that makes the basis for the decision.

Eurobarometer: Europeans science and technology - 2001

A total of 16 029 people - June 2001.Representative sample of the national population aged 15 and over in each Member State.

General trends

- Overall positive perception of science and technology (despite recent crises and the fact that science is also perceived as a kind of Pandora's box)

- Compared with 1992 the average scientific literacy is stable

- Europeans have high expectations about science and technology but...

- Science and technology are no longer considered a panacea for a series of problems
- Interest in science slightly lower, in relative terms, than in 1992 (sport scored higher than science)

A gap between science and society

- 45% of Europeans feel they are neither interested nor informed about science and technology
- Two thirds feel not well informed

Science and the medias

- Scientific and technological developments are often presented too negatively (36.5% agree)
- Most journalists dealing with scientific topics do not have the appropriate background or training to do so (53.3% agree)
- I rarely read articles related to science and technology (60.6% agree)

The public and the scientists

- Scientists have a strong but ambiguous image (knowledge is power!). Europeans are divided on the issue of scientists' responsibility: 42.8% agree and 42.3% disagree with the statement « Scientists are responsible for the misuse of their discoveries by other people»
- Demand for reinforced control: 80,3% feel « the authorities should formally oblige scientists to respect ethical standards»
- BSE: industry is taking most of the blame. 74.3% say the agro-food industry is the main responsible
- Crises can strengthen science and its image, as well as the image of public research. Scientists have been called in and they will be the ones to repair the damage. Crises of this kind can also strengthen science and its image, as well as the image of public research underpinning this kind of work

A specific case: GMOs

- With regards to genetically modified food, 94.6% want to have the right to choose
- 59.4% say «GMOs may have negative effects on the environment»
- No "knowledge/education effect": although it is generally observed that the more knowledge people have the more favourable they are to scientific and technological progress. This not true with GMOs. People interviewed could have a high level of knowledge and still believe that biotechnologies should be subject to more control and demand more safety studies, etc.
- In this case information is not enough and could even be counter-productive

Science and the young people

- The perception of science is no better or worse among young people than among the public as a whole
- According to the people interviewed, causes for declining interest in scientific studies and careers are as follows: science classes at school not sufficiently appealing (59.5%); scientific subjects too difficult (55.0%); young people less interested in scientific subjects (49.6%); career prospects not sufficiently appealing (42.4%)
- 60.3% of Europeans feel «the authorities should try to resolve this situation»

Rethinking science and Society - Ekos – Canada - 2004

Public Opinion survey – 2000 Respondents

- A majority of Canadians believe strongly in the advantages of an education and a career in science. More than three in four Canadians (77 per cent) would recommend a career, and an even greater proportion (84 per cent) would recommend post-secondary studies in science to their own child or young relative.
- A majority of Canadians believe learning opportunities in both math and science, and in the social sciences

and humanities will help make young people more employable. However, there is a clear lean toward math and science being of greater benefit in the workplace: 77 per cent believe the social sciences and humanities increase employability, while fully nine in ten (89 per cent) believe that education in math and science makes young people more employable.

- A large number of Canadians (57 per cent) believe that young people do not get enough

exposure to science in elementary and high school to develop an interest in a career in science. Only about one in three (36 per cent) feel the level of exposure in elementary and high school today is sufficient.

- A large proportion of Canadians (58 per cent) also express concern that Canada will not have enough scientists and engineers to meet its scientific research needs in the future. Looking at the differences by age group there is again a significant generational divide between Canadians 30 years of age and younger, and those between 31 and 64 years of age.

- Canadians are largely divided on what they believe is the main barrier to getting young people more interested in scientific studies and careers. “No funding” and “lack of appeal of science” lead a sizeable list of identified barriers, but neither broke the one in five mark nationally, coming in at 17 per cent and 16 per cent respectively.

SAS – Svein sjoberg - 2002

9300 children from 21 countries at the age of 13 answered a questionnaire with closed and open-ended questions.

S&T-related Experiences

• Children in all countries have a wealth of experience that may be of relevance for the learning of S&T, but there are great variations between countries and between girls and boys.

• In all countries, boys have considerably more experience that is related to mechanics and electricity.

• Children in developed countries have more experience with (costly) new technologies. In these areas gender differences are rather small.

• Children in all countries have considerable experiences with household technologies (preservation and storage of food, knitting, sewing, making mats and baskets) – although the contents varies. Most activities are girl dominated.

• Boys have somewhat more experience with S&T-related tools.

• Girls and boys have similar experience with reading scales and using measuring devices.

• Children in the Nordic countries have more experience with outdoor-life (making fire, setting up tents, using binoculars etc.) than children in other parts of the world.

• Experiences with animals are male-dominated in developing counties, girl-dominated in developed countries.

• The use of guns and rifles is strongly boy-dominated, and with the Nordic countries on top.

S&T-related Interests

• Children in developing countries express an interest in learning almost all topics related to S&T, while children in developed countries have less interest and are more selective.

• Children in Japan are less interested in S&T topics than children in other countries. Their lack of interest in cars and modern technology is striking.

• Girls in all countries are more interested than boys in learning about health, nutrition and most aspects of biology.

• Girls and boys in all countries are interested in learning about earth science, the weather and natural phenomena.

• The difference in interests between girls and boys vary from topic to topic, but are generally largest in the

Nordic countries and Japan.

• In developed countries, the least popular things to learn about seem to be issues relating to plants and animals in their immediate surroundings and neighbourhood.

• The most popular S&T items are often spectacular or relating to natural phenomena (life in the universe, extinction of dinosaurs, earthquakes and volcanoes).

• The interest in particular science content vary strongly with the context in which it is presented, and this may be a key to a gender fair S&T curriculum

Perceptions of Science and scientists

• Children in developing countries have a very positive image of scientists, and this expressed in a variety of ways.

• Many children in developed countries have a negative and stereotyped image of scientists. ('The crazy scientists')

• Children in all countries consider science to be useful for everyday life and for society – although children in developing countries are far more positive. Gender differences are small.

• Few children in developed countries seldom consider scientists to be kind or helpful – while this view prevails among children in developing countries.

• Very few children, in particular girls, consider science to be easy to learn.

• Japanese children find science less interesting and more difficult than children in other countries. (But they score higher on international tests!)

Job priorities

• Girls in all countries are more person-oriented (helping people, working with people etc.) than boys.

• Boys in all countries are more ego-oriented (earn money, become famous etc.) than girls.

• Girls and boys have similar priorities related to 'self-development' and 'time and job security'.

• Children in the Nordic countries are more gendered in their priorities than children from other parts of the world

• In developing countries, many children want to be scientists

• The popularity of possible areas for future work varies. The most popular is biology (for girls), earth science (for both) and technology (for boys). The least popular is physics.

Pupils's views of the role and value of the science curriculum : a focus-group study

J. Osborne, S. Collins, International journal of science education 2001

This paper is based on a study on 20 focus groups conducted with 144 16-year-old pupils in England.

Extracts:

Page 441-442:

"On the negative side, many pupils perceived school science to be a **subject dominated by content** with **too much repetition** and **too little challenge**."

"From a more positive perspective, pupils saw the study of science as **important** and were **engaged by topics where they could perceive an immediate relevance**, **practical work**, **material that was challenging and high-quality teaching."**

pages 460-464:

"Missing for far too many pupils, from far too many of the topics they were taught, were those vital ingredients**: relevance and greater autonomy**"

"The data here suggest that the diet offered by science courses of a content dominated nature such as that found in the English and Welsh National curriculum is **both insufficiently varied and overwhelming"**. In a **climate of 'high-stakes' assessment** where many teachers feel compelled to cover the entire content to maximize their pupils chances of success, the experience is too rushed, forcing teachers to use techniques such as 'copying' (…) The other unintended effects is the **elimination of anything extraneous of a time consuming nature** such as practical work or opportunities for discussion. Yet it is exactly the components that are highly valued and prized by pupils for the interest they generate in the subject."

"(our data) confirm(s) the critical value and significance to pupils of the opportunity to experience physical phenomena first-hand – the opportunity to engage in **apparent autonomous discovery**"

"The issue of **repetition** (through the years) also need to be addressed. (…) A strong finding from this research is that neither the need for repetitions nor the distinction between current and previous approaches is self-evident for pupils. (…) Teachers need to be more aware that the repetition, within the existing spiral structure of the curriculum is a point of disengagement for many pupils"

"The other message we see in this data is that **teacher 'read' from the increasing plethora of national curricula, prescribed scheme of work, or prescribed text-books that their professional judgement is not to be trusted".**

Factors affecting students' choice of science and engineering:

Woolnough B. International journal of science education, 1994

This research paper is based on a questionnaire survey conducted on 1180 18-year old students. The research investigated differences between the scientists and the non-scientists in terms of the preferred science learning activities, the factors they found encouraging and discouraging and their personality traits. It also noted different patterns between the pure scientists and the engineers and between the different types of scientists.

P 664:

"It appears that many of the able students in the physical sciences continue with their physics and chemistry into HE for the love of the subject, not for career reasons. The applied scientists, the engineers and the biology medics were more career motivated".

"For those who had made a decision towards, or away from, a career in science and engineering, many had done so before the end of year nine, age 14th. At the one extreme 38% of the future physicists had decided on a career in these fields by the age of 14, while at the other 42% of those who were to do badly at science and go on to the arts side had made the decision away from science and engineering by the age of 14. Only 22% of the engineers, and 22% of the able non scientists, had made up their mind by this time"

" Most decisions were made just before or just after GCSE. Of those who were to become engineers, 44% made de decision in the 6th form [i.e. between 16 and 18], after they had decided to continue with A-levels in the physical sciences."

P 666:

" The potential scientists and non-scientists had significantly different views on a number of aspects of their science activities. The scientists valued more the opportunity to plan their own experiments, thought that learning scientific facts and theories was more important, thought that extended practical projects showed them what science was like and got them more interested in it, valued the well-structured lesson more and had found involvement in S&T competitions to be more good fun (perhaps the non-scientists had not experienced them). There was some evidence that the non-scientists had had less good work experience in science-based industry, which could turn people off jobs in Science and engineering.

P 669- 670:

"The factors that have been more influential on the future scientists were the quality of the science teaching and the personal encouragement given by science teachers, the practical nature of science lessons and the intellectual satisfaction of doing science, the likely job satisfaction in science and engineering and scientific hobbies and fiddling with gadgets at home."

" When factor analysis was applied, 6 strong groupings were demonstrated (…). This is important as it shows that different types of students are influenced by quite different factors.

One group, especially the engineers, are influenced by **extracurricular activities** such as speakers and visitors, links with local industry and science clubs and competitions.

Another group, especially the future physicists and chemists, are more influenced by **the way that the science in taught in class**. They are influenced by the teachers, the quality of the teaching, and the personal encouragement given, by the nature of the subject, its practical, human and intellectually stimulating nature, and by the department's good exam results.

A third group, especially the engineers and the chemists, are influenced by **career aspirations**, and encouraged by the status, the salary and the job satisfaction of a career in science or engineering.

A fourth group, including physicists and engineers, are attracted by **external factors**, the family background giving experience of the local science-based industry and encouraging scientific hobbies, and being impressed by sophisticated technology.

A fifth group, especially the physicists and chemists, finds the **difficulty of the subject** and the amount of work involved a positive aspect – unlike many others, who find the subject difficult, they find the subject easy and therefore not entailing much work.

A final group, especially the engineers, are encouraged by **the case of entry and the possibility of sponsorship for HE**.

It is clear that we are not going to find one single factor which is universally influential; different students are persuaded by quite different factors."

P675:

" Perhaps the strongest message (…) concern the importance of both the quality of the science teachers and extracurricular activities in scence as encouraging factors for career decision. The former, with high-quality, stimulating subject teaching in class and personal encouragement outside it seem to be particularly influential for the pure scientists who whish to continue with their subject into HE. The latter seems to be especially important for future engineers, for whim science clubs and competitions, and links with local industry through speakers, visits, and work experience were especially influential."

"Why students choose physics, or reject it" Woolnough B. Phys. Educ. 1994

This paper is based on the results of the ACOST study on pre-16 and A-level students (1990).

About sciences: "they commented on the heavy content demands of the courses and the sterile, impersonal nature of much of that content."

"Girls in particular reacted against the impersonal and abstract nature of the physical sciences at A-level, wanting their studies to have relevance to their lives and to environmental issues".

"The sciences were often perceived as being difficult subjects, requiring particular skills which you had either got or you hadn't".

"Students welcomed the active learning and the project work being encouraged in some other, non A-level, courses"

« Attitudes of students towards careers in science and technology were as depressing as they were predictable : in the UK careers in science and technology were seen as having low status, relatively low pay and modest career prospects"

" The structure of the 16-19 curriculum in England and Wales, in which students are forced into premature specialization by having to choose only three or four subjects, came in for much criticism from the students and the teachers. It was only those students with a high commitment to science by the age of 16 who opted for the sciences at A-level; others who were uninterested or agnostic towards science made irreversible choice of subjects which, subsequently, precluded them from a career or HE course in science."

"The feedback from the students concerning their A-level courses, in physics and chemistry in particular, was especially worrying. They were perceived as being very difficult, heavily content-loaded, very dull and demandin passive reception rather than active involvement with the learning process. Coming after their GCSE courses, with their emphasis on process rather than content, and ways of using information rather than mere acquisition of knowledge, the A-level courses were a rude shock."

Arbitrage academic/vocational.

"In contrast with the work their supposedly less able friends were doing in vocational , BTEC or work experience courses, the A-level content dominated courses were seen as increasingly unattractive. The hard divide between academic and vocational courses was seen as untenable, the A-level sciences being academic and dull, the newer BTEC or Design and Technology A-levels tackling real problems, and demanding personal involvement and commitment."

ANNEXE 2:

SUMMARY OF A FEW STUDIES ON REMEDIES

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1. STUDIES ON MOTIVATION

A theoretical framework for the study of motivation

Adar - 1969

Interest points: Four motivational "needs": the need to achieve, the need to satisfy curiosity, the need to discharge a duty and a need to affiliate with other people. Students who most strongly exhibit each of these needs are described as achiever students, curious students, conscientious students and sociable students respectively.

2. EVALUATION OF KINDS OF REMEDIES

“The impact of Science Centers/ Museums on their surrounding communities: summary report”

Context for the paper: Study initiated by a group of 13 Science Centers, under ASTC and ECSITE, to d synthesis of the results of numerous studies on their impact.

Interest points:

The study distinguish 4 kind of impacts: personal, societal, political and economic impacts.

Within personal impact, 5 kind: science learning, changed attitudes to science, enjoyment, career choice and otl

- **Impact on science learning**: no direct impact as immediate learning outcomes are weak but a strong and persistent indirect impact as “increased interest and enjoyment of post-visit activities constitute extremely valuable learning outcomes (…) that persist over time”. Several studies emphasis the limits and the flaws of methods used to measure impact on learning and understanding, suggesting that the actual impact might be higher than the one measured and showing a **need for methodological improvements**. Particularly, the autl express his opinion of a need for “more long-term studies of the impact of science centers on individuals”
- **Impact on career choice**: the author indicates some references (Woolnough, Coventry, salmi, Siegel) th would have shown the existence of an impact but no more detail.

3. EVALUATION OF SPECIFIC ACTIONS

Stimulating Science and Technology in Higher Education

Rand

Context for the paper: Study on 6 countries: Finland, Sweden, Germany, Italy, Ireland & UK. Focused on actions on Higher Education. Objective of the study: establish the key factors that influence the enrolment figures, based on trends analysis.

Interest points: Analyzed best practices: Specialization (UK), more practical orientation (Ireland), "remedial" year (Sweden)

Changing the subject

Innovations in Science, Mathematics and Technology education

Black & Atkin, OECD 1996

Context for the paper: Result of a six-year study in 13 OECD countries focusing on 23 case studies with th to evaluate innovations and draw from them general and reusable knowledge about what can work.

Interest points:

Changing the subject:

- Emerging conception of science and mathematics

Science has been for a long time taught as a dispassionate and objective process. A change described i book relates to the fact science is more and more taught as a human process and thus differ significantly bet individuals and contexts (science at university/in companies/government agencies…).

A special emphasis is put on the social nature of scientific enterprise with the interactions between the scie and between the scientists and the society.

Recruiting female students to HE in mathematics, physics and technology - An evaluation of a Swedish initiative

National Agency for HE, Stockholm – 1998

Context for the paper: Evaluation of the 1992 Swedish government's initiative to attract new groups of students to MDT university programmes. Under this initiative, an annual grant of 5 million Swedish crowns was allocated over a 3-year period "with the aim of attracting new groups of students to university programmes where male, middle-class students are in majority". Two directions were indicated for action: to broaden the recruitment of students and to enhance the quality of teaching by encouraging new teaching methods, more adapted to the new categories of students

The presidents of universities and institutes of technology were invited to take part in a national competition to get these funds. 5 development projects received about 3 to 3,5 million crowns each :

1. *Scientific problem solving in mathematics, physics & environmental sciences* - Master of Science - Stockholm university
2. *The project Programme in mathematics, mathematical statistics and physics* Stockholm university
3. *The IT Programme* - Master of Science - Linköping University
4. *Reforming the Computer Science and Engineering Programme, D++* - Master of Science - Chalmers University

Women in Engineering Education : 3 sub-programmes (Computer engineering, Energy and

5. environmental engineering, innovation & design) - University of Karlstad

The 3 first programmes have been created in the framework of this initiative, while the 2 last are reengineered versions of former ones.

Common points between these programmes:

- Common ambition to recruit new groups of students to the programmes, female students in particular.
- Aspirations to adapt the teaching methods to these new groups of students. Two notions summarised the pedagogical ideas as they were expressed in the interviews with the teachers and project leaders:

  • the notion of the self-directed learner

  • the notion of the social character of learning (emphasis on social interactions & collective work forms, emphasis on dialogue as a strategy for surmounting single-subject perspectives & integration of knowledge from different subject areas; praxis oriented perspectives versus research oriented)

Results:

Enrolment

- The programmes 4 (D++) and 5 (computer engineering) performed the lowest with female participation of 19% & 15%
- The programmes 1 (*Scientific problem solving*), 3 (*The IT Programme*) & 5 (, innovation & design)performed best with rates of 56%, 49% & 45%
- It is noticeable that the lowest performers are reformed programmes while the others are new: it could be easier to attract women to programmes that do not have any history nor tradition
- It is noticeable too that the higher performers included in their admission procedure the writing of short biographical essays on applicants motivations. This did not alter the admission results but the evaluators believe it may have had an impact on the applications themselves as an incitative factor ("**policy marker**"). These reconsidered procedures explicitly valorise communicative skills which are not traditionally associated with S&T subjects.

Drop out

- In all the programmes but one, the drop out rate is significantly higher among female students

Comments:

- Getting more women in a programme cannot be taken as success evidence in itself as the programme value (academically and on work market) can be devaluated compared to others.

4. OTHER PAPERS WITH RELATIONS TO REMEDIES

Primary Teachers' Understanding in Science and its Impact in the Classroom

Wynne Harlen

Research in Science Education, 1997, 14 pages

Context for the paper: Scotland - Research report - Interviews to explore teachers understanding of science. The relationships among the variables of confidence, understanding and background in science are explored.

Results.

"what emerged was a series of strategies that teachers used to cope with low confidence in their ability to teach science. These included:

1/ avoidance – teaching as little of the subject as possible

2/ keeping to topics where confidence is greater – usually meaning more biology than physical sciences

3/ stressing process outcomes rather than conceptual development outcomes

4/ relying on the book, or prescriptive work cards which give pupils step-by-step instructions

5/ emphasising expository teaching and underplaying questioning and discussion

6/ avoiding all but the simplest practical work and any equipment that can go wrong"

" The findings of this and other research (…) leaves little room for doubt that increasing teachers' own understanding is a key factor in improving the quality of teaching and learning science.

At the same time it must be borne in mind that the reason why understanding is needed is not so that teachers can convey factual information didactically to pupils. Rather it is so mat they can ask questions that lead children to reveal and reflect on their ideas, so that they can avoid 'blind alleys" so that they can provide relevant sources of information and other resources, so that they can identify progress and the next steps that will take it further. These things cannot be done if teachers don't understand the ideas they are aiming for.

Hopefully this recognition of the subtle role of teachers' own knowledge will deter a panic response to try to fill primary teachers with dozens of facts when what they need are the big ideas, the broad understanding that will enable them to guide children's learning. The aim cannot be to enable teachers to know the answers to all the questions children may ask. This would not only be impossible, given the creative curiosity of young children, but often inadvisable when children would not understand the answer. What teachers need to have et their finger tips are strategies for handling children's questions and turning them to the advantage of investigative learning. They also need sources of information and a level of general understanding that facilitates quick and effective use of these sources. Again, this points to understanding of broad principles, the big ideas, that enables use of their professional skills."

Comments: file is not available

Changing pupils' attitudes to careers in science

Woolnough Brian E

Context for the paper: An open-question survey among 654 11-16 year old students in 6 UK comprehensive schools in 1996. Objective: "to find students' opinions of why some people go into jobs in science and engineering (…) and why other do not"

Interest points:

- The pupils opinions:

Competition between careers: *"for many, a decision not to pursue a career in science was not so much a negative vote towards science so much as a positive vote towards another career"*

Social status: *"It was interesting to note that those who expressed an opinion about the salary and the status of jobs in science did so in very positive terms. For most students aged 11-16, jobs in science are seen as well paid, secure and of good standing in the community. The oft-quoted view that jobs in science are seen as having low pay and low status has been derived from previous surveys of atypical, selective groups of very able (sixth form) students who are able to consider alternatives in careers as law, medicine and accountancy – careers outside the imagination of the majority of young people"*

The sort of science done in schools: "the percentage of girls who say that the sort of science done in schools makes them less likely to go for a job in S&T rises from 34% in year 7 to 83% in year 11".

Students reaction to practical work in science lessons: *"Many, indeed most, say that they enjoy it but that may hide the fact that they do not like the alternative, which would be writing and doing other more difficult tasks. Even so, for those who enjoyed their practicals and want 'more experiments please', there are those who 'don't find the experiments very interesting', believe that ' the experiments have obvious results' or '..never work' and feel that they are put off science 'because we don't do any investigations on our own, and it's all set down step by step. That is not investigation, just copying'. Clearly practical for its own sake is not an inducement to continue with, or to like, science. Practical work needs a specific purpose and needs to allow students some degree of personal freedom both in selecting their investigations and in the manner of its execution."*

What young people like in science: *"More fundamental reasons for studying science, and considering a career in it, were shown in the intrinsic satisfaction of '...findings out things' and the more altruistic 'ability to do something useful'. 'The chance to discover new things and improve the world' (...) There is evidence that these aspects of science could be stressed more in school science."*

Image of S&T and S&T professionals: *"There is clearly a need for conveying a less stereotypical picture of what scientists do in their work, for many express very simplistic, often quite false views. Comments such as 'I want to work with people and scientist don't do that', 'I think engineering is a man's job', ' I want to be a nurse and so don't need science', suggest that there is still much misunderstanding about what careers in science entail".*

A change around 15 years old? "Many start their secondary career by seeing jobs in science as being interesting, well paid and useful. They enjoy their school science, especially the practical work. Five years later, many – especially many girls – have lost that enthusiasm, that enjoyment (that innocence?), and their belief that they would find a scientific career interesting and possible"

What extra-curricular factors they say attract them towards a job in science: TV programmes (17%), a relative in science (5%), projects and competitions (3%), visits, museums and lectures (4%), hobbies (5%).

- Author's opinion on what can work:

Four motivational "needs" (Afar 1969): the need to achieve, the need to satisfy curiosity, the need to discharge a duty and a need to affiliate with other people. **Four kind of students**: Students who most strongly exhibit each of these needs are described as achiever students, curious students, conscientious students and sociable students respectively. **Each of them with a preferred learning style.**

A specific attention must be put to handle diversity. The author points out that a single kind of policy cannot address the motivational needs of the different kinds of students.. *" We often seek to find the one most effective teaching strategy to motivate all students. But there is no such single way. Different people are most strongly motivated by different things. This statement, almost self-evident when we reflect upon it in the light of real students that we teach, has enormous and fundamental importance in the way we deal with young people. What motivates one pupil towards science will have the opposite effect on another. Some pupils will be motivated by intellectual challenges in science, others will find such aspects impersonal and irrelevant. Some will find the practical work stimulating, others will find it unnecessarily dull. Some like the security of formal, structured teaching, others prefer the more high-risk approach of open-ended projects. Some will be more motivated by elegant abstractions. Some will want to work with people, some will want to work with artefacts or ideas. This diversity will be a central theme in the analysis of those factors which motivates pupils towards a career in science."*

How to handle this diversity?:

The **"scatter approach"** : provide a large rang of teaching strategies throughout a course in which any kind of student will be able to find '*at least some occasions in which they will be particularly motivated'*

The authors favourite: the "**switch on and let go approach**". *"there must be occasions where the studen given freedom to work , to tackle the science in their own way. Only then, can each student really responsibility for their own learning and have genuinely meaningful learning experiences. We must set the we must motivate the students to want to tackle the task in hand, and we must give them space to let them work in the way best suited for them"*

Factors affecting Student choice of career in S&E: parallel studies in Australia, Canada, China, England, Japan, and Portugal

Woolnough Brian E & Al. , 1997

Context for the paper: Parallel studies carried out in 6 countries to investigate the factors that influence school students towards careers and HE studies in the physical sciences or technology. A questionnaire survey supplemented by students interviews, all focused on students in their last year of schooling. Students are called "scientists" for the ones planning to study and work in S&T and "non-scientists" for the others.

Interest points:

The study reveals "differences between scientists and non-scientists in regards to their preferred learning styles, to the broad factors which were influential in their career choice and their perception against different personality styles".

"In all countries except Australia, those aiming to continue with their science were of higher ability than their peers".

"In all countries except Australia, potential scientists saw science more as about doing than knowing, preferring more the process approach than the content approach to science."

"The factors that were more influential for potential scientists related to **the quality of science teaching**, **supportive mathematics teaching**, the **intellectual satisfaction and level of difficulty in school science**, **involvement in science competitions**, **the likely job satisfaction, status and salary in science** and the **influence of scientific hobbies at home**".

"Certain characteristics of the scientists are common across the different countries. Scientists, compared with non-scientists, perceive themselves as more introvert than extroverted, more task-centred compared with people-centred, more tough-minded than tender-minded, more interested in ideas than in people, more loners than gregarious and communicate better in diagrams than in words. (…) **The distinctive features of the traditional stereotype of the scientist look likely to be repeated into the next generation of scientists."**

Letting girls speak out about science

Baker D

Journal of Research in Science Teaching, 32, 3-27; 1995, 24

Context for the paper: USA - research report - A qualitative study on girls feelings about science

Interest points: "the girls liked learning science in an interactive social context rather than participating in activities that isolated them such as independent reading, writing, or note-taking. Those who chose science careers were drawn to them because of strong affective experiences with a loved one and a desire to help"

A summary of major influences on attitudes towards achievement in science among adolescent students

Simpson RD

Science education, 74 (1) 1-18, 1990, 18 pages

Context for the paper: US - Research report

Interest points: Conclusion from their longitudinal study: the way students feel towards science and their achievement in science at the tenth grade level is "a strong predictor of subsequent science achievement in high school". Moreover they say "Science self concept at the tenth grade level is a good predictor of both number and type of science courses a student will take during high school."

"What this research and this model may say the most clearly is that student feeling towards science at the tenth grade level may serve as a profound influence on both an individual's future knowledge of and commitment to science"

"students in this study, by the end of the tenth grade, exhibited near neutral motivation and attitudes toward sc and for the most part, did not elect to take chemistry, physics and other courses in science.

Enrolment trends in school science education in Australia

Dekkers J

International Journal of Science Education, 2001, 13 pages

Context for the paper: Australia - Changes have been made in the provision of science education at primary and secondary education, in recent years. The paper aim to assess their impact. It must be noted that the change was the result of a national initiative while the education system is state and territory based.

Framing choices: a longitudinal study of occupational aspirations among 13-16 year olds

Furlong, A.

Journal of education and work 12, 21-36, 1999, 15 pages

Context for the paper: UK

Interest points: “while males and females tend to aspire to very gender-specific occupations, ideas about the suitability of occupations are formed at a relatively early age and overall levels of change are quite small”

"While occupational aspirations and expectations are shaped by a number of factors, confidence in one's academic ability is highly significant and it appears that by the age of 13, young people have developed fairly clear ideas of their position in the academic hierarchy" (...) " when young people have a high degree of confidence in their likely attainments, aspirations remain high irrespective of social class or area of residence"

"While both aspirations and expectations tend to decline over time, ideas about the suitability of occupatio formed at an early stage and overall levels of change are quite small" (...)”if efforts to broaden the occupa horizons of young women are to be successful, intervention needs to be considered at an earlier stage tha traditionally been the case. In this context, our research highlights a need to begin careers education in the pr school.”

ANNEXE 3: SUMMARY OF REMEDIES

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1. Remedies by target group

		Pre-school	Primary school	Secondary school	Tertiary level	Teachers	Intermediaries	Parents	General public	Adults (for Adult education)	Women and minorities	The political system, local level	The political system, government level	Business &Industry
1.	La main à la pâte													
2.	Tertiary level education with economic support for adults													
3.	The technical-scientific basic year													
4.	NOT													
5.	Radboud													
6.	Sinus													
7.	Women give new impetus to Technology													
8.	Rika Daisuki School													
9.	Science High School													
10.	Science partnership programs													
11.	Science team K													
12.	Europhysics fun													
13.	Promoscience													
14.	Let's talk science													
15.	Actua													
16.	Crystal													
17.	Computer class for women only													
18.	Scientific degrees project													
19.	University fees reduction													
20.	University reform													
21.	Ciencia viva													
22.	Yearly call for proposals for projects for the popularization of STI													
23.	Technology at school for the 21th century													
24.	Giant, giant													
25.	Chip, chip, chip, hurray													
26.	Eye Openers / a taste of your future / future breakfast													
27.	ICT platform for pupils and teachers													
28.	Environment meeting programme / Tessenderlo													
29.	Campaign "do not stay behind, follow sciences"													
30.	The great sEXPERIMENT													
31.	Flemish Science Week													
32.	Educational experiment boxes campaign													
33.	"About Life"													
34.	LUMA													

		Pre-school	Primary school	Secondary school	Tertiary level	Teachers	Intermediaries	Parents	General public	Adults (for Adult education)	Women and minorities	The political system, local level	The political system, government level	Business &Industry
35.	Teacher in-service training													
36.	The development and Information network – Luma centre													
37.	Action plan for Flanders													
38.	Fedichem													
39.	Agoria Vlaanderen													
40.	Multimedia award													
41.	Promotion of Young People into Science & Engineering													
42.	Science Korea													
43.	Deltaplan													
44.	A mapping of production and employment													
45.	Integrating Technology in Primary Education													
46.	Jet-Net													
47.	Redesign in prevocational, secondary vocational and higher professional education													
48.	Chemistry in context													
49.	A selection of NSF initiatives													

2. Remedies by topic

		National policies & action plans	Job opportunities	Employment pattern	Teaching material	Teaching practice & curriculum development	Pedagogical tools /assessment	Involvement of industries	Teachers training	Status of teachers	The transitions	gender issue	minorities	Role models	Public outreach	Resource centres	Summer schools…	Top students
1.	La main à la pâte																	
2.	Tertiary level education with economic support for adults																	
3.	The technical-scientific basic year																	
4.	NOT																	
5.	Radboud																	
6.	Sinus																	
7.	Women give new impetus to Technology																	
8.	Rika Daisuki School																	
9.	Science High School					?												
10.	Science partnership programs																	
11.	Science team K																	
12.	Europhysics fun																	
13.	Promoscience																	
14.	Let's talk science																	
15.	Actua																	
16.	Crystal																	
17.	Computer class for women only																	
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23.	Technology at school for the 21th century																	
24.	Giant, giant																	
25.	Chip, chip, chip, hurray																	
26.	Eye Openers / a taste of your future / future breakfast																	
27.	ICT platform for pupils and teachers																	
28.	Environment meeting programme / Tessenderlo																	
29.	Campaign "do not stay behind, follow sciences"																	
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		National policies & action plans	Job opportunities	Employment pattern	Teaching material	Teaching practice & curriculum development	Pedagogical tools /assessment	Involvement of industries	Teachers training	Status of teachers	The transitions	gender issue	minorities	Role models	Public outreach	Resource centres	Summer schools…	Top students
	Week																	
32.	Educational experiment boxes campaign																	
33.	"About Life"																	
34.	LUMA																	
35.	Teacher in-service training																	
36.	Luma centre																	
37.	Action plan for Flanders																	
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43.	Deltaplan																	
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45.	Integrating Technology in Primary Education																	
46.	Jet-Net																	
47.	Redesign in prevocational, secondary vocational and higher professional education																	
48.	Chemistry in context																	
49.	A selection of NSF initiatives																	

3. Remedies by type of action and by axe

	Image	Careers	Curricula	Teachers	Gender and minorities	Other
Communication	5.Radboud 12.Europhysics fun 15. Actua 21.Ciencia viva 24.Giant Giant 28.Environment neeting pprogramme / essenderlo 29.Campaign “do not tay behind, follow ciences” 31.Flemish Science Veek 33.“About Life” 42. Science Korea	21.Ciencia viva 28.Environment meeting programme / Tessenderlo 29.Campaign “do not stay behind, follow sciences” 44. A mapping of production and employment 46. Jet-Net		4.NOT	30.The great sEXPERIMENT	
Innovation and pedagogical tools			1. La main à la pâte 2. Tertiary level education with economic support for adults 3.The technical-scientific basic year 5. Radboud 8. Model schools 9. Super Science High Schools 10. science partnership programs 11. Science team K 15. Actua 25.Chip, chip, chip, hurray 27.ICT platform 32.Educational experiment boxes campaign 42. Science Korea 45.Integrating Technology in Primary Education 46. Jet-Net 47. Redesign in vocational education 48.Chemistry in context	1. La main à la pâte 4.NOT 5.Radboud 6.Sinus 11. Science team K 23. TOS21 25.Chip, chip, chip, hurray 27.ICT platform for pupils and teachers 32.Educational experiment boxes campaign	17.Computer class for women only 2. Tertiary level education with economic support for adults	
Incentives / call for proposals	13.Promoscience	13.Promoscience	45.Integrating Technology in Primary Education	4.NOT 13.Promoscience	2. Tertiary level education with economic support for adults 13.Promoscience	16.Crystal 19.University fees reduction
Reforms			3. Technical-scientific basic year 20.University reform (Italy)			
Coordination, mutualisation, Network	10.Science partnership rograms 14.Let’s talk science 21.Ciencia viva 26.Eye Openers	5.Radboud 26.Eye Openers 46. Jet-Net	14.Let’s talk science 21.Ciencia viva	4.NOT 6.Sinus 14.Let’s talk science 23.TOS 21		36. Luma centre
Financial support	21.Ciencia viva		21.Ciencia viva	4.NOT 23. TOS 21 35. teachers in-service training		
Other	40. Multimedia award	7. Women give new impetus to technology		15. Actua	7. Women give new impetus to technology 15. Actua	

Action plans:

Japan: (see 8. 9. & 10.) Science Literacy enhancement initiatives

18. Scientific degrees project (Italy)

21. Ciencia Viva (Portugal)

22& 37. Yearly call for proposals & Action plan for flanders

34. LUMA Joint national action

41.Promotion of Young People into Science and Engineering – Korea

43. DeltaPlan – Netherlands

49. NSF Initiatives

4. Summary of Available remedies notes

	Name	Country	Type of action	Written by
1.	La main à la pâte	France	Volunteer teachers have been trained and given support to teach science in a more practical and interactive way. In 2000 a countrywide programme for the "renewed teaching of S&T" was launched by the minister of education, based on the experience gained during the operation "la main à la pâte".	V. Hemmo
2.	Tertiary level education with economic support for adults	Sweden	Financial support (grants and loans with favorable conditions) given to targeted people (adults having not studied in S&T, 28-48 year old, full employment for at least 5 years). A total of 10 000 students have benefited from this support.	V. Hemmo
3.	The technical-scientific basic year	Sweden	Objectives: Giving "second chance to choose science studies" to students having elected other fields at high school. For this, a special year has been set up to permit students that didn't study science at high school to build the science knowledge they need to be admitted in tertiary level science courses. Number of students: from the start a total of 30 000	V. Hemmo
4.	NOT	Sweden	The project has for instance supported: - in-service training of teachers and teacher trainers, - series of seminars for teacher trainers at the university institutes of education, - regional conferences on science education in cooperation with the National Resource Centres, - parents´ meetings called "the active parents´ meeting" - specific studies on related subjects The project has established regular contacts the local districts, to encourage local activities in the SciTech field. Publication of a magazine, named NOT-bladet, on a regular basis, targeted to people working in the SciTech field.	V. Hemmo
5.	Radboud	Netherlands	- PR policy: Communication / Image - Tutor system, Innovation of courses offered, formation of clusters: Innovation / curriculum - Introduction of new teaching methods and of specialization options: innovation / Teachers - Intensification of contacts with the business world : coordination / careers	V. Hemmo
6.	Sinus	Germany	This federally sponsored program was set up in August 1998 in 15 "Bundesländern" (federal states) and aims to establish permanent quality development practice in schools. In this pilot program, teachers develop their lessons autonomously but with academic support. They cooperate in regional networks where they plan, discuss and evaluate their teaching strategies	C Kerst
7.	Women give new impetus to Technology	Germany	An organism collecting funds and developing projects related to the promotion of women in technology. Among projects and campaigns realized or coordinated by them: "career orientation day for girls", "be.it and be. Ing (information about the jobs profiles and degree courses in IT and Engineering), teacher@D21 (stimulating teachers contacts with companies in order to improve their career guidance ability).	C Kerst
8.	Rika Daisuki School /Model	Japan	Part of the national project called "Science Literacy Enhancement Initiatives" In designated schools, promotion of comprehensive S&T education with	Y. Ogura

	Name	Country	Type of action	Written by
	Schools		focusing on observations and experiments, enrichment of elective subjects and advanced learning (Elementary and junior High schools)	
9.	Super Science High School	Japan	Part of the national project called "Science Literacy Enhancement Initiatives" Special programme focus on science, mathematics and technology, with emphasis on cooperative measures with universities and research institutes.	Y. Ogura
10.	Science partnership programs	Japan	Part of the national project called "Science Literacy Enhancement Initiatives" Funding of selected programmes aimed at providing opportunities for secondary schools students and science teachers to gain familiarity with the frontier S&T researches and products	Y. Ogura
11.	Science team K	Denmark	Scope: One secondary school and 17 surrounding primary schools in a minor provincial town, Kalundborg, have been selected. Goal: to increase recruitment from primary school to science in secondary school, and from secondary school to university studies in the fields of science, medicine and engineering. The focus is on the teaching of physics and chemistry. Actions: A spectrum of remedies are implemented, partly inspired by the Ciencia Viva experience, including funding of teachers' innovative ideas. 65 science teachers are actively engaged. Local industrial companies are involved.	Nils andersen
12.	Europhysics fun	Denmark	EuroPhysicsFun is a bottom-up initiative that establishes groups of edutaining students at European universities performing outreach activities. The shows have huge success. EuroPhysicsFun offers a complete package containing workshops, disseminating communication, and performance tools to the local "satellites", and tools to attract local funding. EuroPhysicsFun satellites are connected in web based and human networks.	Nils andersen
13.	Promoscience	Canada	PromoScience is a program operated by Canada's Granting Agency for university and college research in the natural sciences and engineering (NSERC). It provides support for organizations opening science and engineering doors for Canada's young people. PromoScience grants may be used to cover expenses relating to program delivery and to many of the operational costs of the organization. PromoScience grants support organizations that: work with young Canadians to inspire an interest in science and engineering; motivate talented young people to study science and engineering; encourage young people to consider careers in science and engineering; bring science experiences to groups who are traditionally under-represented in scientific and engineering careers; train the teachers who teach science, math and technology to our young people.	Bill Coderre
14.	Let's talk science	Canada	Let's Talk Science in-class workshops provide innovative learning opportunities involving fun and discovery as a basis to facilitate a student's learning and skill development. All in-class workshops are curriculum matched and use guided discovery through hands-on activities. Professional development workshops and conference presentations meet provincial curricula demands and are designed to increase a teacher's confidence and knowledge in Science so that s/he can provide their students with a stimulating Science learning environment. Volunteers are given opportunities to perform hands-on Science activities in the	Bill Coderre

	Name	Country	Type of action	Written by
			classroom and in the community. Participants are provided with a realistic and positive role model, a point of contact with the scientific community and hands-on, interactive science education from a real scientist.	
15.	Actua	Canada	Programs include summer day camps, in-school workshops, teacher training, community outreach activities and specialized programs for under-represented audiences. ACTUA publishes *YES,* a magazine aimed at kids to awaken and nurture their interest in science.	Bill Coderre
16.	Crystal	Canada	Pilot program launched in 2005, CRYTAL ran a national competition and selected five centres each of which will receive $1 million over five years to carry out in-depth research into science teaching and learning for primary and secondary students. The centres will conduct original research, evaluation of education and science promotion activities and will ensure that their research results are made available to the educational community, policy makers and curriculum developers.	Bill Coderre
17.	Computer class for women only	Canada	an experimental project in one school in which classes were set up in secondary school computer science along gender lines, i.e. some classes for girls only, and other predominantly male. The results of the experiment are positive and illustrate one potential solution to the problem of lack of interest in computer science by this segment of the population	V. Hemmo
18.	Scientific degrees project	Italy	Arouse the interest of the population (and of the young in particular) in Science; decrease the negative perceptionof Science as seen today by the layman. Foster scientific studies incentivating the students and upgrading the teachers careers and preparation, gender actions considered	Enrico Predazzi
19.	University fees reduction	Italy	Enrolment fees into *Mathematics, Physics, Chemistry and Statistical sciences* have being reduced for the academic years 2004-2006	Enrico Predazzi
20.	University reform	Italy	Following the Sorbonne and Bologna declarations, Italy, as many other European countries, has reformed radically its University Regulations and structures into a system of 3+2+3 levels of studies. This reorganisation was seized as an opportunity to modernize the S&T tertiary education system.	Enrico Predazzi
21.	Ciencia viva	Portugal	Ciência Viva is a Portuguese Agency created by the Ministry of Science and Technology in 1996 to promote public awareness of Science and Technology. Ciência Viva develops its activities in three fundamental areas: **1. Ciencia Viva in schools** Ciência Viva provides support to education projects to develop practical activities and to promote science and technology culture in basic and secondary education schools. **2. Network of Ciência Viva Centres** A National Network of Ciência Viva Centres, designed as interactive spaces aimed at creating an awareness of science among the population. **3. National scientific awareness campaigns** National Scientific Awareness Campaigns stimulate and provide the opportunity for personal contact with science specialists and institutions in the different fields. These initiatives are free and open to all, with a focus on practical activities, providing active observation and interaction with specialists from the relevant fields. They are intensely publicized on the media (newspapers, radio, TV).	V. Hemmo
22.	Yearly call for	Flander	The call for proposals is the instrument the Flemish Government uses (in the	Sabine

	Name	Country	Type of action	Written by
	proposals for projects for the popularization of S,T and Innovation	s	action plan for Science information and Innovation) in order to stimulate the actors in the field of the popularisation of STI to gain some expertise in this respect. The intention being that the actors become more and more involved in the action plan and to stimulate the bottom-up realisation of activities. Project or actors that are able to prove their worth by regularly scoring well with their proposals can become a (structural) partner within the action plan, meaning that they will receive financial support over a long period (3 to 5 years).	borrey
23.	TOS21 Technology at school for the 21th century	Flanders	The project will provide the framework for better education in technology, a framework that will be used in other projects in order to better co-ordinate and structure the activities. The participation of the educational networks is essential for the realisation of the project, hence they will be involved at an early stage in order to obtain a framework that is agreed by all the actors involved.	Sabine borrey
24.	Giant, giant	Flanders	One actor with his puppets and puppet theatre brings a simple and cute story for children where science and technology are brought under the attention of the children. Teachers are provided with a pedagogical dossier beforehand in order to allow them to prepare the performance. After the performance, the performer also engages the class in a conversation about the performance, thus allowing a deeper insight into what the children have learnt.	Sabine borrey
25.	Chip, chip, chip, hurray	Flanders	Interactive experimental box about ICT and introducing chips for use in the classroom. The boxes are provided with support for the teacher, meaning that there is permanent helpdesk available. A demonstration session is given and a service desk is available for teachers when they try the box on their own.	Sabine borrey
26.	Eye Openers (similar to “a taste of your future” & “future breakfast”)	Flanders	The intention of the project was to provide a number of scientists and engineers willing to come to the classroom to talk about their profession, thus providing role models and an inside view of the “work floor”.	Sabine borrey
27.	ICT platform for pupils and teachers	Flanders	The project provides a platform for pupils and their teacher to introduce ICT in education in accordance with the age group and in correspondence with the attainment targets.	Sabine borrey
28.	Environment meeting programme / Tessenderlo	Flanders	Every year Tessenderlo Group sends out a delegation of its engineers to speak about their passion for chemistry to youngsters of 14-15 years of age. These “teachers for one day” worked within the action plan “Chemistry and Youth” of the Belgian chemical federation “Fedichem”. Since 1999 Tessenderlo Group invites in its West-Limburg Plants children from the local schools, as part of a national program aimed at primary school pupils (age 10-12 years). The children can visit the water purification installations and perform some laboratory tests.	Sabine borrey
29.	Campaign “do not stay behind, follow sciences”	Flanders	Media campaign to provide youngsters with an insight of what S&T really is, what possible professions there are, what educational background they should have for what kind of (S&T) studies, …	V. Hemmo
30.	The great sEXPERIMENT	Flanders	This exhibition brought some interesting information about the so-called talents of males and females that are in most cases strongly attributed to one of the sexes. For instance the fact that women cannot read maps or can perform more than one task at the same time. Visitors had a unique barcode and they could test these hypothesis or statements themselves. Afterwards the scores of all visitors were statistically arranged.	V. Hemmo
31.	Flemish Science Week	Flanders	The Science Week of Flanders is organised every two years since 1994. The Science Week consists of four important parts :	V. Hemmo

	Name	Country	Type of action	Written by
			- Science festival : the science festival is aimed at the general public and provides various hands-on activities, competitions, science theatre, quizzes, etc. - Science through the looking-glass : an interactive program organised at universities, institutions for higher education and scientific institutions, aimed at youngsters aged 16 to 18. - Science project : one week of interactive science for children aged 10 to 12 and organised around one theme. Projects organised by third parties : Observatories, scientific foundations, public libraries, etc. organise interactive scientific activities at their own location and imbedded in there normal programme.	
32.	Educational experiment boxes campaign	Flanders	Nine activities in one box aimed at making science and technology accessible to the pupils. Experiment for instance with a polarization filter, sound in a vacuum, refraction & reflection, spherical lenses, propulsion, spring forces, Benham's disk, the bird in the cage, and the conservation of energy. This box can be used at both a ‘serious’ scientific level and as entertainment.	V. Hemmo
33.	“About Life”	Flanders	OverLeven (literal translation : about Life, but also “to survive”) co-production of the VRT (Flemish Radio and Television) and the Flemish Community. The broadcasts (on Canvas) feature exciting documentaries about recent scientific achievements that are closely related to the everyday experiences of the average citizen. Each edition of the programme is built around a prominent scientist who has been responsible for an important scientific breakthrough in his specialist field.	V. Hemmo
34.	LUMA	Finland	LUMA Joint National Action was an extensive programme to develop knowledge in mathematics and the natural sciences. The Ministry of Education and National Board of Education have allocated a total of EUR 34 million in development funds for the Joint National Action and the National Board of Education´s project group has devoted approx. 20 man-years during the project to developing teaching in mathematics and the natural sciences. Schools, educational establishments and higher education institutions have engaged in significant cop-operation that transcends the boundaries between the various levels. Higher education institutions have provided schools with their equipment and expertise, given teachers supplementary training and carried out research and researcher training projects relating to the learning and teaching of mathematics and the natural sciences.	Hannele Kurki
35.	Teacher in-service training	Finland	The teacher in-service training was an implementation of the LUMA programme. Each year, the universities´ subject departments, departments of teacher education and training schools have been able to apply for the supplementary training allocations set aside for this purpose..	Hannele Kurki
36.	The development and Information network – Luma centre	Finland	The centre promotes the teaching of biology, chemistry, geography, mathematics, physics and technology and enhances interaction between schools, universities and business and industry. The aim is cross-disciplinary co-operation. The Centre also seeks to encourage children and young people to become involved in scientific activities.	Hannele Kurki
37.	Action plan for Flanders	Flanders	The action plan is the instrument used to implement the policy with respect to the popularisation of science, technology and innovation. The policy is outlined in the (yearly) policy letter which covers the whole policy with respect to STI. In the action plan the policy is described in more detail and the actions to be undertaken are described as well	Sabine Borrey
38.	Fedichem	Flanders	Fedichem offers a wide arrange of documentation about the Chemical industry for both the general public and the educational field	Sabine Borrey

	Name	Country	Type of action	Written by
39.	Agoria Vlaanderen	Flanders	Agoria-Vlaanderen is the Flemish federation of technological industry. Its project pursues a variety of actions –in conjunction with the regional associations – to better coordinate education, vocational training, continuing training and employment.	Sabine Borrey
40.	Multimedia award	Flanders	To generate innovative ideas, centred around a central theme (for instance : timesaving Internet applications) by way of a competition	Sabine Borrey
41.	Promotion of Young People into Science and Engineering	Korea	This project is a trans-ministerial initiative of the Korean government in order to respond to the decline of young people's interests in science and technology and the decline of enrolment rate of talented young people into science and engineering fields	Ki-Wan Kim
42.	Science Korea	Korea	"Science Korea" project aims to build an innovation-oriented socio-cultural environment by organizing and motivating various activities related to 'science culture' and popularization of science. This project is funded by the Ministry of Science and Technology (MOST) and coordinated by the Korea Science Foundation (KSF) who is responsible for the planning and implementation of 'science culture' programs. And many other science-related public and non-profit organizations and industries are participating in the project.	Ki-Wan Kim
43.	Delta Plan	Netherlands	National action plan with the objective of increasing S&T graduates by 15% between 2000 and 2010.	M. Vermeulen
44.	A mapping of production and employment	Denmark	This study identifies the career patterns of the 7678 persons that received a five year degree from one of the Danish universities during the 30 year period from April 1, 1971 to October 1, 1999 within the mathematical sciences, the physical sciences, and the chemical sciences. Statistics on production, employment spectra, durations of studies are presented as function of time. The material is used for career advice, etc. addressed at pupils finishing secondary school.	Nils Andersen
45.	Integrating Technology in Primary Education	Netherlands	A programme, first developed by Axis as a pilot and later enlarged to all primary schools. It promotes the teaching of S&T at primary schools and the evaluation of practical skills. At the national level: engineering and technology have been added to the core objectives of primary education and are tested in the primary school final test. Financial incentive have been set up to encourage school to adapt to this additional objective. The project included instruments for the dissemination of good practices and materials on a large scale, a regional infrastructure supporting schools in implementing these tools and a quality improvement system.	M. Vermeulen
46.	Jet-Net (Youth & Technology Network Netherlands)	Netherlands	A network formed by a wide variety of companies to assist secondary schools in making science subjects more appealing to students aged 14–18 and to clarify future career prospects in the industry. A broad range of activities including general introduction and familiarization (company excursions, presentations), subject support (assistance to teachers in specific parts of the curriculum), career orientation support (assistance to students in their individual choices	M. Vermeulen
47.	Redesign in prevocational, secondary vocational and higher	Netherlands	A project aimed at developing more attractive vocational education through the redesign of courses. This includes: - New teaching methods (Mentoring, starting with practice, use of ICT,	M. Vermeulen

	Name	Country	Type of action	Written by
	professional education		emphasis on the context,) - Broad and flexible learning-routes (multi-technical or cross-sectoral programmes) Continuous learning line (improve the connection between the various levels of vocational education)	
48.	Chemistry in context	Germany	The **goal of ChiK** is the development, evaluation and implementation of an innovative chemistry course for students between the ages of 14 and 18 (lower and upper secondary level), which combines the **principles of situated learning** with a systematic understanding of the most important concepts of chemistry. It will provide teachers and students with a documented and partly evaluated course and its own assessment procedures.	V. Hemmo
49.	NSF initiatives	USA	**Informal Science Education** The NSF Informal Science Education program invests in projects that develop and implement informal learning experiences designed to increase interest, engagement, and understanding of science, technology, engineering, and mathematics as well as projects that advance the theory and practice of informal science education **Research Experiences for Undergraduates** REU This program supports active research participation by undergraduate students in any of the areas of research funded by the National Science Foundation. **Instructional Materials Development Program** – IMD (Primary/Secondary Education) **Course, Curriculum, and Laboratory Improvement Program** - CCLI CCLI supports efforts that conduct research on STEM teaching and learning, create new learning materials and teaching strategies, develop faculty expertise, implement educational innovations, assess learning, and evaluate innovations. (Tertiary education) **Teacher Professional Continuum** - TPC (Primary/Secondary Education) This program goals are to improve the quality and coherence of teacher learning experiences. It supports Research Studies, Resources for Professional Development, and Conferences and Symposia. **Math and Science Partnerships** - MSP (Primary/Secondary education) This program supports the development, implementation and ultimate sustainability of promising partnerships among institutions of higher education, K-12 schools and school systems and other important stakeholders to: - ensure that all K-12 students have access to, are prepared for and are encouraged to participate and succeed in challenging and advanced mathematics and science courses; - enhance the quality, quantity and diversity of the K-12 mathematics and science teacher workforce; - and develop evidence-based outcomes that contribute to our understanding of how students effectively learn mathematics and science. **CAREER Program** (Tertiary) This programme support of the early career-development activities of those teacher-scholars who most effectively integrate research and education within the context of the mission of their organization. **Louis Stokes Alliance for Minority Participation** (LS-AMP)	B. Olds

	Name	Countr y	Type of action	Written by
			LSAMP supports sustained and comprehensive approaches that facilitate achievement of the long-term goal of increasing the number of students who earn doctorates in STEM fields, particularly those from populations underrepresented in STEM fields. **Research in Disabilities Education** (RDE) This program supports efforts to increase the participation and achievement of persons with disabilities in science, technology, engineering, and mathematics (STEM) education and careers.. **Research on Gender in Science and Engineering Program:** The program seeks to broaden the participation of girls and women in all fields of science, technology, engineering, and mathematics (STEM) education by supporting research, dissemination of research, and extension services in education that will lead to a larger and more diverse domestic science and engineering workforce.	

ANNEXE 4: DETAILED REMEDIES

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1. La main à la pâte
2. Tertiary level education with economic support for adults
3. The technical-scientific basic year
4. NOT
5. Radboud
6. Sinus
7. Women give new impetus to Technology
8. Rika Daisuki School /Model Schools
9. Super Science High School
10. Science partnership programs
11. Science team K
12. Europhysics fun
13. Promoscience
14. Let's talk science
15. Actua
16. Crystal
17. Computer class for women only
18. Scientific degrees project
19. University fees reduction
20. University reform
21. Ciencia viva
22. Yearly call for proposals for projects for the popularization of S,T and Innovation
23. TOS21 Technology at school for the 21th century
24. Giant, giant
25. Chip, chip, chip, hurray
26. Eye Openers (similar to "a taste of your future" & "future breakfast")
27. ICT platform for pupils and teachers
28. Environment meeting programme / Tessenderlo
29. Campaign "do not stay behind, follow sciences"
30. The great sEXPERIMENT
31. Flemish Science Week
32. Educational experiment boxes campaign
33. "About Life"
34. LUMA
35. Teacher in-service training

ANNEXE 4: DETAILED REMEDIES

36. The development and Information network – Luma centre
37. Action plan for Flanders
38. Fedichem
39. Agoria Vlaanderen
40. Multimedia award
41. Promotion of Young People into Science and Engineering
42. Science Korea
43. National Action Plan on S&T and the S&T Platform (Netherlands)
44. A mapping of production and employment
45. Integrating technology in Primary education (Axis)
46. Jet-Net – Youth technology network Netherlands
47. Redesign in prevocational, secondary vocational and higher professional education
48. Chemistry in context - Germany
49. A selection of NSF initiatives (US)

1. **Title of project: « La main à la pâte », the « Programme for renewed teaching of S&T in primary school » and the new curricula for S&T in primary school**

Country: France

Target group:

Primary school teachers, Primary school children

Partners involved:

The association "la main à la pâte », Primary school teachers, Ministry of Education, Local levels of educative authorities

Ongoing/closed: Ongoing

Description:

At the beginning, an initiative from Georges Charpak and the French Academy of Science to renew science teaching in French pre-primary and primary schools. It functioned on the basis of volunteer teachers that where trained and given support to teach science in a more practical and interactive way.

In 2000 a countrywide programme for the "renewed teaching of S&T" was launched by the minister of education, based on the experience gained during the operation "la main à la pâte".

The Program includes different actions, such as :

- Increasing the part of science in the continuous training of teachers.

- Sharing out money (about 40 MF so far), to purchase pedagogical and scientific equipment.

- Developing and supplying tools to help teachers implement the program and the new curricula, methodological and pedagogical guides, internet services.

- The program involves also the creation of comities (national level and also at the different local levels: the so called "Académies" and their subdivision, the "Départements"). The aim of these comities is to organize the cooperation among the actors of the program, that is: directors of education, inspectors, institutes for teachers' training, scientific institutions.

In 2001-2002, a new curriculum was issued, coherent with the programme for renewed teaching. The emphasis is on the method, based on the pupils' questioning and experimental investigation. Group work is encouraged.

Resources: (financial, human)

- A technical group was established to produce support and other documents
- The technical group also organized seminars for local education authorities
- 7% of all continuous training for teachers resources were allocated to this project from 2001 to 2003
- support documentation was created with the French Academy of Science and the team of "la main à la pâte". These documents were issued at 520 000 copies for the teachers (cost: 0.75 MEuros)
- 3.2 MEuros in 2000 then 1.5 MEuros a year were allocated to support specific projects presented by teams of teachers and to the local teams

Evaluation:

- "La main à la pâte": Carried on by the ministry of education in 1999

Number of students: 2% of French schools. The results were considered good enough to use the principles of this initiative as a basis for a national programme

- « Programme for renewed teaching of S&T in primary school » and the new curricula for S&T in primary school: not yet available
- Positive points (from "la main à la pâte):
  - The knowledge acquired is limited but well organized and deeply assimilated
  - The children experiment the importance of Rationality as a way to understand the world
  - The means of expression in the mother tongue improve
  - The children develop the ability to work in groups and to elaborate consensus on observed realities. Gain in affirmative speaking, listening and cooperation skills
- Limits:
  - The training of teachers to these new methods is heavy in time and means

Further reading:

In English: “teaching science in school.doc” posted on the website by Frederic Sgard (19 may 2004)

In French: “bonne pratique_Fr 2204.doc » posted on the website by Frederic Sgard (19 may 2004)

Websites: www.cndp.fr/ecole, www.eduscol.education.fr, www.inrp.fr/lamap

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2. Title of project: Tertiary level education with economic support for adults (NT-SVUX)

Country: Sweden

Target group: Adults having not studied in S&T.
Age 28 – 48 years
Full time employment for at least 5 years

Partners involved:

National Agency for Higher Education

National Board of Student Aid

Universities

Ongoing/closed: Closed

Description:

Period: 1995 – 1998

Objectives:

- Reduce unemployment in under-qualified groups
- To increase the number of graduates in science and technology

Resources: (financial, human)

- Administration 26 MSEK
- Grants: 2.1 GSEK
- Loan: 550 MSEK
- Univ: 1 – 1.5 GSEK

Actions:

- financial support (grants and loans with favourable conditions) given to the targeted persons

Evaluation:

Number of students: 10 000

- Success ≈ 60 %
- Of those who started in 1995 and finished successfully after 3 years about 90 % were employed in 2001

▪ Limits:
  - Some specific and favourable rules were set for loans attributed to students under this programme. This was criticized by ordinary students as being unfair
  - The Swedish National Labour Market Administration criticised the initiative for not aiming enough at those people who were unemployed and had too “low” education.
  - The universities got the information on this programme very late. Then the university management could not prepare and communicate enough, restraining the success of this programme in the first year (1995). The following years there was heavy advertisement both from the universities and from The Swedish National Labour Market Administration.

▪ Positive points:
  - A significant increase in the number of science and technology students (mechanical effect)
  - The number of students for an age cohort in Sweden is 100 000, 30% of them studying S&T. The programme added 10 000 on 4 years ie 2 500 / year. This means that the increase related to this action represents more than 8%
  - The programme broadened the recruitment basis of students in S&T. This action was aimed at a population that would not have normally had access to high level S&T education.

Further reading:

In English: Note written by Max Kesselberg / Valérie Hemmo

In Swedish: NT-SVUX evaluation report (National Agency of Higher Education, 1998:5 R)

Contact person(s): Max Kesselberg

3. Title of project: The technical-scientific basic year

Country: Sweden

Target group:

Students

Entrants at tertiary Education

Partners involved:

The National Agency for Education

The national Agency for Higher

Ongoing/closed: Ongoing

Description:

Period: The programme was planned to last one year (92/93) was finally continued

Objectives: Give “second chance to choose science studies” to students having chosen other fields at high school

Resources: (financial, human)

- Financial: 93/94 130 MSEK
  94/95 130 MSEK
  95/96 176 MSEK
  96/97 250 MSEK and approx the same level since then

Actions: Advantages allocated to students:

- Success in this programme gives guaranteed place at university
- Affirmative action (gender)

Evaluation:

Number of students: from the start a total of 35 000

- The success rate is 70 %.
- One year after they started, 60- 70 % of the registered is studying natural science or technology at university level and counting those who passed within the stipulated time the share is almost 80 %.
- There is no difference in success rate between “basic year” students and students coming directly from secondary upper level

Further reading:

In English: Note written by Max Kesselberg / Valérie Hemmo

In Swedish: Report 2005 (National Agency of Higher Education, 2005:22 R)

Contact person(s):

Max Kesselberg

4. Title of project: NOT Project / SciTech Project

Country: Sweden

Target group: Teachers, Teacher trainers, General public

Partners involved: The Swedish Agency for School Improvement, The National Agency for Higher Education

Ongoing/closed: Closed

Description:

Period: 1993-1998, renewed for another five-year period 1999-2003

Objectives:

- To stimulate the interest for S&T
- To develop the teaching of those subjects

Resources: (financial, human)

- The resources for the project amount to 5 million Swedish crowns a year, (=450 000 euros)
- The project organisation including 4 persons (3 full-time posts) is not sufficient for work in a national perspective. Therefore an active cooperation with other actors in the SciTech field is necessary. In order to support the project group a so-called SciTech council was established towards the end of 1999. The council acts as a source of ideas and as ambassadors for the project. There were 8 members of the council, representing schools, universities, local and national science centres.

Actions:

The work within the project has been organized in a number of activities.

- The project has for instance supported:
  - in-service training of teachers and teacher trainers,
  - series of seminars for teacher trainers at the university institutes of education,
  - regional conferences on science education in cooperation with the National Resource Centres,
  - parents´ meetings called ”the active parents´ meeting”
  - specific studies on related subjects
- The project has established regular contacts with about one fourth of the local districts in the country, (= 70 districts), so-called SciTech districts, to encourage local activities in the SciTech field.
- The SciTech paper, in Swedish called NOT-bladet, was published 4 times a year in 20.000 copies for information and inspiration for all people working in the SciTech field.

Evaluation:

NOT was evaluated in 1998 by an external expert. The result was positive and led to the project renewal for another five year period

- Positive points:
  - It is not possible to measure effects directly but the great number of activities is a positive indicator. Moreover, the number of students , both boys and girls, chosing MST significantly increased.
  - The project publication called “Notbladet”, was judged to have been useful, to NOT-community coordinators, teacher educators, and teachers who have participated in NOT-conferences.
  - ”The idea of nominating so called NOT-communities has been of great help in developing activities within the area of science and technology”1
  - ”Conferences for teachers and a series of seminars for teacher educators, have been highly valued by the participants.”1
- Limits:
  - If ”project has moved strongly to develop the teaching of S&T”, ”measures to directly influence the attitudes and interest for science and technology have been less extensive”1

[1] Source: English summary of the second NOT evaluation report

- NOT (first period) ended with big ads, promoting science and technology, in the daily newspapers. This was judged expensive and inefficient

The next five-year-period, 1999-2003, was evaluated in Dec 2003 by Umeå Center for Evaluation Research (UCER), Umeå University.

The evaluation shows, among other things:

1. There were few new activities aiming directly at pupils. Instead NOT2 gave financial support to existing activities.
2. There were activities aiming at teachers such as conferences and a series of seminars for teacher educators, which have been highly valued by the participants.
3. That the project has moved strongly to develop the teaching of science and technology. Measures to directly influence the attitudes of pupils and interest for science and technology have been less extensive.
4. The idea of nominating so called NOT-communities has been of great help in developing activities within the area of science and technology, even if no, but asked for, concrete support has been supplied from the NOT-project.
5. The project publication called "Notbladet", has to a certain extent been useful, to NOT-community coordinators, teacher educators, and teachers who have participated in NOT-conferences. It should at least be published electronically in the future.
6. Unfortunately the cooperation between the two agencies was impeded by the fact that the project leaders quit during the last years and the focus towards liberal adult education shifted to more a school-oriented approach.
7. More focus on the needs that pre-schools have.

The evaluators conclude that some of the NOT-activities have been useful and filled an important function. Accordingly, some of the current activities deserve to be continued such as conferences, NOT-bladet and teacher educators' meetings. They also suggest other measures to stimulate the interest for science and technology as well as activities that could develop the teaching in those subjects such as school relevant projects as a joint venture between teachers and teacher educators.

Further reading:

In English: the SciTech project (written by Max Kesselberg)

In Norwegian: first period evaluation report

In Swedish: second period evaluation report

Web-site http://www.skolutveckling.se/utvecklingsteman/naturvetenskap_teknik/not.shtml

Contact person(s):

Max Kesselberg,

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Anders Hanberger – expert for the second evaluation - (*Anders.Hanberger@ucer.umu.se*)

5. Title of project: Attracting Science Students – The faculty of Science of the Radboud University Nijmegen

Country: the Netherlands

Target group: University students, High School Students

Partners involved: University, Secondary School teachers, Businesses

Ongoing/closed: Ongoing

Description:

Period: Started from 1997

Objectives:

- Increase enrolment in S&T courses
- Innovate in education
- Improve the alignment of education and employment

Resources: (financial, human)

- Financial:120 000 euros a year for the PR campaign
- Human: 5.4 full time equivalent for the PR activities

Actions:

- PR policy

  Specific objectives

  - to break through the largely negative image of courses in the exact sciences, as research had revealed that potential students describe science studies as ‘too difficult’, ‘too theoretical’ and ‘too specialist’. Moreover, most students felt that courses in the exact sciences offered a rather limited job perspective. They often depicted these perspectives as laboratories in which boring tests were carried out all day
  - to improve the interface between secondary and higher education

  Actions

  - a magazine for school youth interested in science courses (‘B for you’)
  - a special website for prospective students (‘Place to B’)
  - intensified contacts with secondary school teachers in the region
  - a study into the choice of studies of pupils was carried out. All the used PR- and enrolment activities were geared to the results of this research
  - besides, also the results of the IOWO enrolment monitor (1996-2004) were used

- Tutor system

  Specific objectives

  - to improve the interface between secondary and higher education

  Actions

  - tutors are experienced pre-university secondary school teachers who coach the students during their first year at university
  - they attend lectures and provide feedback to the university lecturers about the used didactics and the extent to which the material discussed in the lecture connects to what the students have learnt before

  Results

  - considered useful by almost all involved parties
  - increase of credits earned
  - a trend study (IOWO, 2003) has shown that the interface between secondary and university education has improved considerably over the past few years, also in the perception of the students

- Innovation of courses offered

  Specific objectives

- attract potential students with broader scientific interests

Actions
- new trans-disciplinary courses: general natural sciences, molecular life sciences, information science and environmental sciences

Results
- the introduction of these courses has attracted many new students

- Formation of clusters

Specific objectives
- To break in the pronounced compartmentalisation of the various courses

Actions
- the set-ups of bachelor studies were made uniform to the greatest possible extent and organized into educational clusters

Results
- science students are enthusiastic about these clusters
- link up more adequately to the interests of first-year students
- students can transfer more efficiently to another course within the faculty
- improved cooperation between the various courses
- problems of coordination have been largely overcome

- Introduction of new teaching methods

Specific objectives
- to emphasis the acquisition of general skills such as:
  - communication and cooperation
  - the ability to deal with large quantities of information and their application

Actions
- the teaching material is offered increasingly in a project-oriented and context-linked manner

Results
- the majority of the science students are enthusiastic about the new methods
- by now, faculty professors have developed a greater educational awareness, but the realisation of the cultural switch aspired by the faculty board, turned out to be a laborious process
- learning items:
  - It is better to realise these changes in a process-oriented manner, making it possible to prioritise matters
  - It is important to develop specific human resource management in which more attention is paid to the didactic qualities of new employees/professors
  - Clarity about the division of research- versus teaching tasks should be aspired

- Introduction of specialization options

Actions

The bachelor-master structure was introduced for all studies. This structure consists of a broad three-year bachelor cycle, followed by a two-year specialised master cycle. The master's course offers three specialization profiles: Research (R), Communication/Education (C/E) and Management (M).

- Intensification of contacts with the business world

Actions
- professors to occupy endowed chairs have been recruited from the business world, to make the courses more application-oriented and more topical

- the formation of businesses is stimulated and the exchange of knowledge from the university to the businesses and vice versa is facilitated by means of the university business centre and the Mercator Technology & Science Park
- the PR materials increasingly offer information about the occupational practice of science graduates
- the curriculum has been changed drastically to offer students a better preparation for the labour market
- the content to be given to the CE/M specialization profiles will also offer opportunities for other than the traditional research positions

Evaluation:

The evaluation has been carried out very precisely with the help of questionnaires

- Positive points:
  - from the 99/00 academic year onwards there has been a marked increase in the number of first-year students at the Nijmegen Faculty of Science
  - the PR- and enrolment activities have led to an increased interest in science courses among school youth
  - the negative image pupils used to have of the faculty has been broken: nowadays, pupils associate the faculty with interesting courses and good occupational perspectives. They also have a positive image of the education, the teaching facilities, the specialization options, the atmosphere at the faculty and the quality of the interface between secondary and higher education
- Limits:
  - pre-university secondary school teachers usually take a less positive view of the faculty
  - too many innovations were introduced in too brief a period of time and with too little cohesion. This has drawn heavily on the organisation's capacity for change, as well as on the employees and the students
  - effects of recent policy measures taken to improve the connection to the job market cannot be measured yet. The educational innovation is still in full swing and the first students with a CE/M profile have yet to graduate
  - students are critical about the faculty's efforts to improve the alignment of education and employment. The faculty is still characterised by a research tradition and has only 'socialised' to a limited extent
  - there is still insufficient preparation for positions that are not specifically scientific. The majority of the students think that the right track has been embarked upon. Besides, they expect that the new specialization profiles will improve the preparation for the occupational practice

Further reading: (In English)

Synthesis note (available on the website; posted 02/24/05 by V. Hemmo)

Full report (available on the website; posted 02/03/05 by R. Oevering)

Contact person(s):

S.E. Wendelaar Bonga

6. Title of project: Sinus/Sinus Transfer/Sinus Transfer Grundschule

Country: Germany

Target group: Primary school, secondary schools, teachers

Partners involved: Federal Ministry of Education and Research (Sponsor), Project holder: IPN Leibniz Institute for Science Education at the University of Kiel (Project Leader: Prof. Dr. Manfred Prenzel), Subcontractors: State Institute for School Education and Education Research (ISB), Munich, University of Bayreuth, Chair of Mathematics and Mathematics Education

Ongoing/completed: Sinus: finished, Sinus Transfer: Ongoing

Description (from the website): This federally sponsored program was set up in August 1998 in 15 "Bundesländern" (federal states) and aims to establish permanent quality development practice in schools. The pilot program started with 180 participating schools. Since August 2003 it is continued in 13 federal states in approximately 700 schools (program "Sinus Transfer"). "Sinus Transfer" is as well funded by the federal and state governments of Germany.

BACKGROUND

In Germany the results of the TIMS study engendered a huge public response. This study shows that Germany ranks only mid-range internationally, though with much graver findings in the detailed results. It shows, for instance, that a relatively large group of students have particular difficulties in understanding demanding questions which presuppose conceptual understanding. The heterogeneity of achievement is unusually high. The achievement level of a significant number of 7th and 8th graders is not much above elementary school level.

Even more, the PISA results stress the importance of a quality development and school monitoring initiative in Germany.

PROJECT TARGETS

Current research on teaching and learning indicates problem areas in mathematics and science education. These problem areas are described in a report which was worked out by a group of experts for a nationwide pilot program. As we know from recent pilot programs, changes in the structure of teaching only endure if they are accepted by teachers and if they can be successfully integrated into their routine actions. In this pilot program, teachers develop their lessons autonomously but with academic support. They cooperate in regional networks where they plan, discuss and evaluate their teaching strategies.

THE MODULAR PROJECT CONCEPTION

The main focus within the framework of quality development in schools comprises eleven modules:

1. Developing a task culture
2. Working in a scientific manner
3. Learning from mistakes
4. Securing basic knowledge
5. Cumulative learning
6. Experiencing subject boundaries and interdisciplinary approaches
7. Promoting girls and boys
8. Promoting student co-operation
9. Autonomous learning
10. Assessing progress: monitoring and feedback
11. Assurance of quality and the development of overall standards

PROJECT STRUCTURE

In the beginning, 180 schools were participating in the program. Sets of six schools were combined as a local network, one of the six assuming a "pilot function". Altogether 30 school sets had been assembled nationwide.

Since August 2003 new local school networks have been implemented according to the increased number of about 700 participating schools.

OECD Activity on declining interest in science studies

The networks work together with regional universities and teachers seminars.

The server is used for publishing results and for retrieving information within the regional networks as well as nationwide. It informs about interesting materials and provides a platform for professional cooperation and scientific dialogue.

RESULTS AND FURTHER PERSPECTIVES

The results of two acceptance studies which were carried out in 2000 and 2003 confirm that the program has made a successful start: Stable groups have emerged within the school sets and started working together in accordance with the modular conception of the expert report. In the specialized school sets cooperation is target and product orientated. Formative and summative evaluation competences are more and more developed in the participating school-networks. This cooperation not only extends across the regional school sets but also across the whole network.

Certainly, the process to establish a new learning culture will take more than a few years. Permanent quality development practice has to be established in our schools nationwide.

Evaluation: ?

Further reading: Links to project description and evaluation documents (to be translated): www.sinus-transfer.de/

Contact person(s): Project Leader: Prof. Dr. Manfred Prenzel (IPN Kiel)

7. Title of project: Women Give New Impetus to Technology

Country: Germany

Target groups: female pupils and students, tertiary graduates, women working in S&T occupations, companies, schools, universities

Partners involved: Federal Ministry of Education and Research, companies and associations

Ongoing/completed: Ongoing

Description (from the website):

A huge number of projects and campaigns are realized or coordinated by the Women give new Impetus to Technology Association, for instance:

GIRLS' DAY: CAREER ORIENTATION DAY FOR GIRLS

Following the resounding success of the first two Girls' Days in 2001 and 2002, the German Federal Ministry of Education and Research and the German Federal Ministry of Family Affairs, Senior Citizens, Women and Young People initiated the third nationwide career orientation day for girls on 8 May, 2003, in conjunction with the German Trade Union Federation (DGB), the Confederation of German Employers' Associations (BDA), Initiative D21, the Association of German Chambers of Industry and Commerce (DIHK), the Federation of German Industries (BDI) and the German Confederation of Skilled Crafts (ZDH) .

As part of a wide-scale campaign, businesses, higher education establishments and research institutes are being called upon to hold a special open-house day for girls, thereby giving then insights into technical and technically supported fields of work.

idee_it

With the Project idee_it the German Federal Ministry of Family Affairs, Senior Citizens, Women and Youth has in co-operation with the initiative D21 started an educational project aimed at encouraging young women to train in the areas of IT and media occupations.

Future Opportunities generated by Diversity in higher Education and Training

Gender mainstreaming as an impetus and driving force behind the course reform in computer science, engineering and natural sciences

The attractiveness of degree courses in engineering and natural sciences to young people is one of the most important preconditions for recruiting highly qualified personnel which is able to fulfil the demands of jobs in future industries. Through new initiatives in mathematics and natural sciences at schools young women and men with varied interests can be further encouraged to start a professional career in computer sciences, engineering and natural sciences.

Be.it | Be.ing: Project innovative reform of studies

In order to draw young women's attention to these career fields the Federal Ministry of Education and Research has initiated the Be.it and Be.ing projects. These projects offer comprehensive information about the various job profiles and degree courses in the fields of IT, computer science and engineering.

Teacher@D21

Female teachers play a dual role in their schools, as they also function as career guidance counsellors. The goal of TrainTheTeacher@ D21.ibm was to promote teacher competence in this type of work by providing them with a glimpse into the daily routine in an industrial corporation – IBM – and to learn which key skills industry is demanding. Beyond that, teachers participating in the project were also familiarised with the various workshop methods employed in companies.

Evaluation: ?

Further reading: www.frauen-technik-impulse.de/verein/englisch/association with descriptions of the association's structure and information on many projects. See also www.kompetenzz.de

Contact person(s): Barbara Schwarze, Manager of the association (schwarze@frauen-technik-impulse.de)

8. **Title of project: Rika Daisuki School (Model Schools for Promotion of Science Education)** (Part of the national project called "Science Literacy Enhancement Initiatives")

Country: Japan

Target group:
Elementary and junior high school students and science teachers

Partners involved:
Elementary and Junior high schools, research institutes, science museums

Ongoing/closed: ongoing

Description:

Period: Started in 2003

Objectives: increase the willingness of young people to learn about science, technology and natural science

Resources: (financial, human)
- Financial: 217 million yen in 2004
- Human: unaccountable (regular teachers of the schools, invited lecturers from research institutes, other relevant individuals)

Actions:
- In designated schools, promotion of comprehensive S&T education with focusing on observations and experiments, enrichment of elective subjects and advanced learning

Evaluation:

102 elementary and 65 junior high schools in 19 areas have been designated for the period of 2003-2004 (approximately 0.5% of the cohort).

Sampled students who participated in the programme have been surveyed by a questionnaire and compared with the results of national sample in 2005. Preliminary results from a questionnaire survey show:

- Positive points:
  - Rika Daisuki school students partly show significantly higher level of willingness to learn science, technology and natural science than those of students under general programmes.
  - Rika Daisuki schools could have much more opportunities for students to listen to scientists and engineers, and to visit science museums than normal programmes have.
- Limits:
  - There appeared more or less successful schools. This difference can be explained how intensively a school has provided opportunities for their students to engage in S&T activities such as listening to scientists and engineers, visiting science museums and research institutes, doing field trips, and conducting scientific project works.

Further reading:

In English: (under preparation)

In Japanese: "Survey results of willingness to learn science" (under preparation)

Contact person(s):

Y. Ogura

9. Title of project: Science High Schools (SSH) (Part of the national project called "Science Literacy Enhancement Initiatives")

Country: Japan

Target group: High school students and science teachers

Partners involved: High schools, universities and research institutes

Ongoing/closed: Ongoing

Description:

Period: Started in 2002

Objectives:

- increase the willingness of young people to learn about science, technology and natural science

Resources: (financial, human)

- Financial: 1,349 million yen in 2004
- Human: unaccountable (regular teachers of the high schools, executive board members of each school, invited lecturers from universities and research institutes, other relevant individuals)

Actions:

- Special programme focus on science, mathematics and technology, with emphasis on cooperative measures with universities and research institutes.

Evaluation:

72 high schools are designated in 2004 (approximately 1% of the cohort)

26 schools first designated in 2002 for three years project have been evaluated in 2005. Preliminary results from a questionnaire survey show:

- Positive points:
  - SSH students keep high level of willingness to learn science, technology and natural science over the three years of high school. The level is conspicuously higher than those of students under general programmes.
  - High percentage (50-55%)of SSH students want to become scientists or engineers in their future.
  - SSH schools in their programme could have much more opportunities for students to listen to scientists and engineers, and to visit science museums and research institutes than normal programmes have.
- Limits:
  - SSH students may have originally been those who have relatively higher level of willingness to learn science, technology and natural science. Though the net effect can not be known, high percentage (55-60%) of SSH students answered that they have increased their level of willingness to learn science.
  - Only about one third of SSH students answered that they have increased their level of willingness to learn mathematics.
  - Only about one third of SSH students think their experience under SSH programme will be helpful for preparing the entrance examination to tirtially education.
  - There appeared more or less successful schools. This difference can be explained how intensively a school has provided opportunities for their students to engage in S&T activities such as listening to scientists and engineers, visiting science museums and research institutes, doing field trips, and conducting scientific project works.

Further reading:

In English: (under preparation)

In Japanese: "Survey results of willingness to learn science" (under preparation)

Contact person(s):

Yasushi Ogura

10. Title of project: Science Partnership Programs (SPP)

(Part of the national project called "Science Literacy Enhancement Initiatives")

Country: Japan

Target group:

Secondary schools students and science teachers

Partners involved:

Universities, schools, research institutes and educational centers

Ongoing/closed: Ongoing

Description:

Period: started in 2002

Objectives:

- increase the willingness of young people to learn about science, technology and natural science

Resources: (financial, human)

- Financial: 1,270 million yen in 2004
- Human: More than 1,100 lecturers and 900 assistants, belong to universities, research institutes, schools, and educational centers, in 2004

Actions:

- Funding of selected programmes aimed at providing opportunities for secondary schools students and science teachers to gain familiarity with the frontier S&T researches and products

Evaluation:

Number of students- In 2004:

- 428 programmes for students involving a total of 15,700 students at 225 schools and 77 research institutes and universities
- 141 programmes for science teachers involving a total of 3,800 teachers at 75 educational centers and universities
- Students, lecturers and assistants were asked by a questionnaire for the evaluation purpose. Preliminary results from the questionnaire survey show:

▪ Positive points:

- More than 80% of the participants have enjoyed and about two thirds of the participants have understood the programme in spite of the difficult topics. More than 70% of the participants thought they wish to participate in a similar programme again.
- More than 90% lecturers and assistants expressed they wish to cooperate again.
- 90% of teachers participated in professional development programmes evaluated themselves as they have attained the objectives of the programme. 70% of participated teachers expressed they can utilize the content learned in the programme into their teaching.

Further reading:

In English: (under preparation)

In Japanese: leaflet of SPP programme by MEXT

Contact person(s):

Yasushi Ogura

11. Title of project: Science Team K

Country: DK

Target groups: Pupils in primary and secondary school, parents, teachers, headmasters

Partners involved: A private foundation, a science promotion assoc., teachers and local politicians, local industries, ministries of education and science.

Ongoing/closed: Ongoing

Evaluation: Most of the components are evaluated, see below**.**

Description:

Scope: One secondary school and 17 surrounding primary schools in a minor provincial town, Kalundborg, have been selected.

Goal: to increase recruitment from primary school to science in secondary school, and from secondary school to university studies in the fields of science, medicine and engineering. The focus is on the teaching of physics and chemistry.

Actions: A spectrum of remedies are implemented, partly inspired by the CienciaViva experience, including funding of teachers' innovative ideas. 65 science teachers are actively engaged. Local industrial companies are involved.

Results: Statistics on student flow and performance/grades is collected as function of time, 1992-2010. When effective measures have been identified, these will be implemented nationally.

Resources: the total funding is 1.1 Meuro from a private foundation linked to a major pharmaceutical company.

Project duration is 3 years(2004-2006)

Further reading: to project description and evaluation documents (to be translated.)

Contact person(s): Project Manager: Bo Løkkegaard, email: bl@formidling.dk
Evaluations: Assoc. prof. Henrik Busch, Danish University of Education,
email: busch@dpu.dk

12. Title of project: EuroPhysicsFun – on the very edge of Physics Edutainment

Country: DK

Target groups: General public, parents, potential science students

Partners involved: A private foundation, a European network of university students in science.

Ongoing/closed: Ongoing

Evaluation: (No hard facts)

Description:

EuroPhysicsFun is a bottom-up initiative that establishes groups of edutaining students at European universities performing outreach activities. The shows have huge success. EuroPhysicsFun offers a complete package containing workshops, disseminating communication, and performance tools to the local "satellites", and tools to attract local funding. EuroPhysicsFun satellites are connected in web based and human networks.

Announced benefits are:

(1) Good communication is the first step towards a better understanding of the physics of everyday life.

(2) Without good communication one cannot expect a layman to understand the role of physics in our technology-based society.

(3) An increased recruitment of science students requires a visible and noticeable communication to a broad target group.

(4) Physics students are able to settle with the public's stereotypical image of the physicist.

(5) Physics students are closer to the educational level of the ordinary audience hence understand easier the difficulties of the audience's comprehension.

(6) Aiming at physics students, one has access to future teachers of science, scientists and physicists employed in the private sector. The outcome is a vast number of excellent ambassadors of physics, who regardless of their future career will benefit from the communicational skills obtained.

(7) Stimulating physics students to communicate motivates them to become teachers, hereby contributing to the solution of future shortage of teachers.

Further reading: project description (in English)

Contact person(s): Project Manager: Mikkel Bo Nielsen, University of Aarhus,
e-mail: epf@phys.au.dk

13. Title of project: PROMOSCIENCE

Country: CANADA

Target group: NGOs and educational institutes staging science promotion and awareness activities aimed at young Canadians in elementary school, high school, or (in Québec) their first year of college.

Partners involved: About 30 grants per year are issued on a competitive evaluation basis

Ongoing/completed: Ongoing since 2000

Description:

PromoScience is a program operated by Canada's Granting Agency for university and college research in the natural sciences and engineering (NSERC). It provides support for organizations opening science and engineering doors for Canada's young people. PromoScience grants may be used to cover expenses relating to program delivery and to many of the operational costs of the organization. PromoScience grants support organizations that: work with young Canadians to inspire an interest in science and engineering; motivate talented young people to study science and engineering; encourage young people to consider careers in science and engineering; bring science experiences to groups who are traditionally under-represented in scientific and engineering careers; train the teachers who teach science, math and technology to our young people.

Evaluation (if any): A formal evaluation will be conducted within the next few years

Further reading: http://www.nserc.ca/promoscience/index_e.htm

Contact person(s): see above website

14. Title of project: Let's Talk Science

Country: Canada

Target group: Young People, Teachers, Volunteers (MSC and PhD candidates)

Partners involved: Schools for Classroom projects

Ongoing/completed: Ongoing since 1991

Description: Let's Talk Science is aimed at improving Science literacy through innovative educational programs, research and advocacy. The project goal is to motivate and empower young Canadians through Science education. The long-term goals of Let's Talk Science are to: interest young people in Science; improve the confidence and competence of teachers in teaching Science; encourage participants to become life-long learners of Science; and understand Science learning and develop effective teaching strategies through research.

Let's Talk Science in-class workshops provide innovative learning opportunities involving fun and discovery as a basis to facilitate a student's learning and skill development. All in-class workshops are curriculum matched and use guided discovery through hands-on activities. Many have a take-home component so students can share their achievement with their parents.

Professional development workshops and conference presentations meet provincial curricula demands and are designed to increase a teacher's confidence and knowledge in Science so that s/he can provide their students with a stimulating Science learning environment.

Through its national volunteer-based program, Let's Talk Science provides a mechanism to expand the Science and innovation network and the skill set of volunteers, teachers and youth. Volunteers are given opportunities to perform hands-on Science activities in the classroom and in the community. Participants are provided with a realistic and positive role model, a point of contact with the scientific community and hands-on, interactive science education from a real scientist.

Evaluation (if any): Several articles and conference papers have been presented on Let's Talk Science

Further reading: http://www.letstalkscience.uwo.ca/aboutus/index.ihtml

Contact: info@letstalkscience.ca

15. Title of project: ACTUA

Country: CANADA

Target group: Young people aged 6-17 (27,00 per year)

Partners involved: a network of 27 member organizations across Canada

Ongoing/completed: Ongoing since 1993

Description: ACTUA is a national, not-for-profit organization and registered charity. The mandate of ACTUA is to increase the scientific and technical literacy of young Canadians. Programs include summer day camps, in-school workshops, teacher training, community outreach activities and specialized programs for under-represented audiences. ACTUA publishes *YES,* a magazine aimed at kids to awaken and nurture their interest in science.

Evaluation (if any):

Further reading: http://www.actua.ca/site_english_go.html

Contact person(s): See above site

16. Title of project: CRYSTAL

(Centres for Research into Youth, Science, Teaching and Learning)
Country: CANADA

Target group: University Researchers investigating the teaching of science, technology and math and the learning of the same by students **in grades 1-12**

Partners involved: University research teams must involve professors from both the faculties of science or applied science and the faculty of education. Team must also include practitioners and other agents involved in science education.

Ongoing/completed: Pilot program launched in 2005

Description: CRYTAL ran a national competition and selected five centres each of which will receive $1 million over five years to carry out in-depth research into science teaching and learning for primary and secondary students. The centres will conduct original research, evaluation of education and science promotion activities and will ensure that their research results are made available to the educational community, policy makers and curriculum developers.

Evaluation (if any): Will be carried out formally during and at the end of the five year pilot period.

Further reading: http://www.nserc.ca/about/initiatives/crystal_e.htm

Contact person(s): see above link

17. Title of project: Computer class for Female only – A good idea or a waste of time?

Country: Canada

Target group:
Female students, grade 11

Partners involved:
Department of computer sciences
Nortel

Ongoing/closed:

Description:
Nortel has run an **experimental project** in one school in which classes were set up in secondary school computer science along gender lines, i.e. some classes for girls only, and other predominantly male. The results of the experiment are positive and illustrate one potential solution to the problem of lack of interest in computer science by this segment of the population

Objectives:
- To encourage more women to enroll in computer science class

Resources: (financial, human)
- None specific

Actions:
- classes for female only (3)
- the course provides Internet programming in place of the standard programming languages

Evaluation:
The work turned in by the majority of the boys and the girls was equally acceptable

After the course was over, sufficient female students opted to take the advanced course, to enable two sections to be offered – a doubling of the previous enrollment. In addition, there was enough interest for the female-only course to be offered again.

Further reading:
On the website, posted by Bill Coderre (12/21/04): NORTEL sept3_99.doc

Contact person(s):
Penelope J. Gurney: pgurney@uottawa.ca

18. Title :Scientific Degrees Project

Country	Italy
Target group	High school (mostly) children & teachers
Partners involved	Ministry of Education Association Deans of Faculties of Science Confederation of Industries of Italy
Ongoing	Being implemented

Description

Aim	Arouse the interest of the population (and of the young in particular) in Science; decrease the negative perception of Science as seen today by the layman.
Objectives	Foster scientific studies incentivating the students and upgrading the teachers careers and preparation, gender actions considered.
Topics	Mathematics, physics, chemistry and material sciences
Resources	
financial	About 9 M€ joint funding by the Ministry of Education for the next three years (and presumably 6 or 7 by Universities and other sources)
human	Not yet defined
Implementation	Project to become operational beginning next academic year (2005-06). Guidelines in the process of being defined (have to be ready by May 15, 2005)

Evaluation	From next year for the next three years
Further reading	Full report at www.con-scienze.it under *Meeting at Villa Mondragone* or at www.scienzemfn.unito.it under *Documentation*
Contact person	predazzi@to.infn.it

19. Title **University fees reduction in selected areas**

Country	Italy
Target group	University students
Partners involved	Ministry of Education Universities of Italy (Faculties of Science)
Ongoing	Being implemented
Description	Enrolment fees into *Mathematics, Physics, Chemistry and Statistical sciences* have being reduced for the academic years 2004-2006
Evaluation	Impact on enrolment very limited if at all visible (but derivative is positive)

20. Title ***University reform***

Country Italy

Target group Universities

Partners involved Ministry of Education
Universities of Italy (all Faculties)

Ongoing Being implemented

Description Following the Sorbonne and Bologna declarations, Italy in 1999 has reformed radically its University Regulations and structures into a system of 3+2+3 levels of studies, as most European countries did

This reorganisation was seized as an opportunity to modernize the S&T tertiary education system.

The increase of student's enrolment had been steady at a rate of about 6-8% per year. Most Faculties of Science have experienced a higher rate of increase

Evaluation Impact on enrolment has been positive and the rate of dropouts has decreased substantially

21. Title of project: Ciência Viva

Country: Portugal

Target group: Various: teachers, children, general public…

Partners involved: Teachers, Scientific institutions, Science centres.

Ongoing/closed: Ongoing. Since 1996

Description:

Ciência Viva is a Portuguese Agency created by the Ministry of Science and Technology in 1996 to promote public awareness of Science and Technology. In particular, the Agency promotes and supports science education projects at school, short placements for students in research laboratories, a Science and Technology Week, summer science activities for the general public and a network of interactive Science Centers throughout the country, in collaboration with universities and local authorities.

Ciência Viva develops its activities in three fundamental areas:

1. **Ciencia Viva in schools**

Ciência Viva provides support to education projects to develop practical activities and to promote science and technology culture in basic and secondary education schools.

For this purpose three main lines of action were launched:

- an annual national project competition in the field of scientific education,
- a programme fostering the twinning between schools and scientific institutions
- a programme for the scientific occupation of teenagers : *"Science in the Holidays for Young People"* provides work experiences for the students in research laboratories during one or two weeks in the summer holidays.

2. **Network of Ciência Viva Centres**

A National Network of Ciência Viva Centres, designed as interactive spaces aimed at creating an awareness of science among the population.

The Pavilion of Knowledge – Ciência Viva, in The Parque das Nações in Lisbon plays a fundamental role as the national resource centre for all Ciência Viva Centres. This Science Centre is a multipurpose area, which has interactive science and technology exhibitions, a media library, cyber cafe, bookshop and an auditorium where regular public conferences are held.

A national network of Ciência Viva Centres also provide the opportunity for scientific, cultural and economic regional involvement. The network already includes 10 science centres and other projects to create new Ciência Viva Centres have already been launched around the country.

3. **National scientific awareness campaigns**

National Scientific Awareness Campaigns stimulate and provide the opportunity for personal contact with science specialists and institutions in the different fields. These initiatives are free and open to all, with a focus on practical activities, providing active observation and interaction with specialists from the relevant fields. They are intensely publicized on the media (newspapers, radio, TV). A toll-free telephone line and a web site are available for enquiries.

Each summer, field activities are organized for the general public, in collaboration with research institutes, universities, associations and local authorities (Astronomy, Biology, Geology, Science in the lighthouses and Engineering). Astronomical observations, field trips with biologists and geologists, visits to lighthouses guided by naval officers and, starting in 2004, visits to engineering facilities like bridges and dams, power stations, antennas are available for a non specialized public.

A Science and Technology Week is held in November since 1998, including a National Day of Scientific Culture, celebrated on the 24th. During this week, open-door activities in scientific institutions exhibitions, science films, conferences and discussions are held, promoting debate on current scientific issues by leading personalities from the national and international scientific communities.

Evaluation:

OECD Activity on declining interest in science studies

Ciência Viva has relied on the advice of an International Evaluation Committee, chaired by Prof. Joan Solomon, from the Open University, UK, for the development of the projects to promote practical work at school. From 1996 to 2001 they regularly visited projects in schools and science centers all over the country and talked to students, teachers and researchers during their visits and at the Ciência Viva Forum.

"In respect to the first and most important aim of Ciência Viva (To improve the science education of Portuguese school students through the inclusion of skills of observation and experimentation) there can be no doubt that the programme has been a very great success. Many Portuguese students have had their education improved in terms of observation and experiment." 1

1. Ciencia Viva in schools

More than 3000 projects have been supported, in partnership with research institutions, local authorities and scientific associations.

Since 1996, 5 annual calls for projects have been held, and 3,200 projects have been funded. Until now, over 3,000 schools, 7,000 teachers and up to 600,000 students were involved.

"Science in the Holidays for Young People" is now widespread, involving 55 scientific institutions across the country and more than 4,000 secondary school students had the opportunity to participate since 1997.

2. Network of Ciência Viva Centres

3. National scientific awareness campaigns,

S&T week: more than 400 events in 2004, organized by about 40 institutions

Engineering in summer started in 2004 with 14 companies and 127 events

Astronomy in summer: 300 events in 2004

Further reading:

In English: About Ciência Viva

In Portuguese: http://www.ucv.mct.pt/home/

Contact person(s):

Rosalia Vargas

Ciência Viva – Agencia Nacional para a Cultura Cientifica e Tecnologica

rvargas @cienciaviva.pt

[1] Final Report from the International Evaluation Group, Chairperson Prof. Joan Solomon, UK, 1997

22. Title of project : Yearly call for proposals for projects for the popularization of science, technology and innovation

Country : Flanders - Belgium

Target group : actors in the field of the popularisation of STI

Partners involved : Science division of the Ministry of Flanders

Ongoing completed : the calls were initiated in 1999 and there has been a call up until 2003. In 2004 there has been no call, but in 2005 a new call should be launched, taking into account the work that will be done in the TOS21-project.

Description : The call for proposals is the instrument the Flemish Government uses (in the action plan for Science information and Innovation) in order to stimulate the actors in the field of the popularisation of STI to gain some expertise in this respect. The intention being that the actors become more and more involved in the action plan and to stimulate the bottom-up realisation of activities. Project or actors that are able to prove their worth by regularly scoring well with their proposals can become a (structural) partner within the action plan, meaning that they will receive financial support over a long period (3 to 5 years).

The call for proposals is extensively covered in the Euroscene report for Flanders (see also further reading).

It is the intention of the Flemish government to screen and validate the different projects that were realised in the calls and that are aimed at the educational field within the framework the TOS21-project should deliver shortly.

Topics : (Part of) regional policy and action plan; all topics mentioned can be covered

Evaluation :

For the educational field, it seems that a large arrange of topics were covered, but to what extent and how applicable, will become clear in the TOS21-project. If there should still be some blanks within the topics identified, a specific call would be launched for these specific activities.

For other types of activities, the call would remain the same.

Further reading : Euroscene report for Flanders, chapter 3

Contac person(s) : Liliane Moeremans, Science Division (Ministry of Flanders)

23. Title of project : TOS21 (Technology at school for the 21st century)

Country : Flanders – Belgium

Target group : Intermediary actors in the educational field and in the field of S&T-actors

Partners involved : Department of Education – Dienst voor Onderwijsontwikkeling and Science Division of the Ministry of Flanders

Ongoing/completed : Initiated on January, 1 2005.

Description:

The project is the continuation of two previous projects, namely the TOBO (Technological education at primary level) and TOSO (technological education at secondary level) networks.

These networks of teachers were intended as networks of expertise for Technological education, providing a helpdesk (of peers) for teachers who experience some problems with this subject.

The networks were inspired both by the results of the analysis of the policy of the Flemish government with respect to the popularisation of science, technology and innovation (See report "possible causes and remedies in Flanders – chapter 2") and by the reports of the Inspectorate on Technological education in the classroom. The latter showed a lot of deficits with respect to the subject. As a consequence, the two policy areas responsible joined forces and this resulted in the common realisation of the two networks mentioned earlier. After two years however, several weaknesses of the project became clear :

- The networks operated at school level and did not transcend to the intermediary level. This was partly due to the fact that the pedagogical networks were not involved enough in the project. Since these networks are responsible both for defining the curriculum and the realisation of the curriculum in the class room, this was an essential weakness
- The networks also tended to develop tailor made materials for the work groups in the network, rather than building further on existing materials. As the Flemish government had already invested a lot in different materials, it would be essential that these would first be used
- The project also lacked a basic framework that could be used as a reference for all involved
- The human resources invested in the project, became insufficient very soon

As a consequence, it was decided to redesign the projects in order to address these weaknesses and increase the project efficiency.

The new project was named "TOS21". This joint project by the Education department and the Science, Innovation and Media department of the Ministry of Flanders aims to uplift "technological education" as a general subject (in education) rather than as a subject preparing for a technical profession. The project will provide the framework for better education in technology, a framework that will be used in other projects in order to better co-ordinate and structure the activities. As a consequence the essential building blocks (both with respect to knowledge and skills) for the curricula of the subject will be made available in the framework, thus allowing the educational networks to better structure their curricula within the agreed framework. The participation of the educational networks is essential for the realisation of the project, hence they will be involved at an early stage in order to obtain a framework that is agreed by all the actors involved.

Objectives

- Build a concept and vision with respect to technological education (framework)
- Building of (a cell of) expertise with respect to technological education
- Search for good practices, screen (existing or new) projects, validate (existing or new) projects
- Implement the framework in all other activities that are directed at the educational field and use the framework as a means to better structure these activities (undertaken by the actors)
- Topics : (Part of) regional policy and action plan ; teaching material, practice and curriculum development ; teacher training and education ; bridging difficult transitions (in a later phase)
- Financial and HR elements :
- Estimated cost of 250.000 euro/year for cost of personnel (4 FTE for cell of expertise) and 160.000 euro/year for project costs. These costs are split between both departments involved.
- Duration of project : 1 January 2005 – 31 December 2008

Evaluation (if any):

None since the project was just initiated. For the preceding project, a short evaluation is given above.

OECD Activity on declining interest in science studies
Further reading: Euroscene report for Flanders .
Contact person(s): Sabine Borrey and Gaston Moens

24. Title of project : Reuske, reuske ("Giant, giant")

Country : Flanders – Belgium

Target group : Children of the last year of kindergarten and the first year of primary education

Partners involved : Flanders Technology International Foundation/Technopolis

Ongoing/completed : The project was started in 2001, but the play itself was implemented from January 2002 onwards. It is still running today.

Description: One actor with his puppets and puppet theatre brings a simple and cute story for children where science and technology are brought under the attention of the children. Teachers are provided with a pedagogical dossier beforehand in order to allow them to prepare the performance. After the performance, the performer also engages the class in a conversation about the performance, thus allowing a deeper insight into what the children have learnt.

Objectives : To engage children (5-6 years) in an interactive way into the science and technology of their daily life

Reach :

School year	# performances	# schools	# of pupils
2001-2002 (from January 2002)	142 (78 single, 29 double and 2 triple)	109	6 402
2002-2003	240 (102 single, 63 double and 4 triple)	165	11 026
2004-2005 [2]	147 (63 single, 39 double and 2 triple)	101	6 796

Topics : (Part of) regional policy and action plan; teaching material

Financial and HR aspects :

- Cost from beginning of project until December 2004: 130 Keuro ; Income generated (schools have to pay for a performance – 65 euro/single performance) in the same period : 25 Keuro.
- HR involved : One actor travelling with the theatre and back office (reservations etc) provided by Flanders Technology International Foundation

Evaluation :

Initially no evaluation was provided. Since October 2004 the performer presents the teacher with an evaluation form. 49 were returned (up until 1 April 2005).

- The evaluation of the performance itself is very positive : teachers agree that :
- children were (very) enthusiastic about the performance
- the performance is at the level of the target group
- the performance is scientifically and pedagogically sound
- 71% agree that the project contributes to the increasing the interest for S&T among the target group, whereas the rest of the teachers thinks it maybe does
- The evaluation of the pedagogical dossier (file) to be used in the class room, shows that :
- Teachers use the file both before and/or after the performance (43%, 28,5% and 18%)
- 49% use the file to do experiments in the classroom
- Teachers agree that the file corresponds (very) well with the attainment targets and is scientifically sound

Further reading : not available

Contact person(s) : Sabine Borrey and Halinka De Visscher (e-mail : halinka@technopolis.be ; tel +32-15-34 20 20)

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[2] Estimated number

25. Title of project : Chip, chip, chip, hurray

Country : Flanders – Belgium

Target group : 3rd stage of primary education (10-12 years old)

Partners involved : Roger Van Overstraeten Foundation (based at IMEC, the interuniversitary (research) centre for micro-electronics)

Ongoing completed : project running since 2001

Description :

Interactive experimental box about ICT and introducing chips for use in the classroom. This box is comparable with the educational experiment boxes, but with one large difference : the boxes are provided with support for the teacher, meaning that there is permanent helpdesk available. Indeed, a demonstration session is given and a service desk is available for teachers when they try the box on their own. From the analysis of policy and the action plan and some of the activities (see report "causes and remedies for Flanders", available on the OECD-website) we leant that the educational experiment boxes were sometimes left aside, just because such a helpdesk was lacking. It is one of the merits of this project that it provides such a service and fills in a gap that was detected during the analysis.

The project is specifically developed for Technological education and provides for one of the topics of the framework envisioned by the TOS21-project, namely ICT, a sound starting base to fill in a whole educational trajectory (from 2,5 years old to 18 years old). It is the intention of the actor responsible to provide for the whole trajectory and also introducing nanotechnology.

Objectives

To provide an interactive package that gives an educational and scientifical sound realisation of technological education, linked to modern day technology that is very much present in daily life.

Topics : (Part of) regional policy and action plan ; teaching materials, teaching practice, pedagogical tools, teacher training and education

Financial and HR aspects :

80.000 euro/year. 1 FTE employed on the project (included in projectcosts).

Evaluation : The group of schools using this package is growing steadily and the support provided is much appreciated. Project is thus very successful and also engages in close contacts with the pedagogical networks. As a consequence the project is also supported at that level. Only constraints in available resources limit the project at the moment in the sense that it is not possible to provide the package and the extra's to a larger group at any given time.

Further reading : see website http://www.stichting-rvo.be/chips.asp?taal=en (in "projects", Class about chips: how, what and why?).

Contact person(s) : Jo Decuyper, director (Stichting Roger Van Overstraeten, Kapeldreef 75
3001 Heverlee – Belgium; Tel.: + 32-16- 28 10 64 ; e-mail : decuyper@imec.be)

26. Title of project : Eye-openers

Country : Flanders – Belgium

Target group : last year of secondary level

Partners involved : Flanders Technology International Foundation/Technopolis

Ongoing/completed : From January to June 2002.

Description : the project was presented as one of several within the Innovation action paper. Two other projects from the action plan in this respect were "A taste of your future" and "Future breakfast".

Intention of the project was to provide a number of professionals willing to come to the classroom to talk about their profession. According to our own analysis and a study of 2002 (in the framework of the Dream-it-project ; see www.dream-it.be) pupils in the last year of secondary education express a real need in this respect.

Objectives : to provide the target group (at school) with the real life experience of the job they are interested in.

Topics : (Part of) regional policy and action plan ; role models

Financial and HR aspects : cost of project : ca 3.000 euro

Evaluation : although 128 speakers were available providing a wide range of topics, only one person was contacted to talk in a class. It is possible that the other two projects mentioned earlier were of greater interest to the teachers.

The project was not repeated, because another (related) project was initiated later on, namely the Technology Day (in 2003 and 2004). For Technology Day, co-operation with the Dream-it project was realised.

Further reading : not available

Contact person(s) : Sabine Borrey and Halinka De Visscher

27. Title of project : ICT-platform for pupils and teachers

Country : Flanders – Belgium

Target group : teachers and pupils of secondary level

Partners involved : Free University of Brussels

Ongoing/completed : the subprojects were initiated at different moments, starting with the ComiX-files in 2000.

Description : The project provides a platform for pupils and their teacher to introduce ICT in education in accordance with the age group and in correspondence with the attainment targets. The platform consists essentially of three subprojects : the ComiX-files (1st stage of secondary level (12-14)), Stimulus (a virtual science class for the second stage of secondary education (14-16)) and the Virtual Museum (3rd stage of secondary education (16-18)).

- ComiX : pupils use comics to find and decode the scientific experiments of the heroes in the comic books. A number of mysteries have to be solved and the final solution be presented. The project is built as a competition. In the three editions, more than 7000 pupils participated. (http://comix-files.vub.ac.be/ (in Dutch)).
- Stimulus : is an educational computer game for beta sciences. It is built up around a central theme, with different modules. At the moment one module in chemistry is available : "the fireworks factory", that welcomed 4000 visitors. A second module for chemistry ("the washing machine") will become available in September 2005. The development of modules in other subjects is envisioned in the short term. (http://stimulus.vub.ac.be/ (in Dutch))
- Virtual Museum : in co-operation with teachers, scientists and multimedia specialists pupils investigate a certain aspect of Brussels. The result of their investigation is translated to a mini-site who has an exposition room at the virtual museum.
- There have been three editions already. The results of each edition can be visited at the corresponding level of the museum. (http://virtueelmuseum.vub.ac.be/ (in Dutch)).

Objectives : To provide teachers and pupils with an ICT platform enhancing S&T-lessons

Topics : (Part of) regional policy and action plan; teaching material; teacher trainign and education

Financial and HR aspects :

Costs/year	Personnel	Working cost	Infrastructure	Overhead
comix	23.000 euro	39.000 euro	5.000 euro	6.700 euro
Stimulus	27.000 euro	25.000 euro	0 euro	5.200 euro
Virtual Museum	12.000 euro	32.000 euro	3.000 euro	4.700 euro
Total	62.000 euro	96.000 euro	8.000 euro	16.600 euro

For the three projects, the personnel costs rflect 1,3 FTE

Evaluation : Projects were evaluated and their continuation is the result of the positive evaluation.

Further reading : see websites (Dutch).

Contact person(s) : Prof. Jean-Pierre de Grève, Free university of Brussels (jpdgreve@vub.ac/be).

28. Title of project : Environment meeting programme

Country : Flanders – Belgium

Target group : Several target groups in education

Partners involved : Tessenderlo Group (Chemical company – www.tessenderlogroup.com)

Description :

Every year Tessenderlo Group sends out a delegation of its engineers to speak about their passion for chemistry to youngsters of 14-15 years of age. These “teachers for one day” worked within the action plan “Chemistry and Youth” of the Belgian chemical federation “Fedichem”.

Since 1999 Tessenderlo Group invites in its West-Limburg Plants (B) children from the local schools, as part of a national program aimed at primary school pupils (age 10-12 years), to enhance the children’s awareness for the environment. The children can visit the water purification installations and perform some laboratory tests, what was highly appreciated.

Other educational projects gain the companiy active support, such as the “mini-enterprises” to make 16-year olds familiar with professional life and to prepare them for later entrepreneurship.

(see http://www.tessenderlogroup.com/S03_Safety%20&%20Environment/S07_Community%20Programmes/S03_Educational%20projects/content.asp)

Topics : role models, involvement of industry

Financial and HR aspects : Not available at the moment

Further reading : see www.tessenderlogroup.com (in English)

Contact person(s) : Kathleen Iwens (kathleen.iwens@tessenderlo.com ; tel : +21-13 61 22 11)

29. Title of project : Campaign "Do not stay behind, follow sciences"

Country : Flanders – Belgium

Period: 2001

Objective:

To provide an alternative view on S&T(-studies) especially to those who have not decided yet on their further studies in order to make them choose for S&T

Target group: Last year of secondary level (17-18 years)

Actions

Media campaign to provide youngsters with an insight of what S&T really is, what possible professions there are, what educational background they should have for what kind of (S&T) studies, …

Evaluation:

The activity was evaluated quite extensively. The campaign appealed to the target group and the sceptics about S&T-studies now considered such a study as a possibility

Further reading:

In Deutch:

http://innovatie.vlaanderen.be/knap/acties/secundair/blijf_niet_achter.htm

and http://www.innovatie.vlaanderen.be/volgwetenschappen/

Contact person(s):

Sabine Borrey

Science Division of Ministry of Flanders

30. Title of project : The great sEXPERIMENT

Country : Flanders – Belgium

Target group:

General public

Partners involved:

Flanders Technology International Foundation (SFTI)/Technopolis

Ongoing/closed:

Closed

Description:

Period: 2002.

Objectives:

To try to prove to both men and women that they have many talents and that they can attain some things about which they always believed this was not for them. (Women and technical professions for instance).

Actions:

This exhibition brought some interesting information about the so-called talents of males and females that are in most cases strongly attributed to one pf the sexes. For instance the fact that women cannot read maps or can perform more than one task at the same time. Visitors had a unique barcode and they could test these hypothesis or statements themselves. Afterwards the scores of all visitors were statistically arranged.

Evaluation:

Not available as such, because the exhibition was incorporated in Technopolis for some time. The exhibition has now been rented to other science centres in Europe (Netherlands and Denmark).

Further reading:

Contact person(s):

Sabine Borrey

31. Title of project : Flemish Science Week

Country : Flanders – Belgium

Target group: Several: see description

Partners involved:

The Science and Innovation administration of the ministry of Flanders is the main organiser in close co-operation with the Flanders Technology International Foundation

Ongoing/closed: Ongoing

Description:

Objectives: Information about and sensibilisation for the importance of STI and research in these topics for society and to give pupils hands-on experience with research in the appropriate setting

Actions:

The Science Week of Flanders is organised every two years (even years ; since 1994) and the sixth edition took place in October 2004.

The Science Week consists of four important parts :

- Science festival : the science festival is aimed at the general public and provides various hands-on activities, competitions, science theatre, quizzes, etc.
- Science through the looking-glass : an interactive program organised at universities, institutions for higher education and scientific institutions, aimed at youngsters aged 16 to 18.
- Science project : one week of interactive science for children aged 10 to 12 and organised around one theme.
- Projects organised by third parties : Observatories, scientific foundations, public libraries, etc. organise interactive scientific activities at their own location and imbedded in there normal programme.

Evaluation:

The two main elements of the Science Week (Science festival and Science through the looking glass) have been evaluated since 1998 (survey of participants and organisers and some years there has also been a survey among non-participants).

Main results[3] :

- Participants are more interested in STI after participation
- The image of STI the participants have, is altered positively after participation
- Participation enables pupils to regard STI as a valuable option for future studies in higher education

Number of participants

- On average 27.000 pupils participate in "science through the looking glass"
- On average 20.000 people participate in the Science Festival

Further reading:

e-mail : wetenschap.innovatie@vlaanderen.be

website : www.innovatie.vlaanderen.be/knap and www.vlaamsewetenschapsweek

Contact person(s): Sabine Borrey

[3] All surveys of the Flemish Science Week, Science Festival and Science Happening avialable (in Dutch) on the website mentioned

32. Title of project : Educational experiment boxes Campaign

Country : Flanders – Belgium

Target group:
Primary level (the boxes contain 3 experiments for each of the three stages at primary level).

Partners involved:
Organiser : Flanders Technology International Foundation (SFTI)/Technopolis

Ongoing/closed:
First realised in 1995 and since then 5 sets of boxes were realised, amounting to 45 experiments

Description:
Objectives:

The familiarize pupils with STI in an interactive way.

Actions:

Nine activities in one box aimed at making science and technology accessible to the pupils. Experiment for instance with a polarization filter, sound in a vacuum, refraction & reflection, spherical lenses, propulsion, spring forces, Benham's disk, the bird in the cage, and the conservation of energy. This box can be used at both a 'serious' scientific level and as entertainment.

Evaluation:
Boxes were ready to use, but teachers felt that no helpdesk was available to them in case they had questions, or could not start up with the box. As a result the boxes would remain in the cupboard. As a consequence a level of support was set up by establishing a network of teachers.

Number of participants

An average of 2.100 boxes were distributed with every edition. Each box contained – for each experiment - material for one class of 30 pupils.

Further reading:

Contact person(s):
Sabine Borrey

33. Title of project : About Life ("over Leven")

Country : Flanders – Belgium

Target group:
General public

Partners involved:
VRT-Canvas and Ministry of Flanders

Ongoing/closed:
Broadcasted for several years and still on air

Description:
Objectives:
Information about scientific breakthroughs related to every day life
Actions:
OverLeven (literal translation : about Life, but also "to survive") co-production of the VRT (Flemish Radio and Television) and the Flemish Community. The broadcasts (on Canvas) feature exciting documentaries about recent scientific achievements that are closely related to the everyday experiences of the average citizen. Each edition of the programme is built around a prominent scientist who has been responsible for an important scientific breakthrough in his specialist field.

OverLeven was awarded several prizes, amongst others the "Boy Trip Award" for the episode "De ware Lodewijk" (The real Louis XVII) at the Film festival 2000 in the Netherlands, earned featured billing in the New York Festival of TV programming and promotion competition with "Het Zout der aarde" (Salt of the Earth), received the price for science communication by the Royal Flemish Academy of Belgium for Science and the Arts. The prize money of this last prize was dedicated by overLeven to a competition for original and good ideas (related in a text) for an issue of overLeven. Any scientific subject could be taken into account. This competition was concluded during the Flemish Science Week 2004 and was quite a success

Evaluation:
Each feature is rated by way of number of viewers and share in number of viewers. On average around 150.000 viewers watch a feature.

Further reading:
Website : www.canvas.be

Contact:
Sabine borrey,
and
VRT-Canvas
Redactie overLeven
1043 Brussels
Belgium
Tel : +32-2-741 31 11

34. Title of project: LUMA Joint National Action ("LUMA" is an acronym of the Finnish words meaning natural sciences and mathematics.)

Country: FINLAND

Target group: Teachers and pupils in upper secondary schools

Partners involved: Several different players (state's education administration, municipalities, schools, educational establishments and higher education institutions, industry and many NGOs).

Ongoing/completed: 1996-2002, but different spin-offs ongoing as development projects.

Description:

LUMA Joint National Action was an extensive programme to develop knowledge in mathematics and the natural sciences. The Ministry of Education and National Board of Education have allocated a total of EUR 34 million in development funds for the Joint National Action and the National Board of Education´s project group has devoted approx. 20 man-years during the project to developing teaching in mathematics and the natural sciences.

Schools, educational establishments and higher education institutions have engaged in significant cop-operation that transcends the boundaries between the various levels. Higher education institutions have provided schools with their equipment and expertise, given teachers supplementary training and carried out research and researcher training projects relating to the learning and teaching of mathematics and the natural sciences.

Evaluation: The interim assessment 2000 and the final, international assessment 2002.

Further reading: http://www.oph.fi/SubPage.asp?path=1,443,3218,6717,18762
http://www.minedu.fi/minedu/education/luma/finn_knowhow.html

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http://www.edu.fi/projektit/luma

35. Title of project: Teacher in-service training

Country: FINLAND

Target group: Class teachers and kindergarten teachers.

Partners involved: The Ministry of Education, universities, polytechnics, National Board of Education, municipalities, subject teacher organisations.

Ongoing/completed: 1996-2002

Description: The teacher in-service training was an implementation of the LUMA programme. Each year, the universities´subject departments, departments of teacher education and training schools have been able to apply for the supplementary training allocations set aside for this purpose. Many in-service courses have related to information and communication technology. Many projects have included research activity and the production of net material suitable for teaching.

The other subjects of the training events were, e.g. mathematics and natural sciences contents in pre-school education, mathematics in remedial teaching and the development of the teaching of mathematics and natural sciences subjects at training schools.

Evaluation: Evaluation 2002.

Further reading: http://www.edu.fi/julkaisut/luma8.pdf (available only in Finnish, contents also indicators for the project)

Contact person(s): Counsellor of Education Marja Montonen, National Board of Education
GSM +358 050 435 0806,e-mail: Marja.Montonen@oph.fi, http://www.edu.fi/projektit/luma

36. Title of project: The Development and Information network, now LUMA Centre

Country: FINLAND

Target group:.25 municipalities and six teachers training school

Partners involved: The National Board of Education, municipalities, schools, educational establishments

Ongoing/completed: ongoing since1996

Description: In 1996 the National Board of Education established the mailing list, which has been the fastest channel to communication that takes place with wide coverage and in many directions.

In 2003 University of Helsinki, City of Helsinki, the National Board of Education, Ministry of Education, Chemical Industry Federation, Finnish Forestry Industries Federation, The Economic Information Office of Finnish industry and commerce and Technology Industries of Finland establish the centre, which promotes the teaching of biology, chemistry, geography, mathematics, physics and technology and enhances interaction between schools, universities and business and industry. The aim is cross-disciplinary co-operation. The Centre also seeks to encourage children and young people to become involved in scientific activities.

Evaluation: Activities just started.

Further reading: http://www.helsinki.fi/luma/english/

Contact person(s): see above

37. Title of project : Action plan for Science Information and Innovation (policy and actions with respect to the popularisation of STI)

Country : Flanders – Belgium

Target group(s) : all (both actors themselves as the target groups mentioned)

Partners involved : Flemish government (and partners for the realisation of the project

Ongoing/completed : since 1994

Description : the action plan is the instrument used to implement the policy with respect to the popularisation of science, technology and innovation. The policy is outlined in the (yearly) policy letter which covers the whole policy with respect to STI. In the action plan the policy is described in more detail and the actions to be undertaken are described as well.

An extensive description of the policy, the action plan and the activities undertaken is described extensively for the period 1999-2003 in the Euroscene report for Flanders (available on the website).

In general it can be said that the policy has gone through the following periods :

- 1994-1999 : seeding period. This period marks the beginning of the policy and the action plan and is characterised by a gradual growth of funds available for these activities. In 1994 the total budget was around 750.000 euro whereas in 2004 the budget has grown to around 9 million euro (0,56% of the total budget of STI-policy).

  This period is also marked by a growing number of activities and more and more actors entering the field, hence gradually covering all target groups.
- 2000-2004 : this period can be seen as a maturisation period. Specific landmark in this period is the analysis of the policy in Flanders up until that time (including a benchmark with the policy in the Netherlands) and the formulation of recommendations for the future period. The policy for the period under consideration is built strongly upon these recommendations and is characterised by two developments : establishing a strong co-operation with the Department of Education and the enhancement of the structuring and co-ordinating role of the government, thus allowing the actors to play a larger part in the action plan. Activities are set up top-down (the government asking actors to participate in an activity defined by government) and bottom-up (actors presenting ideas for activities, either on an ad-hoc basis or by participating in the call for proposals). This period is hence also characterised by the building up of expertise among the actors and this by way of the call for proposals (see also further on).
- 2005-2010 : this period is a period a consolidation, where the best activities (including materials developed – see also TOS21-project) and actors will be prolonged and where a better co-ordination and structuring of the activities will be organised by way of the establishment of a network of actors (supported by an electronic tool). In order to realise this consolidation, a follow-up analysis (covering the previous period) will be carried out. The outlines of the policy for the period under consideration (together with an action plan for 2005) are expected very shortly.

Objectives :

"To strengthen the social basis for science, technology and technological innovation in a society which is constantly evolving further towards a knowledge society".

General:

- To provide information on science and technology in general, and on research related to this in particular.
- To raise awareness for the importance of scientific (and innovative) technological research and innovation.
- Accountability for the expenditure of the funds which are assigned by the government for this research and for innovation.
- To create a culture which encourages technological innovation

Specific:

- **To increase the influx, flow through and efflux** in the exact and applied sciences (more people educated in the sciences and technology)

OECD Activity on declining interest in science studies

- To encourage entrepreneurs to embrace technological innovation
- **To find the potential that is not used (in particular, girls) and try to involve them in the above-mentioned objectives**
- To target the general public (to increase ”awareness”).

(see elaborate description of policy and action plan in Euroscene report for Flanders).

On overview of a lot of activities that were organised within the framework of the action-plan is given in chapter 3 of the Euroscene report Flanders.

Topics : all

Financial and HR-aspects : total budget of action plan in 2005 : around 8 million euro. In 2006 this budget will be augmented with 1 million euro

Evaluation : analysis of policy and action plan (and 5 activities) available on website. The micro-analysis of the 5 actions (science kits, science centre, science theatre, science in the picture (part of Flemish science week) and campaign “Do not stay behind, follow sciences”) is only available in Dutch.

Further reading : Euroscene report for Flanders and notes on causes and remedies for Flanders

Contact person(s) : Sabine Borrey

38. Title of project : Fedichem

Country : Flanders – Belgium

Target group : teachers, pupils, general public

Partners involved : Fedichem (federation of chemical industry)

Description : Fedichem offers a wide arrange of documentation about the Chemical industry for both the general public and the educational field.

These are available (in Dutch and a large number also in French) on the following sites :

http://www.fedichem.be/nl/publications/everyday_science

http://www.fedichem.be/en/publications/chemistry_and_you

39. Title of project : Agoria Vlaanderen

Country : Flanders – Belgium

Target group : diverse groups

Partners involved : Agoria Vlaanderen (federation of technological industry Flanders)

Description : "One of a company's aims is to have properly qualified staff. Our industry needs an educational system that will enable it to recruit employees who are capable of discharging their duties after undergoing in-company training. Our industry also needs a modular and flexible system of continuing training that will allow workers to increase their knowledge and hone their skills while constantly adapting to technological innovation and new forms of labour organization. Agoria-Vlaanderen is pursuing a variety of actions – in conjunction with the regional associations – as it strives to better coordinate education, vocational training, continuing training and employment and offer its members genuine services. "

Contact: Joris Celis, Tel.+32 2 706 78 38 Fax +32 2 706 78 44.

Further reading : http://www.agoria.be/Vlaanderen/en/home.htm (in Dutch only)

40. Title of project : Multimedia award

Country : Flanders - Belgium

Target groups : general public, students, employees

Partners involved : Alcatel

Ongoing/completed : Every year from 1996 to 1999

Description and objective : to generate innovative ideas, centred around a central theme (for instance : timesaving Internet applications) by way of a competition.

Evaluation : the project became too successful, creating a logistic problem. In the last year there were around 800 participants filing a project.

Contact person : veronique.martens@alcatel.be (tel : +32-2-240 40 11)
www.alcatel.be (English)

41. Title of project: "Promotion of Young People into Science and Engineering" (national trans-agency initiative, 2002-)

Country: Republic of Korea

Target group: Pupils in primary and secondary school, scientists and engineers in general, general public

Partners involved: Ministry of Science and Technology, Ministry of Education, Ministry of Industry, and various related public institutions

Ongoing/completed: Ongoing

Description: This project is a trans-ministerial initiative of the Korean government in order to respond to the decline of young people's interests in science and technology and the decline of enrolment rate of talented young people into science and engineering fields. Policy measures of this initiative are categorized into three main policy areas:

Part 1: Strengthening of math and science education in primary and secondary school

Part 2: Strengthening of science and engineering education at colleges and universities

Part 3: Motivation of scientists and engineers by providing long-term occupational vision.

Mainly three government ministries – Ministry of Education, Ministry of Science and Technology and Ministry of Industry – are involved in this initiative and each ministry has been planning and implementing specific policy measures related to its major activity areas.

Most important policy measures of this initiative are as follows:

1) Development of new S&T textbooks for creative education and strengthening of experiments in science education
2) Revision of college exam system to enhance the advancement of pupils in natural science at high school into the science and engineering fields at colleges
3) "Advanced Placement"(AP) and "Placement Test"(PT) for the easier entrance of talented young pupils into science and engineering study
4) Policy measures to support research activities of young female scientists and to facilitate women's participation in the science and engineering education ("WISE" program)
5) Policy measures to improve welfare and social status of scientists and engineers in society (e.g. "Best Scientists Support Program", Hall of Fame for scientists etc.)
6) Strengthening of demand-oriented education and improvement of employment rate of college graduates in science and engineering (including intensifying the cooperation between universities and industry)

Evaluation: Performance results of each ministry are examined at the upper-level government committee regularly.

Further reading: Documents about the policy measures of each ministry (Korean)

Contact person(s): Ministry of Education, Ministry of Science and Technology, Ministry of Industry

42. Title of project: "Science Korea" Project (2004-)

Country: Republic of Korea

Target group: Pupils in primary and secondary school, general public

Partners involved: Korea Science Foundation, Government (Ministry of Science and Technology), Regional government, academia, industrial R&D institutes, mass media, NGO(non-government organization) etc.

Ongoing/completed: Ongoing

Description: "Science Korea" project aims to build an innovation-oriented socio-cultural environment by organizing and motivating various activities related to 'science culture' and popularization of science. This project is funded by the Ministry of Science and Technology (MOST) and coordinated by the Korea Science Foundation (KSF) who is responsible for the planning and implementation of 'science culture' programs. And many other science-related public and non-profit organizations and industries are participating in the project.

The project is composed with a number of specific projects. The "core" project is the "Science Culture City" project, which tries to expand voluntary regional science culture movement. Three main projects are as follows:

1) Establishment and management of "Everyday Science Classroom" in order to facilitate contacts of the public with scientific elements in everyday life
2) Building "Science Online Community"(Sci-Net) for the popularization of science and technology through online media
3) Management of "Youth Science Club" in order to promote scientific activities of young pupils in primary and secondary school

The "Science Korea" project includes other various activities such as science polurarization projects using mass media, public science events, "Science for Leaders" program etc. This project tries to contribute to the expansion of scientific mind and culture among general public and the increase of the interests in science and technology among general public, especially among younger people.

Evaluation: The overall performance of the project is examined by the funding agency, the Ministry of Science and Technology, except some voluntary programs in which various NGOs are participating.

Further reading: Documents about the "Science Korea" (in Korean)

"Science Korea" project homepage (in Korean) (http://sciencekorea.scienceall.com/)

Contact person(s): Ministry of Science and Technology, Korea Science Foundation (KSF)

43. Title of project: National Action Plan on S&T and the S&T Platform

Country: Netherlands

Target groups: various

Partners involved: Ministry of Economic Affairs, Ministry of Social Affairs and Employment and Ministry of Education, Culture and Science.

Ongoing/closed: Ongoing

Description:.

In 2004 the government launched its National Action Plan on Science and Technology (Nationaal Actieplan Bèta/Techniek[11]). The plan expresses the ambition to achieve 15% more new science and technology graduates in 2010 relative to 2000, and to ensure that scientists and technologists are more effectively retained and used. To put this ambition into practice, the Science and Technology Platform (Platform Bèta Techniek) was established by the ministry of Economic Affairs, the ministry of Social Affairs and Employment and the ministry of Education, Culture & Science in 2004 with a budget totalling 285 million euro for the period 2004-2010.

Approach

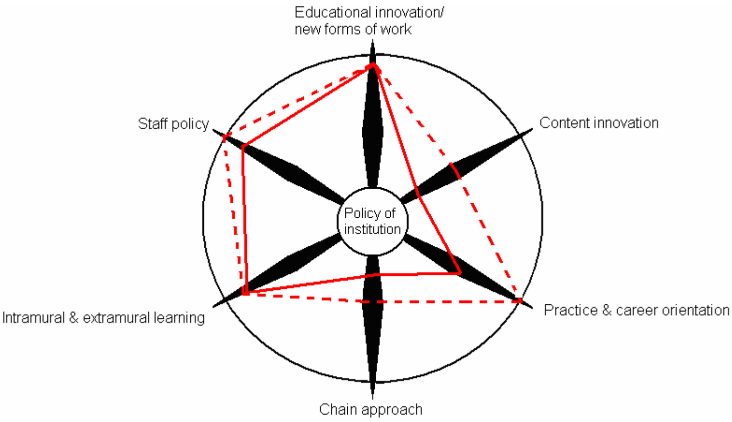
Based on experiences in the past the Platform has developed an approach that is aimed on the entire chain from primary schooling to the labour market. The goal is to permanently anchoring science and technology policy into the overall policy of schools and companies. The trio of education, government and industry must collaborate in order to achieve results.

Starting point is the schools own policy. The Platform is developing a range of solution directions and methods with which schools can start changing things according to their own choices and insights. Innovation and performance agreements are made with the school or company regarding the ultimate objectives. The core of this approach, then, is the autonomy of the school. Nothing is imposed. Progress is monitored, and the results of monitoring are discussed with the school at auditing meetings, when the school as it were has a mirror held up to it so that it can see its strengths and weaknesses.

In addition to its nationwide programme the Platform is also active in the regions, collaborating with the business community, schools and regional and local government to establish and carry out science and technology agendas.

Substantive support

The Platform's aim is to offer institutions as much support and expertise as possible. The Platform has developed an 'education and labour market compass'. This illustrates the various elements that contribute to a successful approach. The more of these elements a school takes up, the greater the chance of success. The compass can be used to visualize both the initial situation of a school and the target situation. It looks like this:



The Platform works from primary school up to and including the labour market, making the entire educational career of a young person more attractive. In what follows we examine the most important initiatives of the Platform.

Primary education

The Science and Technology Platform has extended the successful VTB programme (Verbreding Techniek Basisonderwijs: broadening engineering and technology in basic education) introduced by Axis (see good practice). Under the programme, a third of all primary schools receive an incentive premium for permanently anchoring engineering and technology in their teaching programme. The object is to introduce children to engineering and technology not as an isolated subject but as an integral part of their education so that they both gain an awareness that engineering and technology are all around them and at the same time start collecting positive experiences of the subject at a young age. Each school in the programme is assisted by a support network consisting of other schools and a central support point. Schools taking part in the programme must undertake to involve and support other schools on the basis of their own experiences. At the same time the programme ensures that each school is given easily approachable access to information and material for introducing engineering and technology into its programme, policy and organization, e.g. through workshops, websites and regional support points. Where material is not readily available, it is developed. Likewise, engineering and technology are being incorporated into the curricula of all primary teacher training colleges so that teachers will come to the classroom better equipped. A postgraduate course leading to a qualification as technology coordinator is also under development.

All schools in the Netherlands are required to include engineering and technology in their curricula from 2006.

Secondary education

In secondary education the “Universum programme” has been developed to encourage schools to elect for a ‘science and technology profile’. School policy towards constructing such a science and technology profile is determined by the factors in the compass referred to earlier. Schools are assisted with workshops and seminars on e.g. specific problems relating to girls, training opportunities and teaching material. To aid the introduction of ‘learning by doing’ methods one approach has been the creation of a partnership of multinationals to help schools (Jet-Net, see good practice), which is supported by the Science and Technology Platform.

Schools participating in this programme receive an incentive premium and become part of a network in which, after a certain time, they will be expected to assist new schools entering the scheme. The intention is that 20% of all schools will be profiled as science and technology schools by 2010.

Vocational and prevocational education

In 2004 seven regional redesign projects were allocated and started up. These projects involve institutions that were already engaged in educational innovation during the Axis period and are now continuing to build on that start. The object of these projects is to arrive at a redesign of vocational education in technical fields, both as regards teaching methods and in overall programme terms. It was in this context that the institutions were asked to set up the projects on a regional basis. Three of the projects are at the prevocational secondary and secondary vocational (VMBO-MBO) level and the remaining four are at the secondary and higher vocational (MBO-HBO) level.

Performance and innovation contracts have been entered into with these projects: the projects commit themselves to a growth target of 15% more volume in combination with innovation in technical vocational education. In an outline Plan of Effort the pilots have indicated what ambitions they hope to achieve in the coming years.

Alongside the redesign projects the Platform is also hoping to broach new initiatives. In the Prevocational Education Ambition Programme for Science and Technology (VMBO Ambitieprogramma Bèta/Techniek) 2005-2008 ambitious prevocational schools are given an extra incentive to offer innovative and attractive education in science, engineering and technology. Two routes are offered: further development or total innovation. In the case of further development the school embarks on innovation on the basis of the possibilities that are already available. In the case of total innovation the school focuses on a new educational philosophy and structure and the entire organization is involved in the process. Both routes are designed to strengthen the position of science and technology; the tempo and intensity of the innovation can vary considerably from school to school.

Higher vocational education

Innovation and performance agreements have been entered into with all eighteen higher vocational education establishments (also known as universities of professional education) in the Netherlands. Under the terms of these agreements all the establishments commit themselves to the aims of the government, undertaking to make education more attractive, to reduce dropout rates and to create hybrid courses. The Platform supports them in these innovations in various ways, including regular audits giving them an objective view of how each establishment's approach is faring.

Universities

Debates with each individual university are being entered into regarding the possibilities that these institutions already have for making themselves more attractive to pupils with qualifications in science and technology. The programme is based on three themes:

- the development on a regional or national basis of networks between universities and secondary schools;
- broadening first degree courses;
- encouraging applied science master's courses.

Labour market

Together with relevant industry bodies and employers, '2010 explorations' (a tool developed by the Science and Technology Platform) is used to set the agendas by which work is to proceed in both the labour market and the education system. The object is to strengthen the attraction to job-seekers of technically skilled jobs and companies and at the same time to promote the retention of available potential within companies.

In 2004 the Casimir programme was launched to reinforce research and development. The programme aims to boost R&D careers by enhanced public-private mobility, i.e. making it easier for researchers to be exchanged between universities and companies. In the autumn of 2005 grants will be awarded to some twenty new projects. At the same time a study is being carried out to determine what further bottlenecks exist in this area.

OECD Activity on declining interest in science studies

Science and Technology Communication

In the area of communication on science and technology, too, the Science and Technology Platform is developing activities. Key to these is the premise that the activities must both fit in with other projects and be subservient to them. The focus will be on putting the spotlight on the many interesting areas in which technology plays a part, e.g. technology and sport, technology and nutrition, or technology and lifestyle.

Financial incentives

To determine whether financial incentives might be able to encourage students to take science and technology courses a number of pilot projects have been established. At the time of writing these have yet to yield results.

Evaluation: This initiative is too recent to be evaluated. Interim evaluation is planed for 2007.

Further reading: Deltaplan

Contact person(s): Ronald van den Bos, Ministry of Education Culture and Science the Netherlands, r.l.vandenbos@minocw.nl

Marjolijn Vermeulen, Science and Technology Platform the Netherlands, m.vermeulen@deltapunt.nl

44. Title of project: A mapping of production and employment of Danish M.Sc's in Mathematical, Physical and Chemical Sciences, 1971-1999

Country: Denmark

Target groups: Secondary school, parents, teachers, the political system

Partners involved: A national network of university science teachers

Ongoing/closed: Closed

Evaluation: -

Description: This study identifies the career patterns of the 7678 persons that received a five year degree from one of the Danish universities during the 30 year period from April 1, 1971 to October 1, 1999 within the mathematical sciences (mathematics, statistics, computer science, mathematical economics, actuarial science), the physical sciences (physics, astronomy, geophysics, biophysics), and the chemical sciences(chemistry, biochemistry, environmental chemistry). Statistics on production, employment spectra, durations of studies are presented as function of time. The material is used for career advice, etc. addressed at pupils finishing secondary school.

Further reading: The full text: http://presse.uvm.dk/nyt/pm/gik1.pdf

The text is in Danish, but a summary in English may be found on pages 48-49.

Contact person(s): Professor Nils O. Andersen, email: noa@fys.ku.dk

45. Integrating Technology in Primary Education

Country: Netherlands

Target groups: Primary pupils & teachers

Partners involved:
- 11 regions
- 125 schools
- Axis
- Five industries in science and technology
- Ministry of Education

Ongoing/closed: ongoing

Evaluation:

In eleven regions some 125 primary schools and ten elementary teacher training colleges have been actively engaged in bringing engineering and technology into their curricula.

A practical test has been developed by the National Institute for Educational Measurement (CITO) for the purpose of testing technical skills.

About 200 teaching boxes have been developed which are now being used by the participating schools. They appear to be generating growing interest in engineering and technology, particularly among girls.

Test results show that girls benefit particularly well from the programme, scoring significantly higher than girls at schools not participating.

Description:

Between 2001 and 2004, Axis set up and implemented a programme that involved embedding science and technology in primary schools and also testing these practical skills at the end of this educational phase, alongside with cognitive skills.

This first pilot was regarded as successful by participants. It was therefore expanded considerably in the period 2004-2010, covering all 7500 primary schools and all 40 teacher training institutes. A financial stimulus and extra support is to be provided for 2500 schools.

Objective
- Integration of technology in 125 primary schools
- Dissemination of technology through national standards and educational tools

Final objectives
- Improving the attitude of both teachers and children towards science and technology studies and professions
- Providing teaching material and methods of integrating technology in primary schools, that can be adapted to apply to all 7500 primary schools.
- Making all teachers technology-literate
- Making technology a natural part of primary education and a means of improving the learning process.

Key activities

Eleven regional networks of school enrolled and were enabled to integrate technology in their curricula. These networks consisted of some 125 primary schools, 12 teacher training institutes and various other parties, such as enterprises and mainly local business communities.

New materials, methods and good practices were developed and exchanged within and between the networks and were disseminated by websites, newsletters, workshops and other means and media.

National measures were taken by the Dutch Ministry of Education, Culture and Science. This includes the formal (statutory) learning goals for the primary education system

Working methods

At the national level: engineering and technology were added to the core objectives of primary education and the subject is one of those on which primary school children are tested in their final test.

At the school level: the guiding principle is that each school has both the opportunity and prime responsibility to realize its own agenda with respect to the integration of technology.

Schools were encouraged by being offered a financial incentive.

Important instruments were the dissemination of good practices and materials on a large scale, a regional infrastructure supporting schools in implementing these tools and a quality improvement system.

Example: Engineering and Technology at De Wichelroede primary school

De Wichelroede primary school has included engineering and technology in its teaching ever since 1995. There are two main goals. In the first place there is the aim of giving children an appreciation of the part engineering and technology play in everyday life and in so doing allowing them to form an affinity with the subject. Second, there is the goal of teaching children to collaborate with each other, take responsibility, tackle problems in a systematic way, and reflect on what they are doing. To achieve these objectives, in primary years five to eight (age eight to twelve) children spent one lesson a week working in pairs with teaching boxes developed by the school. The school now has over 150 teaching boxes which fall into four categories: (a) engineering and technology (ready-made material e.g. Lego), (b) projects (measuring, electricity, material board, dismantling), (c) construction (using e.g. wood, metal, paper and cardboard) and (d) experimentation (e.g. light and heavy, hot and cold, hard and soft). Both inside and outside the classroom there are fixed workspaces associated with the facilities required for the various sorts of teaching box, e.g. water and electricity. The local business community supports De Wichelroede by making available all sorts of materials and products. There are also regular excursions to nearby companies.

Financial support

Period 2001-2004: *EUR 4 million*.

This was gathered through contributions by the ministry of Education and industry associations.

The fact that the business community funds a programme in primary education which is at least 10 years away from any benefits is quite unique.

Further reading:

see various good practices at www.kennisbanktechniek.nl)
On the evaluation:Toetsen Techniek in het basisonderwijs, Cito-groep, 2003

Contact person(s):

46. Jet-Net (Youth Technology Network Netherlands)

Country: Netherlands

Target groups: secondary education students (14-18 year old)

Partners involved:

A wide variety of industry and technology sectors such as petrochemicals, defense, food, ICT, metals, electronics and instrumentation[4]).

30 companies (partner companies, including subsidiaries and branches) have collaborative agreements with some 125 individual schools across the country (i.e. reaching approx. 25% of the target population of students eligible for higher education).

Ongoing/closed: ongoing

Evaluation:

Jet-Net has been active for two consecutive academic years. It is still to early to claim a direct impact on student enrolment in higher science and technology education. However, the overall experience for schools and companies so far has been very positive. In a recent evaluation study, teachers underlined the benefits of Jet-Net both in terms of education enrichment and in terms of increasing student awareness of their wider future perspectives.

As at mid 2005, Jet-Net has reached approximately 25% of the target group of 550 secondary schools in the Netherlands (approx. 15,000-20,000 students).

Description:

Objective

Jet-Net (Youth and Technology Network Netherlands) was set up in 2002 as a joint initiative of industrial employers, the education sector and the Dutch government.

Its main purpose is:
- to assist secondary schools in making science subjects more appealing to students aged 14–18,
- and to clarify future career prospects in the industry.

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

Key Activities

Jet-Net participants offer a broad range of inputs which constitute the main ingredients of tailor-made programmes set up jointly with schools.
- general introduction and familiarization (company excursions, presentations)
- subject support (assistance to teachers in specific parts of the curriculum)
- career orientation support (assistance to students in their individual choices)

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

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

Working methods

Jet-Net provides a common label for participating companies in their school activities. It also helps develop the overall programme and the further development of Jet-Net both in terms of industry participation and in terms of the scope of the school activities.

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[4] Participating companies a.o. are: Royal Dutch Shell, Philips Electronics, DSM, Corus, IBM, DOW Chemicals, TNO, Royal Navy, Brunel Engineering, AKZO Nobel, Unilever, Océ, Schiphol Group, Siemens, GTI et alia.

These will include an increasing share of classroom and project work based on actual (industry/technology) practice and hence will require lasting interaction between schools and industries in their region.

Schools are also encouraged to make active use of the increased availability of industry capacity in the school curriculum and in assisting individual students with project work. In turn companies establish a unique rapport with members of the younger generation, hopefully increasing their ability to recruit new talent for technology development in the future.

Example: Expert meeting for school children at Shell

After a general introduction, pupils form groups to talk to experts from – in this case – Shell. Each group is given one-and-a-half hours to quiz the Shell experts on every aspect of an energy- or technology-related subject. Subjects range from tar sands in Canada to hydrogen in Iceland and wind energy in the Netherlands. The discussion is not confined to purely technical matters, however: the associated social changes and economic problems are also raised. Pupils then present their findings to a larger audience, again including experts from Shell. The format of the expert meeting is suitable for a wide range of subjects and can therefore be used with other industries and companies. This project also demonstrates that much can be achieved even without much time for preparation or a hefty injection of capital.

Financial support

The capacity for Jet-Net programmes is predominantly generated by existing staff of participating companies. No additional financial assistance is given to these programmes.

In addition Jet-Net is guided by a central co-ordinating mechanism to which the participating companies and the government jointly contribute on a 50/50 basis. This co-ordinating mechanism also supports joint expert functions and an office for national Jet-Net events (for teachers and students).

Further reading:

Contact person(s):

47. Redesign in prevocational, secondary vocational and higher professional education

Country: Netherlands

Target groups: secondary and tertiary education students (12-22)

Partners involved:
- 140 prevocational schools, 15 secondary vocational schools, 4 colleges (universities of professional education)
- Axis
- Ministry of Education

Ongoing/closed:

Evaluation:

In its recently published progress report the Education Inspectorate says that Axis's redesign projects have set in train a movement which, in prevocational secondary education, has led to improvements in both student intakes and numbers completing the course, along with a more positive attitude.

The projects in secondary vocational education and higher vocational education were on too small a scale to be able to draw national conclusions, but here too the same positive effects were observed.

In prevocational secondary education these developments are currently in the process of being standardized so that all prevocational secondary schools can start offering the programmes developed.

In secondary vocational education redesign has led to the 'renewal platform for technical secondary vocational education', in which the majority of regional training centres (and industry) are involved. At the same time developments are afoot such as a new qualification structure for which special provisions have been made so that the results of redesign can be enshrined in a national and structural framework.

In higher vocational education all 18 institutions have entered into agreements under which they will redesign their engineering and technology teaching.

In prevocational secondary education the impact rate was high at 140 schools – a quarter of the total. In secondary vocational education seven projects and fifteen regional training centres were involved, one-third of the total (45). In higher vocational education the impact rate was lower: a not unexpected result given that here only a few intensive pilot projects were carried out.

Description:

Objective

To develop more attractive vocational education through the redesign of courses.

The initial numerical objective was of 60 pre-vocational schools but due to the success of the project, this number rose to 140.

In the case of secondary vocational education and higher vocational education there were a number of intensive pilot projects in a limited number of courses.

Key activities and working methods

The participating schools and colleges in prevocational secondary education, secondary vocational education and higher vocational education have thoroughly reformed their teaching. To do so they worked along three lines:

1. New teaching methods

These new teaching methods were designed to bring engineering and technology alive for students. Mentoring, turning the learning cycle upside down (first the practice, then the theory) and ICT are all part of an integrated approach.. This is aimed at ensuring that pupils and students are given more context, broad-based foundation courses, and flexible learning routes – in addition to closer alignment with the new learning possibilities.

2. Broad learning routes

Education is being increasingly organized on the basis of multitechnical or cross-sectoral programmes. Learning routes are offered with broad-based foundation courses and specialist final subject choices. broad orientation in the initial phase is designed as an eye-opener when it comes to the variety and number of choices available to them.

3. Continuous learning line

Setting out study paths in courses and industry to create a “continuous learning line”.

For this, the connection between the various levels of vocational education in the Netherlands have to be made smoother. This approach has led to a great diversity in redesign projects and new sorts of education.

Example

Human Technology (HT) is the Hanzehogeschool Groningen’s answer to a number of different developments in the market and in education. The market is asking for new engineers who will continue to develop their own skills and abilities. The traditional intake has changed with the coming of application-oriented students and more women. The new course has been designed on thematic and competency-directed lines. From day one the central focus is on the student’s future occupation. Teaching is activating and motivating. Students themselves are responsible for their professional development and the introductory HT foundation course gives an impression of the entire field to allow them to select their subjects. Teaching is arranged in theme blocks each of which deals with one or more particular professional competencies. Each block consists of a practical module and modules that deliver the knowledge and skills needed to carry out the practical task. This theory is firmly founded on tasks. In the Netherlands, Human Technology courses are enjoying rising numbers of new students including a fair proportion of women (approx. 20%).

Financial support

The premise of the redesign projects was that they had to be funded by the trio of government (in this case Axis), industry and the educational institution itself.

Further reading:

Onderwijsverslag 2003/2004, Inspectie van het Onderwijs, 2005
Naar aantrekkelijk technisch VMBO, Axis, 2004
Herontwerp techniek in het middelbaar beroepsonderwijs, Axis, 2004
Herontwerp hoger technisch onderwijs, Axis, 2004

Contact person(s):

48. Chemistry in context - ChiK

Country: Germany

Target groups: lower and upper secondary level students
Partners involved: - IPN
- University of Oldenburg, University of Dortmund, University of Saarland, University of York Science Education Group

Ongoing/closed:
Evaluation:
Description:

The **goal of ChiK** is the development, evaluation and implementation of an innovative chemistry course for students between the ages of 14 and 18 (lower and upper secondary level), which combines the **principles of situated learning** with a systematic understanding of the most important concepts of chemistry. It will provide teachers and students with a documented and partly evaluated course and its own assessment procedures.

ChiK confronts the well-rehearsed problems of science education in Germany, namely
students interest in chemistry declines as they progress through the school;
students find the **concepts difficult** to master;
uninspiring teaching using out-of-date curricula.

The lessons in ChiK are based on **three principles**:

1. *An implementation of the principles of situated learning:*
The course is based on authentic contexts which are relevant and interesting for the student, such as "The hydrogen car for the future?" or "Polymers - boom or waste?".

2. *Development of basic chemical concepts:*
Skills and competencies are interwoven into a few central concepts, such as "matter and particles", "structure and properties", "energy and entropy".

3. *A methodical implementation of the principles of situated learning:*
In order to give students the opportunity of reflective learning and the time to master the basic concepts, the lessons are arranged in **a cycle of four phases**:

(i) a **phase of contact**, when the context is presented and the students articulate their knowledge and ideas on the topic;

(ii) a **phase of curiosity**, when students develop strategies to explore the topic and plan further work;

(iii) a **phase of elaboration**, when the work is carried out, chemical principles are being developed and the results are presented to, and discussed with, other students;

(iv) a **phase of deepening and connecting**, when the context of the work is linked to other contexts and to other chemical principles.

This cycle is characterized by the use of many different teaching and learning strategies.

ChiK brings together a very wide range of groups and individuals, each with their own expertise. **These include teachers, scientists and science educators** (from science education and the social sciences). All are playing an important role in the construction, evaluation and implementation of the course.

Contact person(s): Prof. Dr. Ilka Parchmann (parchmann@ipn.uni-kiel.de)

Further reading: http://www.ipn.uni-kiel.de/abt_chemie/ChiK/sites/english.htm

49. A selection of NSF initiatives (US)

a. <u>With possible impact on image of S&T, S&T professionals and S&T careers:</u>

Informal Science Education

The NSF <u>Informal Science Education</u> program invests in projects that develop and implement informal learning experiences designed to increase interest, engagement, and understanding of science, technology, engineering, and mathematics (STEM) by individuals of all ages and backgrounds, as well as projects that advance the theory and practice of informal science education. Projects may target either public audiences or professionals whose work directly affects informal STEM learning. ISE projects are expected to demonstrate strategic impact, collaboration, and innovation.

- *ISE Project Example*: Oregon Public Broadcasting received funds to produce three one-hour nationally broadcast television programs, a project website, community-centered outreach coordinated by AAAS in 7 U.S. cities, a seminar discussion guide and a series of 90-second programs as part of the "Earth &Sky" radio series. The subject and purpose of the project is to attract public interest in nanotechnology by examining the social, ethical, legal and environmental issues surrounding its application. Inverness Research Associates and Edu, Inc. is conducting both formative and summative evaluation of the project components.

Research Experiences for Undergraduates

The National Science Foundation <u>Research Experiences for Undergraduates</u> (REU) program supports active research participation by undergraduate students in any of the areas of research funded by the National Science Foundation. REU projects involve students in meaningful ways in ongoing research programs or in research projects designed especially for the purpose. This solicitation features two mechanisms for support of student research: (1) *REU Sites* are based on independent proposals to initiate and conduct projects that engage a number of students in research. REU Sites may be based in a single discipline or academic department, or on interdisciplinary or multi-department research opportunities with a coherent intellectual theme. Proposals with an international dimension are welcome. (2) *REU Supplements* may be requested for ongoing NSF-funded research projects or may be included as a component of proposals for new or renewal NSF grants or cooperative agreements.

- *Example Individual REU Project*: *Occupation History and Diet of Adelie Penguins in the Ross Sea Region* (Steven Emslie, University of North Carolina at Wilmington). This project investigates the occupation history and diet of Adelie penguins (Pygoscelis adeliae) in the Ross Sea region, Antarctica, with excavations of abandoned and active penguin colonies. The material recovered from excavations is being quantified and subjected to radiocarbon analyses to obtain a colonization history of penguins in this region. Identification of prey remains in the sediments will allow assessment of penguin diet. Other data (ancient DNA) from these sites is being analyzed through collaboration with New Zealand scientists. Graduate and undergraduate students are involved in this project and a project Web site is being developed to report results and maintain educational interaction between the PI and students at local middle and high schools in Wilmington, NC.
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b. <u>With possible impact on S&T Education and curricula:</u>

<u>Instructional Materials Development Program</u> (Primary/Secondary Education)

The Instructional Materials Development (IMD) program includes four components:

Learning Progressions -- supports the creation of instructional frameworks centered on learning progressions in science and technology education and the development of associated teacher resources and models for professional development.

Instructional Materials for Students -- supports the creation and substantial revision of comprehensive curricula and supplemental instructional materials that are research-based; enhance classroom instruction, preK-12; and reflect standards for science, mathematics, and technology education developed by national professional organizations.

Assessment -- supports the creation of tools for assessing student learning that are tied to nationally developed standards and reflect the most current thinking on how students learn mathematics and science. Projects can also focus on developing resources that provide technical assistance to schools and districts in implementing new assessments.

Applied Research -- supports the research for development of the IMD program and projects; provides evidence for the effectiveness of materials and feedback for strengthening the portfolio; and identifies possible new directions in instructional materials and assessment.

- Examples of Instruction Materials Developed through IMD:

  Effective Approaches to Materials Development: NSF supported development of *Benchmarks* (AAAS), *National Science Education Standards* (NRC), and *Technology Standards* (ITEA). NSF-supported instructional materials, developed by interdisciplinary teams, must align with these standards, which are highly correlated with state standards. Rigorous pilot- and field-testing ensure effectiveness with teachers with varying content preparation and students with varying learning styles and capabilities.

  Introduction of New Content to K-12: Teacher leadership projects, coupled with materials development efforts, have introduced new content to K-12 education, e.g., discrete mathematics, fractals, probability, statistics, bio-mathematics, and more recently nanoscience. New models of course sequencing respond to scientific advances, e.g., understanding biology at the molecular level.

  Building Infrastructure: NSF supported early development of distance learning programs, as well as subsequent research on strategies for enhancing their effectiveness. In the informal science arena, the ISE program is credited with formative development of the nation's Science and Technology Centers ensuring science content and up-front, formative, and summative evaluation.

  Effective Tools and Resources: Over the years, NSF has developed a set of educational tools that have significantly advanced STEM education, e.g., FastPlants, Geometer's Sketchpad, and Logo, as well as computer simulation models, classroom observation protocols, searchable databases, and resources of materials evaluated for accuracy of scientific content.

<u>Course, Curriculum, and Laboratory Improvement Program</u> (Tertiary education)

The Course, Curriculum, and Laboratory Improvement (CCLI) program seeks to improve the quality of science, technology, engineering, and mathematics (STEM) education for all undergraduate students. Based on a cyclic model of knowledge production and improvement of practice, CCLI supports efforts that conduct research on STEM teaching and learning, create new learning materials and teaching strategies, develop faculty expertise, implement educational innovations, assess learning, and evaluate innovations. The program supports three types of projects representing three different phases of development, ranging from small exploratory investigations to comprehensive projects.

- *CCLI Project Example: Project Kaleidoscope (PKAL)*: Goal 1: To enhance the capacity of science, technology, engineering and mathematics (STEM) faculty as leaders in 21st century undergraduate learning environments, to bring a deeper understanding of the changing context for undergraduate STEM, what works in improving undergraduate STEM education, and the roles of faculty leaders in shaping 21st century learning environments. Goal 2: To provide faculty leaders in STEM with a human and intellectual infrastructure at local and national levels that supports and sustains their work, and that of building and sustaining strong STEM learning environments.

  Two significant 'findings' are: a) statements of 'what works' in transforming undergraduate STEM programs, each a summary of discussions at a single PKAL event in 2002/2003; these are posted on the

PKAL web site and continue to drive the direction of PKAL planning; and b) a set of instruments from which individuals, departments, and institutions can evaluate their progress toward reform, as measured by rubrics established by participants in the various workshop.

c. With possible impact on S&T Teachers:

Teacher Professional Continuum (Primary/Secondary Education)

The Teacher Professional Continuum (TPC) program addresses critical issues and infrastructure needs regarding the recruitment, preparation, induction, retention, and life-long development of K-12 science, technology, engineering, and mathematics (STEM) teachers. Its goals are to improve the quality and coherence of teacher learning experiences across the continuum through research that informs teaching practice and the development of innovative resources for the professional development of K-12 STEM teachers. The program supports Research Studies, Resources for Professional Development, and Conferences and Symposia.

- *Example TPC Project*: (Hyman Bass, University of Michigan) This five-year project is designed to build resources for helping teachers learn mathematical content in ways usable for the work of teaching. Two practice-centered packages are being developed for use in the professional education of K-8 teachers of mathematics. The packages will be usable by the existing range of teacher developers. Each package will comprise selections of records of practice and resources for their use with teachers. Teacher educators are a diverse audience, but with enough in common that the materials will address the needs of each segment of this audience. The work will be an extension of work done by the project team over the last decade. Evaluation will include examinations of the material from both pedagogical and mathematical points of view, in both formative and summative environments.

Math and Science Partnerships (Primary/Secondary education)

In launching its Math and Science Partnership (MSP) program in 2002, the National Science Foundation (NSF) assumed important responsibilities for building the capacity to implement a key facet of the President's No Child Left Behind (NCLB) vision for K-12 education. Now in its fourth year, the MSP program at NSF is recognized as a research and development effort for building capacity and integrating the work of higher education - especially its disciplinary faculty in mathematics, the sciences and engineering - with that of K-12 to strengthen and reform science and mathematics education. The MSP program therefore supports the development, implementation and ultimate sustainability of promising partnerships among institutions of higher education, K-12 schools and school systems and other important stakeholders to:

Ensure that all K-12 students have access to, are prepared for and are encouraged to participate and succeed in challenging and advanced mathematics and science courses;

Enhance the quality, quantity and diversity of the K-12 mathematics and science teacher workforce; and

Develop evidence-based outcomes that contribute to our understanding of how students effectively learn mathematics and science.

- *Example Math and Science Partnership Project*: (Susana Navarro, University of Texas-El Paso) The El Paso Math and Science Partnership (El Paso MSP) includes the three urban school districts that encompass El Paso, nine rural school districts in El Paso and Hudspeth counties, the University of Texas at El Paso (UTEP), El Paso Community College, the Region 19 Education Service Center, and El Paso area civic, business and community organizations and leaders. The El Paso MSP is aimed at improving student achievement in mathematics and science among all students, at all preK-12 levels, and at reducing the achievement gap among groups of students. The goals of the partnership include: fully engaging university and community college leadership and mathematics, science, engineering and education faculty in working toward significantly improved K-12 math/science student achievement; ensuring the number, quality and diversity of K-12 teachers of mathematics and science across partner schools, particularly schools with the greatest needs; building the capacity of area districts and schools to provide the highest quality curriculum, instruction and assessment, and to ensure the highest level achievement in mathematics and science for every student; ensuring the K-16 alignment of mathematics and science curriculum, instruction and assessment, to ensure that students graduating from area high schools are prepared to enroll and be successful in mathematics, science and engineering courses at UTEP and El Paso Community College; and prioritizing research on educational reform and preK-16 partnerships.

CAREER Program (Tertiary)

The Faculty Early Career Development (CAREER) Program is a Foundation-wide activity that offers the National Science Foundation's most prestigious awards in support of the early career-development activities of those teacher-scholars who most effectively integrate research and education within the context of the mission of their organization. Such activities should build a firm foundation for a lifetime of integrated contributions to research and education. NSF encourages submission of CAREER proposals from junior faculty members at all CAREER-eligible organizations and especially encourages women, members of underrepresented minority groups, and persons with disabilities to apply.

- *CAREER Example Project*: (Jennifer Turns, University of Washington) The central idea of the project is to explore portfolio creation as a means of promoting (and studying) knowledge integration by engineering students. The portfolio activities will build on existing strengths of the engineering curriculum by providing students with opportunities to reflect on their accomplishments, see and articulate connections between engineering and their accomplishments, and develop more integrated conceptual structures associated with engineering. Three objectives are to (1) document the nature of engineering students' conceptual structures in their engineering discipline, with specific attention to how integrated the conceptual structures are, (2) use what is known about portfolios in education to develop an intervention that makes it possible for engineering students to document and refine their conceptual structures in engineering, and (3) identify the learning affordances and cognitive challenges associated with the intervention.

d. With possible impact on Gender and Minorities issues:

Louis Stokes Alliance for Minority Participation (LS-AMP)

This program is aimed at increasing the quality and quantity of students successfully completing science, technology, engineering and mathematics (STEM) baccalaureate degree programs, and increasing the number of students interested in, academically qualified for and matriculated into programs of graduate study. LSAMP supports sustained and comprehensive approaches that facilitate achievement of the long-term goal of increasing the number of students who earn doctorates in STEM fields, particularly those from populations underrepresented in STEM fields. The program goals are accomplished through the formation of alliances. Phase I awards place emphasis on aggregate baccalaureate production. Phase II awards augment the Phase I emphasis with attention to individual student retention and progression to baccalaureate degrees. Phase III awards augment the Phase I and Phase II with attention to aggregate student progression to graduate school entry.

Research in Disabilities Education

OECD Activity on declining interest in science studies

The Research in Disabilities Education (RDE) program supports efforts to increase the participation and achievement of persons with disabilities in science, technology, engineering, and mathematics (STEM) education and careers. Meritorious projects from a diversity of institutions are supported via the RDE Demonstration, Enrichment, and Information Dissemination (RDE-DEI) program track. Promising research efforts are also developed further via awards under the Focused-Research Initiatives (RDE-FRI) program track. In the third program track, broadly applicable methods and products are disseminated for widespread use, commercialization, or inclusion in the activities of program-sponsored Regional Alliances for persons with disabilities in STEM education (RDE-RAD). RDE Alliances serve to inform the public, government, and industry about proven-good practices in the classroom, promote broader awareness of disabilities issues, and define specific areas of accessibility and human learning in need of further attention by educators and the research community.

RDE Project Example: (Robert Gotwals, the Shodor Education Foundation) The Shodor Education Foundation, Inc. received funding for a research and development effort, Deaf Educational Access For Science, Technology, Engineering, and Mathematics (DEAF STEM). DEAF STEM will expand the work of Project SUCCEED-HI (NSF #9906189) by adding American Sign Language (ASL) versions to the existing text of a wide variety of Shodor materials. A project goal is to improve access for all students to the National Science Digital Library (NSDL), including Shodor's extensive STEM materials, which have been developed through previous, and current NSF funding. In addition, DEAF STEM will provide a dynamic resource for educational interpreters and other providers to increase their competence and confidence in interpreting and supporting education in STEM areas to deaf students.

Research on Gender in Science and Engineering Program:

The program seeks to broaden the participation of girls and women in all fields of science, technology, engineering, and mathematics (STEM) education by supporting research, dissemination of research, and extension services in education that will lead to a larger and more diverse domestic science and engineering workforce. Typical projects will contribute to the knowledge base addressing gender-related differences in learning and in the educational experiences that affect student interest, performance, and choice of careers; and how pedagogical approaches and teaching styles, curriculum, student services, and institutional culture contribute to causing or closing gender gaps that persist in certain fields. Projects will disseminate and apply findings, evaluation results, and proven good practices and products.

Project Example: (Valerie Vjkuck, Seton Hall University) Seton Hall University will determine factors influencing the differential training and career patterns of women graduating in physics, engineering, and mathematics. The study will permit a comparison of the academic development, particularly at the graduate level, of women and men and will identify reasons for their different career choices. The path from a bachelor's degree to a faculty position in STEM loses women every step of the way. Women are less likely to be awarded a doctorate degree in chemistry, physics, engineering, and mathematics than men. No research has examined explicitly the reasons for this under-representation of women among doctoral recipients. The findings will potentially form the basis for thoughtful and critical discussion of the status of women, and will lead to institutional self evaluation and reform at the elite schools and others producing STEM graduates. The desired outcome is to decrease the under-utilization of women in academe and industry.