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SCIENCE CAREERS AND GENDER

**Gapp summary report of the focus group with students,
science teachers and parents**

[BELGIUM, DENMARK, ITALY, THE NETHERLANDS, POLAND, PORTUGAL]

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Perception of science and technology

Science is generally represented with relation to hard and natural sciences. Particularly students and parents, see it as operating scientific methods and experimental tools – a very positivist approach to science. It is also seen as a very-specialized activity, distant from everyday life and ordinary people. Social sciences are rarely evoked within this scheme. Science is hardly seen as something negative or dangerous. The single negative aspect of science has to do with the risk of unemployment and job uncertainty the scientists face, due to the weakness of national science system.

Furthermore, **technology** is firstly associated with new technological everyday life products, which produces mainly positive outcomes to society. Those are the two main images of technology. The association with ICT products is absolutely evident. For almost everybody, technology is mainly seen as the information and communication technologies associated with the idea of a global society.

The most significant division appearing in the **students'** classifications on science is the one between science itself and science understood as education & learning process experienced at school. The first is evaluated positively and is described in terms of adventure, challenge, satisfaction, progress etc. The second is perceived negatively, with respect to such terms as boredom, hard and unfruitful work, stress etc. Other notions related to science refer to aspects of practice, theory, progress, adventure or threat (technological threat, i.e. fear of violating nature by advanced biotechnology).

As a central element, forming the basis for their choices of educations and careers, the **students** stress their own interests. Among other things, one of the reasons given for this emphasis is the fact that it is not good enough to excel at just one subject. A student has to have a desire to learn. According to some of the students, this desire and interest is a natural result that comes from work with various tasks and a high level of flexibility. Furthermore, some of the students state that the ability to adapt is also important to the process of learning to accept and understand the opinions of others and thereby a means to become more tolerant. Tolerance is important to the students, as it enables the improvement of social skills and relation to colleagues. The students emphasize personal competences and qualities as high priorities when choosing an education.

The **parents** all agree that they as parents play an important role in the career choices of their children. However, they do not agree on *how* they influence their children's choices. Some of the parents find that their direct guidance is decisive, because parents tend to inquire about the reason behind the choices made by the pupils, thereby encouraging the pupil to reflect on his or her choice. Others think that the influence of a parent on a pupil is in part subconscious and is inherent in the 'safety' of choosing the same thing that the parent chose, as well as in the parents' role as a role model. Furthermore, the choices of the pupils' friends tend to have an effect on choosing an education or career. The 'trendsetting' friends and the choices they make automatically become more interesting than subjects that 'nobody cares about'.

Several of the **teachers** think that the pupils are too young to make independent decisions on which education and career to pursue. According to some of the teachers, the choice is too important for teenagers to make on their own. Therefore, it is – according to the same teachers – primarily the teachers who make this decision. Finally, the opinions of friends are also important to the decision, because young people are easily influenced by those whom they connect with, since 'the idea of going to school

somewhere where you do not know any of the other pupils, can be a scary experience'. In other words, the pupils base their choice on security and safety instead of challenges.

The teachers consider themselves, the media and parents to be the most important influential factors.

1) Teachers: when compare with reference models, teachers are defined as "*charismatic people*" or "*antagonists*", i.e. people who can influence students' attitude and approach to a particular subject for the rest of their lives. This particularly applied to students in middle schools, i.e. students going through a crucial moment in their life: the beginning of adolescence. Teachers can – with their "*attitude*" and teaching method – convey passion and love for the subject they teach, thus arousing students' interest and in life models influencing their choices by emulation.

2) Mass media are referred to by teachers as having a crucial role in creating expectations in students about their future (promotion of models that can be more or less winning, more or less enviable). They think that the media confirm the stereotype of the scientist as nerd. In addition, scientists are most noticeable by their absence in the news media, series and soaps, and so on.

3) Parents: Our main finding is that teachers stress that the socio-cultural and educational background of a child's family is of first importance while considering a career. Parents who possess themselves a university or higher diploma insist on their children for following their pace and obtaining a good diploma, no matter in which area. Sciences, as they are often considered to be difficult sections have then a good reputation amongst the parents, which also means amongst the students, even if in some schools they come just after ancient languages sections.

Science is perceived as a very demanding activity, firstly because it is associated with complexity, creativity, innovation, challenge, and non-routine performances. Therefore, people working in S&T have to be intelligent, curious, inspired, and able to deal with new problems. Simultaneously, science is also associated with objectiveness and rigor. Creativity has, then, to be coupled with a critical and rigorous attitude.

Science is also represented as time consuming – important achievements can only be reached if people work for many years –, and social and economic recognition may not be achieved before long-time. For that reason, people in science have to be persistent, patient, determined and intrinsically motivated. They really have to love their work – otherwise it could become frustrating. And they should not be arrogant because they have to accept their errors – science implies successive trials until a solution is found.

The common opinion is that S&T carriers are not potentially gender-oriented. As a general statement, people (especially females) want to make clear that gender discrimination, at school or in labor market, is not acceptable anymore. Besides, as previously mentioned, people consider that in order to become an S&T professional what is needed is a formal diploma, what is accessible for both genders, and preferentially some personal characteristics (like intelligence, creativity and persistence), which are seen as independent from gender.

In order to be a scientist one must have:

imagination, creativity, perseverance and tenacity, rigor, patience, curiosity, analytic mind, observation talent, logical mind, problem-solving skills, counter-intuitiveness, structured working and social.

Another important element has to do with labor market opportunities, particularly in technology domains. Most people consider that women have fewer opportunities in finding a job – they are afraid of unemployment. Adults make clear that, especially in smaller and more traditional companies, employers favor men because they are considered more suitable for leader positions and also because they are expected to work for longer periods (women are seen as having more problems conciliating work and family life). As regards biology, chemistry or mathematics professions, employability problems are considered less relevant, because those jobs are not so connected with leadership concerns, being more closely dependent on cognitive competences. Furthermore, the most of those professional would find a job in public sector, which is less permeable to gender discrimination trends.

Health issues vs. technological success

Girls tend to emphasize a little more the social outcomes of S&T, namely concerning health issues, and boys are slightly more attentive to the success that some well-known male scientists or technological entrepreneurs have achieved. Vice versa, gender differences in science and technology performance are recognized by all the targets. They are located in the sphere of social norms and believes or in the nature – apparent biological determination in a way of thinking. There is a significant “generation gap” in the attitudes towards gender issues. Young girls are a kind of rebels – not agreeing on any gender based limitations and barriers. Majority of female teachers (except the young generation) seem to agree with the “order of genders” and sometimes they appear to strengthen this division.

People consider that engineering and IT are predominantly male-oriented activities, due to its connection with hands-on tasks; and that biology is a more female-oriented, because of its connection with jobs that imply taking care of human beings’ health or of animals; other S&T professions do not have a precise gender characterization.

Although sometimes the issue of “natural vocational” or different abilities for men and women is mentioned, gender differences regarding boys and girls interest in technology is mostly thought as a result of cultural and sociological factors – mainly of a differentiated education at home, but also of some labor market resistances for women. And everybody agrees that those differences are decreasing.

In addition, one of the most important aspects of scientific professions is, for women, their social impact (“*it’s great to be useful*”): the disciplines they mostly referred to are medicine, biology, bio-medical research, environmental engineering... Others – such as mathematics and physics – are considered to be less fascinating (and less enjoyable) and their possible applications unclear (especially mathematics).

Their representation implied an “extra-ordinary” view of scientific professions: female students dream of female scientists rescuing the world, travelling and sometimes unable to harmonize family and career, despite wanting it. The reasons of the lack of women in S&T careers come back to a “nature vs nurture” long lasting debate: some think women do not take S&T direction because they do not want to, because their qualities lead them somewhere else; others think there are historical, educational and so political reasons that women have more difficulties to access to traditionally considered men’ jobs and responsibilities.

The issue of juggling these two elements was crucial for women, as confirmed by mothers and teachers. Today's society is full of stereotypes and is ruled by men, thus making it more difficult for women to have a career, in that they have a lot of family commitments.

However, these obstacles are not strong deterrents from engaging in a particular profession: adult women stated that neither male, nor female young people are aware of these issues. The girls interviewed, despite claiming to be aware of some discriminations, assert the decisive role their passions play: it is therefore necessary to opt for an enthralling job including what they considered to be important aspects, such as the desire to change the world for the better, not getting bored - freedom of expressing and the desire to be creative -, succeeding in a particular realm.

Males seem to be more interested in the great challenges posed by technology (information technology, engineering, chemistry, physics) and to better understand what future prospects scientific disciplines have. In particular, they claim they felt "*more attracted*" and fascinated by this kind of professions. Having to work long hours, travelling and moving very frequently are not a reason for concern in terms of family issues, but rather in terms of competition.

Arguments concerning the social importance of science (scientist is a synonym for benefactor) are more important in the general debate about science and scientific professions, but when discussing what they really wished for their future, both males and females stressed the importance of social prestige, the possibility to imagine themselves working in some specific contexts and working environments and the enjoyable component of their jobs (little or no reference was made to financial aspects).

Among adults, women seem to be more critical towards contemporary society in terms of future scientific and technological developments, of involving new generations and in terms of differences between men and women (who are bearing the consequences of cultural stereotypes, chauvinistic attitudes directed at them and differences in distribution of tasks and responsibilities).

Just like young female students, adult women show a greater interest in disciplines like medicine, biology, applied chemistry, (environmental) engineering – defined by them as the key to mankind's problems – and less interested in technological competition between different worlds and markets. Moreover, they find that these scientific disciplines have a wider range of applications (freelance professions, teaching, academic research etc.), thus making it possible to harmonize family and career.

Both parents and teachers had the impression that the number of male and female students interested in scientific professions (particularly: physics and mathematics) is decreasing. This might be a consequence of low education quality, which has led to identify mathematics, physics and information technology with something abstract and boring and to put them in contrast with different media and social models, with the considerable commitment (great ideal investment) associated with these professions, with the need to move and use the same resources (languages, travelling) over and over again, thus generating fear.

Main influences in the choice of a career are personal interests, teachers and parents. In general, students think the choice is theirs, parents think teachers have the most important influence on their children and teachers believe it is parents who decide in higher social background and friends elsewhere.

Therefore, when it comes to encourage the youngsters to choose an S&T career, nobody thinks it is relevant to address special attention to girls.

We conclude the report with two lists: one composed by remarkable statements, the other by proposals:

Statements

The exact sciences are generally considered to be difficult: the general opinion is that you need to have talent for science (a special gift), otherwise you will not be successful. Many teachers also consider the science subjects to be 'more' than the other subjects. This may contribute to the idea that the exact sciences are more difficult than the other subjects.

Technology involves a lot of sawing: many students think that technology involves large projects and objects. They think that you need to be physically strong and that you get dirty. This leads them to think that it is more a field for boys than for girls. Technology is hands-on.

Technology can lead to disasters: sciences and technology arouse spontaneous positive feelings amongst our participants. When asked if they really do not see anything more contrasted they come to say that the uses of S&T by human kind is not always what it should be and sometimes lead to disasters.

Differences in talent between men and women: the students explain the differences between men and women and between the sciences and technology in terms of talent and interest. Both students and teachers consider men to be more ambitious and oriented towards status. Women are more oriented towards social status and enjoying their work in addition to taking care of the children. Biology is considered to be less exact and more social, and therefore more suitable for women. Many women choose biology because they wish to work in health care later.

Women take care of the children: the students assign care-giving tasks almost without discussion to the women. Teachers see the fact that S&T careers are time-consuming as one of the disadvantages to a career in those fields. This makes the combination with child care difficult. Teachers see it as the most important hurdle for women to choose a career in science and technology. Women choose professions where it is easier to work part-time, such as doctor or teacher.

No gender gap in knowledge: we have not found any conclusive differences between the sexes' knowledge of and opinions on educations and job opportunities within the fields of science and technology.

Girls' self-image: both the students and their parents remark that girls are more likely to think that the profile 'Science and Technology' is too difficult. They therefore choose another profile that is 'safer'. The teachers claim that this choice is provoked and confirmed by their social surroundings. Girls who do choose the profile 'S&T' are often asked 'Can you do that?', while it is seen as a very sensible choice for boys.

Students are not yet ready to make an independent and informed choice: both teachers and parents think that the students, and especially the boys, are not yet able to make an informed decision at the moment they must choose their profile.

A 'Science' profile keeps all options open: the students who choose a 'Science' profile often do so in order to keep as many options open as possible. This is also what a number of their parents explicitly advise them. Teachers claim that that is the reason why many students who had chosen a 'Science' profile do not go on to study exact sciences and technology in higher education.

Students have no concept of the professions in the exact sciences: the students have no clear concept of the professions available in the exact sciences, especially physics and chemistry. Their frame of reference is primarily the subjects they have in school and the experiments they perform there.

The situation of women in S&T careers is evolving in a positive way: the fact that women are few is common and assured. But this is a consequence of generational matters. Women are still few but now the situation is evolving in a positive way. And we are getting more and more women in S&T careers.

Students think that parents' career is not so relevant: some of the pupils claim that the career choices of their parents have not had any influence on their own choices, while other pupils say that they have consciously contradicted their parents' choices. In contrast, the parents feel that they influence their children subconsciously.

Parents are more important than they realize: the most important role models are those individuals in the students' immediate surroundings, especially their parents. At least that is what the students themselves claim. The parents think that their children's attitudes towards technology are primarily influenced by teachers and peers. The teachers claim that the lack of role models in the media is also an important factor.

Good teachers increase pupils' interest: the deciding factor in pupils' interest for education and job opportunities within the fields of science and technology is 'the good teacher' and in particular 'the good story'. The teacher takes centre stage as the propagator and role model committed to their profession. 'The good story' is pivotal, in that it helps identification and understanding of the subject matter.

Media do not influence students: the pupils do not consider themselves influenced by the media. Contrary to this, the parents believe that the media play an important role. One explanation for these contradictory statements from pupils and parents may be that there are far too few role models for the pupils to be influenced by via the media.

S&T jobs secure the future: several parents toy with the idea that *securing the future* is achieved by the inherent job opportunities within the fields of science and technology. Apart from the individual securing of self interests, they mention securing the future of the planet through research in pollution, health and environment.

Proposals

Participants demand for a better knowledge of S&T professions: all our participants tell us the importance of practice in S&T and see S&T as strongly linked with reality. Understanding of their daily life is one of their first reasons of interest in S&T and seems to be the first incentive for studying such disciplines.

Gain experience with science and technology: teachers emphasize that it is vitally important that students – especially girls – should be exposed to science and technology at an early age. This could be by offering practical science lessons in the first year of secondary education, or by going on field trips to companies and institutions. Also by creating some kinds of relation between school and business world so that teachers and students will know more about this latter.

Change stereotypes through role models: parents and teachers emphasize that it is important to do something about the stereotypes regarding men and women in science and technology, such as making these subjects more visible in the media (soaps and advertising), or by filming interviews with young, sexy and dynamic role models (both boys and girls).

Involve parents in the decision-making process: both parents and teachers think that the parents should be involved in the students' decision-making process, for two reasons: 1. Parents often know too little about the career opportunities in the exact sciences and technology, and 2. Parents can be utilized as role models for the other students.

As much direct participation and "science in action" approach as possible: introducing all possible forms of direct, personal contact with representatives of science and technology – models. Creating links (formal and informal, local and central) between schools and science & technology institutions – great need of private business engagement.

Look for the students' self interest: *self interest* is among other things expressed through the opportunity for high wages, which several parents point to as either an output of their strategy or as a fringe benefit. Furthermore, self interest is moved to the foreground through a slogan used by a group of parents: 'a goddess for your entire life', which expresses the act of taking responsibility for making your own career meaningful and lucrative, by choosing to pursue a scientific or technological education.

Emphasize the job opportunities: the parents think that the global job opportunities within the fields of science and technology have to be emphasized: demonstrate that enrolling in a scientific degree program offer more job opportunities than other university courses This is also the centre of what one parent refers to as 'diversity'. As science and technology is increasingly used as a means of connecting with the rest of the planet – more so now than ever before.

Meet a (female) scientist: let female scientists come in school in order to explain their jobs and curriculum. Spread more female scientists' images in the world in general and media in particular. Organize scientific workshops with the help of persons coming from scientific world and during school hours. This point is important because if such workshops are optional they will be attended by boys and girls will go to theatre lessons.

Start with the children: bring up children in an egalitarian spirit. Work has to be done especially towards girls because many of them ignore that discrimination exists and that they have to fight against it.

Give a better image of science: do something about the image problem by making films with young, sexy and dynamic role models (both boys and girls). The role models should be students or just have begun with their careers. The films should be shown several times before the students choose their profile.

Create hands-on activities for girls: people consider that engineering and IT are predominantly male-oriented activities, due to its connection with hands-on tasks – technology is hands-on. In order to reduce the gap, it will be useful having hands-on activities thought for girls.

Let friends talk together: the opinions of friends are important to the decision, because young people are easily influenced by those whom they connect with, since the pupils base their choice on security and safety instead of challenges. Organizing activities for groups of friends will be a good strategy.

The Gapp project

Starting from the evidence that in the European Union gender differences still exist in science in science and technologies, Gapp is a project intended to investigate differences between girls' and boys' in their perception of science careers and to propose a range of innovative and concrete participatory activities involving scientists, engineers and professionals from the public and private S&T sectors.

Gapp wants to explore how the perceptions of science professions affect interest, motivation and subject choice at school, at the university and consequently in their career in order to implement an effective social dialogue and identify main issues and expectations from research community, teachers, students, parents and other social actors.

Gapp uses innovative participatory methods, among which focus groups that will lead to practical activities to overcome gender differences.

In this report, Gapp presents the results obtained in the focus groups with students, science teachers and parents in Belgium, Denmark, Italy, the Netherlands, Poland and Portugal. The complete analysis of the results is exposed in the survey "*Why do so few students (especially girls) choose science and technology studies?*". Both the report and the survey are based on the six national reports.

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