Women in IT

The European situation and the role of public-private partnerships in promoting greater participation of young women in technology

M. Durando, P. Wastiau and A. Joyce

www.europeanschoolnet.org - www.eun.org

CONTENTS

1. INTRODUCTION – STUDENTS' FALLING INTEREST IN SCIENCE AND TECHNICAL STUDIES: REASONS AND ISSUES

Students' falling interest in science and technology studies, especially among young women, concerns almost all industrial countries. This is particularly worrying for two reasons:

- It is likely to create problems for the economy, which is increasingly dependent upon its ability to foster technical innovation. Scientific and technical skills are at the heart of the change towards a knowledge-based economy, and a country's strength will be measured, among other things, by the number of innovators, researchers and registered patents.

- It poses a threat to the public research sector, which will have to cope with the high number of researchers and technicians retiring in the next few years. In human resources terms, about 700,000 new researchers are currently needed if the challenges of the Lisbon strategy are to be met.

Europe's development into a knowledge-based society requires a population with a reasonable level of scientific and technical literacy, if they are to become active citizens in the process of scientific and technological decision-making.

High-quality science education is therefore essential, both to give citizens the basic scientific skills required by the knowledge-based society and to train sufficient numbers of specialised scientists and researchers. Investing in knowledge and innovation increases the need for education and training, particularly in terms of scientific and technical skills and technical careers.

However, in several EU countries the number of young people opting for science studies is declining and there is a shortage of scientists and engineers in the labour market that the ageing population will exacerbate.

Young people's motivation is of major importance in increasing the number of students taking science courses; adequate information and scientific literacy are also key factors. School children's views of science are formed at a very early age (usually at primary school level) and these can have a positive or negative impact on attitudes to science and technology.

School children often perceive science as dull and insufficiently related to every day experience. For girls and young women in particular, this relationship is even more important when it comes to arousing their interest. In recent studies, motivation is considered as fundamental in the decision to study science and consequently in the choice of a career in this field.

Schools, teachers and the education system have an important role to play here in fostering a positive attitude to science, although the influence of the family environment and society as a whole should not be forgotten.

Several questions may now be raised:

- How can the image of science and technology as well as science studies be made more attractive to young people?
- How can school children be encouraged to study science?
- Which pedagogical tools, curricular changes, extracurricular activities and so on are needed in order to improve science education?
- How can science and research career prospects be improved and what can be done to stop people abandoning their careers in these areas?
- How can links between research and the world of business and society be strengthened?

To begin answering these questions, it is first necessary to carry out a detailed analysis of the situation at all levels (secondary education, higher education and the labour market) and in the various subject areas (not just mathematics, physics, chemistry, biology etc. but also fundamental science as opposed to applied science) and employment issues (status, level, pay, resistance to short-term trends, etc). This analysis requires sound evidence and comparable statistics at European level.

Research and statistics already exist. They are often incomplete, fragmented and difficult to compare because they are based on non-harmonised definitions, classifications and census techniques. They help to give a preliminary insight into the situation, but are inadequate for the development of effective strategies.

2. WHAT IS THE SITUATION IN EUROPE?

A) THE EUROPEAN SITUATION IN FIGURES - YOUNG PEOPLE ON SCIENCE COURSES

Since the Lisbon Declaration of March 2000, people have been stressing the need to increase the number of people opting for a career in science and technology.

The Commission's report on the progress made in achieving the Lisbon strategy sheds light on the quantitative situation regarding the problem of maths, science and technology (MST).[i] Firstly, it is important to distinguish between the different sectors and subjects covered by the term MST in this report; it includes life sciences, physical sciences, mathematics and statistics, computing, engineering and engineering trades, manufacturing and processing, architecture and building.

The European benchmark used in the Lisbon strategy was an increase in the number of MST graduates by 15% by 2010 (compared to the situation in 2000), and at the same time to reduce the imbalance between men and women in this area.

In Europe there are 32 million young people between 20 and 24 years old, of whom 49% are women and 51% are men. 58% of them go into higher education, where the ratio is 55% women

and 45% men, so women are better represented in higher education in Europe. Of these 18.5 million students, 22% study MST subjects, in other words 4.1 million, with just 30% of them being women.

During the 2000-2005 period, the number of graduates in science and technical courses increased by 16.4%. This increase varied from country to country. There was a big increase in Estonia, Greece, Austria, Slovakia and Poland, whereas there was a sharp fall in other countries such as Sweden or Spain.

As far as subject areas are concerned, there was a fairly sharp increase in the number of graduates in the following subjects between 2000 and 2005: computing (83% increase), architecture and building (24% increase) manufacturing and processing (22% increase) and engineering and engineering trades (18% increase), whereas there was a decrease in physical sciences (-4.9%) and to a lesser extent in life sciences (-0.5%).

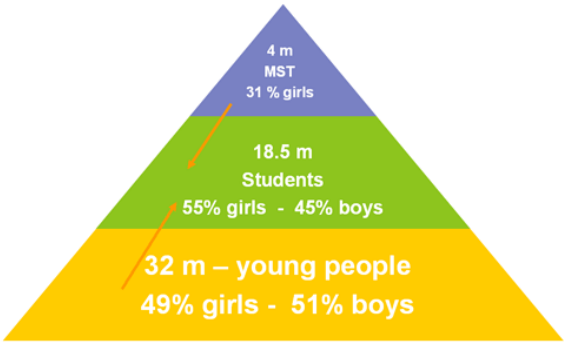
At worldwide level:

- There are 5 million MST graduates every year
- Europe produces one sixth of the total graduates, in other words 825,000 per year
- The US produces 407,000 graduates per year
- Japan produces 227,000 graduates per year
- China produces over 1 million graduates per year (the number has doubled over the last four years)

Regarding the imbalance between men and women, the situation has scarcely changed at European level as the number of women has only increased by 1% in the last few years (from 30 to 31%). A sector by sector analysis is rather informative. The imbalance is very noticeable in engineering and engineering trades (only 19% are women), computing (24% are women) and to a lesser extent architecture and building (35% are women), whereas the opposite is the case in life sciences (61%) and the numbers are balanced in mathematics.

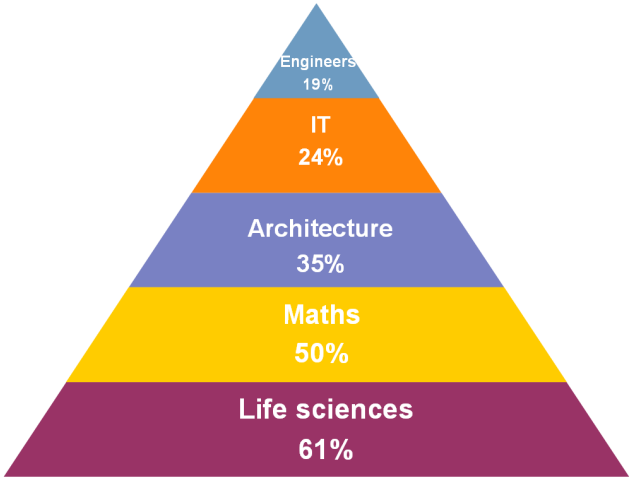
In sum, the situation is as follows:

Male: female ratio



Figures for 2005 - Source: DG EAC and Eurostat

Percentage of women per field



Figures for 2005 - Source: DG EAC and Eurostat

B) GENDER GAP IN EMPLOYMENT IN SCIENCE AND TECHNOLOGY

The Eurostat report "Women employed in science and technology" (Issue number 10/2008[ii]) indicates that 75.7 million people work in Europe in the science and technology field. The gender ratio is fairly balanced. At country level, 72% are female in Lithuania whereas only 47 and 48% are in Austria and Spain. These figures give the impression that the gender situation is not a significant problem.

However, in the research field, the higher the hierarchical level in terms of function and career, the smaller the proportion of women, especially in industry. It should for example be noted that across all categories only 14% of professors are women. According to the results of the SheFigures 2006 study, women account for over 50% of the student population and obtain 43% of PhD-level degrees, but on average they only obtain 15% of senior academic positions.

There are several reasons for this imbalance. Certain fields are deemed to be reserved for men, so the bias against women affects judgements on scientific excellence. This may also be explained by the generally obscure system for making appointments by nominating peers at these levels of responsibility where, without there necessarily being a bias against women, the men already working at these levels 'naturally' select other men.

C) WHAT ACTIONS AND INITIATIVES SHOULD BE TAKEN AT EUROPEAN LEVEL?

The Commission's first Women and Science conference in 1998 highlighted the gender gap in research linked to these sectors. Shortly thereafter, in 1999, an Action Plan on Women and Science was launched. The Helsinki Group on Women and Science was also created in 1999 with a view to developing synergies between national and European policies and providing a framework for pooling national policy experiences and exchanging good practice.

The Commission's 2001 Science and Society Action Plan further developed the approach of the Action Plan on Women and Science and supported a series of projects in the MST field in general, but also on the specific issue of gender, for example:

- Supporting women scientists in Central Europe
- Statistically profiling Europe's women scientists
- Increasing opportunities for women scientists in the wider Europe
- Pushing for quality and excellence in science
- Connecting women scientists at European level
- Measuring progress towards gender equality
- The place of women in industrial R&D

As part of the Lisbon Strategy monitoring process, the Commission (DG Education and Culture) has set up the MST Cluster, which is responsible for analysing how the different education ministries are dealing with this issue.

Networks and platforms have been developed. The following deserve a mention:

- The International Task Force on Women and ICTs,[iii] which aims to create synergies at international level to increase women's participation in the IT field.
- Women in Science, Engineering and Technology (WITEC).[iv]
- The European Platform of Women Scientists, (EPWS).[v]This was launched in March 1995 with start-up funding from the Commission. The Platform aims to bring together networks of women scientists and organisations committed to gender equality in scientific research.

Reference reports have been produced:

- The ETAN Report (2000) on the situation of women in Europe in the university and research field.
- The Women in Industrial Research Report (2003), calling on European industry to act so that women can have a play a bigger role in R&D.
- The ENWISE (ENlarge Women In Science to East) Report (2004) on the situation of women scientists in Central and Eastern Europe and the Baltic countries.
- The Women in Science and Technology Report (2006) and the SheFigures Report (2006) – European statistics programme.
- The report of the high level group chaired by Michel Rocard (requested by the Commission), which proposed areas for discussion on the renewal of MST teaching methods in schools

- The Relevance of Science Education (ROSE) study, which analysed, at international level, factors affecting the importance of learning in the science and technology fields.[vi]
- The report entitled "For the teaching and learning of mathematics in Europe - industrial initiative proposals" published in November 2007 by the National Center for Mathematics Education of Gothenburg University, Sweden, which was commissioned by the European Round Table of Industrialists.
    - The Science Education in Europe report published by the Nuffield Foundation, which provided a number of specific recommendations for improving science education in Europe, further to the organisation of consultation seminars with experts from nine countries.

Lastly, the **European Parliament** Resolution on the Role of Women in Industry (January 2008) "regrets the low proportion of women in the advanced technology sector, and stresses the importance of operational educational and training programmes in science and technology, which guarantee the quality and diversification of training opportunities for women in the various Member States, and the promotion of scientific and technological studies for girls.

The Parliament "calls on the Member States and the Commission to develop and implement strategies to address discrepancies in the work environment and the career development of women working in science and technology."

3. SOME AREAS FOR REFLECTION

At present, with the exception of a few projects supported by DG Research's Science and Society Programme and DG Education and Culture's Lifelong Learning Programme, no real action plan or major strategy has been developed at EU level.

The Rocard report urged the Commission dedicate significant budget (a €60 million fund) to the issue of MST education, but the first possible projects would still be funded by current programmes.

Other debates have been launched by European education ministries, through European Schoolnet, and industry, notably through Corporate Social Responsibility Europe, the e-Skills Industry Leadership Board and the European Roundtable of Industrialists. The latter is supporting the development of public-private partnerships in order to promote the development of new approaches to teaching MST within our education systems and to enhance the attractiveness of occupations and careers in this field.

A) SOME QUESTIONS ON THE ISSUE

All these facts and figures lead us to ask the following questions:

- A great many enterprises indicate there is a real lack of interest and young people are turning away from jobs and careers in science and technology. However, there has been a significant increase in the number of extra graduates in recent years and the 15% benchmark will already have been achieved well before 2010. Furthermore in some

countries young graduates in fundamental science subjects struggle to enter the job market at the end of their studies, sometimes even more so than graduates from other subject areas when the economic situation is difficult. This leads us to raise the following questions:

In Europe we have about 825,000 science and technology graduates each year.

- Does this mean that the number of graduates is not enough to meet industry's needs? Should the 15% benchmark be called into question and increased?
- Or, are companies dissatisfied with the quality of graduates and do they want a greater number of candidates during recruitment?
- Or does it suggest that of the 825,000 graduates, some are not pursuing a career directly connected to their field of study, bearing in mind for example the attractiveness of other fields of employment that are much better paid? Or are they pursuing a career in science but on another continent?

- Supposing the problem is due to a quantitative deficit, does the upper secondary system have enough reserves of young people with a high-level scientific and technical background, who finally decide to study something else? This highlights career promotion issues and the importance of guidance at the end of secondary school. There is currently very little data on this aspect and it is impossible to come up with any answers based on well-founded and proven statistical analysis.

B) THE CONTRIBUTION OF PUBLIC-PRIVATE PARTNERSHIPS

The initiatives currently being developed are mainly based on public-private partnerships. For example:

- The e-Skills Career Portal, which involves a group of companies under the aegis of the e-Skills Industrial Leadership Board (Microsoft, Cisco, Oracle, CompTIA, ECDL Foundation, Siemens) and national education ministries through European Schoolnet. The aim is to promote the attractiveness of IT sectors and occupations among young people.

  The pilot phase of this initiative will come to an end in late 2008. It is notably proposing the following activities:

  - The launch of a pilot website for the e-Skills conference in Thessaloniki, Greece, in October 2008
  - A series of online events, targeting different careers in the IT field
  - A data base on institutions, qualifications, studies and relevant statistics on e-skills, as well as a database of educational resources in the IT field

- The European Round Table of Industrialists, through its working group on societal change, has had in-depth debates about the issues surrounding young people's loss of interest in science and technology. At national level, companies are being urged to work with public authorities in order to develop initiatives to help promote and strengthen MST teaching in formal education systems (the example of cooperation between Volvo and the Swedish Ministry of Education deserves a mention, and other countries are starting to look at the type

of partnership that needs to be developed). As well as these national initiatives, a European debate has also begun with European Schoolnet (a network of 30 European education ministries), with a view to planning the development of a European coordination system for all these national public-private partnerships (cross-comparison of experience, exploitation of good practice, etc.).

- The Women's Forum has begun discussions with European Schoolnet and Cisco with a view to launching a specific study on perceptions of careers in IT, particularly network and network security careers. The study will take place in a few pilot countries in order to analyse different perceptions among girls and boys and identify practical recommendations on how to deal with them. European Schoolnet has proposed to Women's Forum that there should be a debate at Sci-Tech Girls Day in Deauville, France in November 2008.
- And of course we are participating here today, not just as speakers but also by organising the participation of a group of young women in the debate on science and technology with all of the speakers invited.

The main aim of all these initiatives is to address the situation regarding the promotion of scientific and technical studies. They also deal with the gender issue even though they have not been created specifically for this purpose.

These public-private partnerships present the following different advantages:

- The development of cooperation between schools and industry, which helps to improve information about and promote science and technology occupations and counteract inaccurate perceptions that are rooted in young generations' mentalities.

- Access to industrial facilities (e.g. laboratories), which makes it possible to develop much more interesting and appealing learning experiences for school children.

- The possibility to introduce joint learning activities (e.g. participation of business staff in mentoring schemes, opportunities for teachers to refresh their technical knowledge by cooperating with companies working in the field).

- The possibility to develop extracurricular activities that bring the world of science, technology and business closer to schools:

    - IT-night in Denmark for example, when, during one-week, children visit businesses after school and learn about various occupations and activities in the IT field.
    - The Engineers Go Back to School initiative in some countries, which helps to share information with young people and demystify science and technology occupations and careers.

4. CONCLUSIONS

Bearing in mind how important this subject is, it is difficult to be totally comprehensive. We will thus highlight the following aspects:

- The development of new teaching approaches in MST education is of fundamental importance.
- The need to reflect about teachers' profiles in these subject areas and the vital role they can play (at all levels of education) in combating falling interest in MST.
- The necessary strengthening of relations between educational institutions (in the wide sense) and enterprise (i.e. school-industry links), which should among other things help give science and technology a different image, and demonstrate the potential of MST careers to students.
- The vital importance of engaging parents in this process.
- The need to develop new links and cooperation mechanisms between primary and secondary education on the one hand, and higher education on the other.
- The diversity of approaches regarding practice within different countries.
- The mobilisation of women scientists from the private sector by identifying career role models and examples of good practice.
- The need to identify and map good practices regarding the different issues mentioned above.

Furthermore, we would not be complete without mentioning the considerably important issue of the renewal of the educational profession in the next ten years.

The development of a knowledge-based society will notably happen through:

- Knowledge creation, notably through research and development activities.
- The dissemination of this knowledge through our education and training systems.
- The application of this knowledge to innovation and the development of new technologies in our day-to-day life.

In this context, we must ensure that we have enough very high-quality teachers in Europe. This is one of the vital prerequisites for the development of a knowledge-based society. At the same time, our constantly evolving society is developing increasingly numerous and complex expectations with regard to teachers. This is why it is important to invest even more in them.

We are thus confronted with a dual challenge as far as the teaching profession in Europe is concerned:

- Firstly, a quantitative challenge, in which about 1 million teachers will have to be recruited in the next five to ten years, between now and 2015 (i.e. much more than the number needed in the last 20 years).
- Secondly, a qualitative challenge - these future teachers require top-quality training to enable them to meet the challenges of the knowledge-based society.

This is a considerable challenge, but it also offers many opportunities. With regard to the problem of the lack of interest in science and technology studies, we must bear in mind how important it is to launch positive actions to improve the recognition and importance of the teaching profession in these subject areas.

Lastly it is critical to appeal to our European and national decision-makers regarding the importance of launching new initiatives and debates. In this context, European Schoolnet, as a network of 30 education ministries in Europe, proposes to launch a debate focusing on the following three priorities:

- Development of an initiative involving the main European Commission departments (DG Education and Culture, DG Research, DG Enterprise, DGINFSO) to develop pilot actions and innovative schemes on science and technology occupations and careers. This should be part of the support for multilateral initiatives involving all stakeholders (the Commission, industry, ministries and actors on the ground) in the debate. By drawing on the initial pilot experiments presented earlier, some actions could be developed to promote occupations and careers, analyse company needs, foster vocations and propose new teaching approaches in MST education.

- Development of new indicators and methods to better comprehend the situation regarding MST in upper secondary education. The compilation of information and development of indicators should help to provide more detailed analysis, firstly of the continuum between guidance in terms of subject choices in upper secondary education, guidance in higher education and the employment situation of young graduates (job conditions such as wages, and length of job contracts, etc.), for MST in general, as well as for the specific sectors of MST.

- Planning of specific actions to give future MST teachers all the tools, methods and approaches they need in order to teach these subjects in the best possible conditions, and thereby to foster new vocations and augment interest in this field and related careers.

---

[i] Commission of the European Communities. (2008). *Commission Staff Working Document – Progress towards the Lisbon objectives in education and training - indicators and benchmarks - 2007* (Publication based on document SEC (2008) 2293), from http://ec.europa.eu/education/policies/2010/doc/progress08/report_en.pdf

[ii] Meri, T., (2008). Women employed in science and technology. *Statistics in focus. Science and technology (10/2008)*. European Communities - Eurostat, from http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-08-010/EN/KS-SF-08-010-EN.PDF

[iii] http://taskforce.wigsat.org/
[iv] http://www.witec-eu.net/
[v] http://www.epws.org/

[vi] Schreiner, C. & Sjøberg, S. (2004). Rose. The Relevance of Science Education. *Acta Didactica (4/2004)*. Department of teacher education and school development, University of Oslo, from http://www.ils.uio.no/english/rose/key-documents/key-docs/ad0404-sowing-rose.pdf