



RHEINLAND-PFÄLZISCHES
MENTORING-NETZWERK
FÜR FRAUEN IN MINT

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Images of science, engineering and technology
Explanatory results of a European project

*„Was ich will,
das kann ich!“*



Contents

Preface / Vorwort	3
Table of Figures	4
Abstract	5
1. Introduction: Science education in European schools	6
2. Underrepresentation of women in SET.....	7
3. Background: from “WomEng” to “MOTIVATION”.....	8
4. Methodology	9
4.1 Magazine analysis	9
4.2 Soap analysis	10
4.3 Biographical interviews	10
5. Results	11
5.1 Youth magazine analysis	12
5.2 Soap analysis	16
5.3 Interview results	17
Excursus: The French specialty	18
6. Discussion	19
7. Conclusion	21
8. References	22
Publisher Information	25



Preface / Vorwort

Liebe Leser/innen,

der allgemeine Fachkräftemangel in den Bereichen Mathematik, Naturwissenschaften, Informatik und Technik ist ein europaweit beklagtes Phänomen. Wie wir ja wissen, ist eine Ursache dafür in der horizontalen Geschlechtersegregation des Arbeitsmarktes zu sehen. Mädchen und junge Frauen meiden Ausbildungen und Berufe im MINT-Bereich, was eine deutliche Unterrepräsentation von weiblichen Absolventen in den betreffenden Berufen zur Folge hat und den generellen Mangel noch verstärkt.

Das öffentliche Bild von Personen, die in einem Beruf in den Natur- oder Ingenieurwissenschaften tätig sind, ist dadurch auch häufig mit starken – auch geschlechtsbezogenen – Stereotypen behaftet. Diese Stereotype wiederum beeinflussen die beruflichen Erwartungen und das Berufswahlverhalten von Schüler/innen und Student/innen in diesem Bereich.

Jennifer Dahmen, Anita Thaler und Cloé Pinault stellen in diesem Heft Teilergebnisse aus dem von der Europäischen Gemeinschaft geförderten Projekt MOTIVATION vor, die sich auf Studien aus Deutschland, Österreich und Frankreich beziehen. Das Projekt hat sich mit den individuellen und sozialen Faktoren befasst, die europaweit das stereotype Image der MINT-Fächer beeinflussen und auch mit den Konsequenzen dieses oft unattraktiven und häufig schlicht veralteten Bildes auf geschlechtstypische Fach- und Berufswahlen von Mädchen und Jungen. Deutlich wird die große Rolle, die Lehrpläne und Unterrichtsmethoden bei der Weckung von Interesse in den betreffenden Fächern haben. Aber auch die Verbreitung unrealistischer und

geschlechtstypisierter Images bestimmter Fächer und Berufe durch Medien wie Jugendzeitschriften oder Fernsehen trägt offensichtlich zur Perpetuierung der Ablehnung von MINT-Fächern bei.

Am Ende des Jahres 2012, in dem das Ada-Lovelace-Projekt sein 15jähriges Bestehen feierte, erscheint damit zum ersten Mal ein englischsprachiger Beitrag in unserer Schriftenreihe. Auf diese Weise tragen wir der im vorliegenden Beitrag beklagten Situation Rechnung, dass nicht nur in Deutschland zu wenige Mädchen und Frauen MINT-Berufe und -Studiengänge wählen. Wir sind der Auffassung, dass eine internationale Perspektive dabei helfen kann, dieses Phänomen besser zu verstehen und gegebenenfalls zu verändern.

Neben der Öffnung für internationale Beiträge gibt es mit dem vorliegenden Heft noch eine weitere Neuerung für die ALP-Schriftenreihe. Um die Qualität unserer Reihe noch mehr zu erhöhen wurde zum ersten Mal bei der Begutachtung der Beiträge ein peer review-Verfahren unter Hinzuziehung externer Reviewer durchgeführt. Diese Verfahrensweise hat sich als sinnvoll und gut praktikabel erwiesen und soll deshalb auch zukünftig bei der Begutachtung von Beiträgen praktiziert werden.

Auf diese Weise gelingt es unserer Schriftenreihe – genauso wie dem Ada-Lovelace-Projekt – etabliert und innovativ zugleich zu sein.

Wir wünschen Ihnen wie immer viel Spaß beim Lesen des interessanten Beitrags!

Die Herausgeberinnen

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Table of Figures

Figure 1: Engineers' images from students' perspectives	8
Figure 2: Gender distribution of SET pictures in youth magazines	12
Figure 3: Gender distribution of music technology pictures	13
Figure 4: Gender distribution of cell phone pictures	14
Figure 5: Gender distribution of vehicle pictures	14



Images of science, engineering and technology

Explanatory results of a European project

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Abstract

Images of engineering majors and jobs often go along with general and gender specific stereotypes of science, engineering and technology (SET) and outdated clichés about scientists and engineers. Some of these stereotypical attitudes are still active and have great impact on study decision making processes and students' job expectations. This paper will discuss results of the European Commission (EC) project MOTIVATION, which is looking for factors influencing

young people's perception of SET and SET careers. Results from interviews with female and male upper secondary school pupils in Austria, France and Germany will be presented. Additionally, the impact of gendered SET representations in youth magazines and soap operas will be shown as these magazines build a daily companion for youngsters and therefore have an important role in their lives.



1 Introduction: Science education in European schools

The proportion of students in science, engineering and technology (SET) can be seen as a crucial factor for creating a competitive knowledge-based economy. But in fact, the number of students in SET degree courses is declining in many European countries. Society is aware of the important role young people have for the economic development as shown in a EU-wide survey, where 82 % of the respondents agreed that “young people’s interest is essential for the future prosperity of Europe” (European Commission 2005, p. 100). Already in 2001 the European Commission proclaimed a “young people and the scientific vocation crisis” in Europe (European Commission 2001; see also Millar, Leach & Osborne 2000) and called for a “renewed pedagogy” in schools (European Commission 2007), which does not incline to isolate science classes from remaining subjects creating some kind of subculture (European Commission 2004). Those efforts should lead into a higher percentage of young people who make the decision to opt for an occupational training or study in SET. This goes along with the results of a study on students’ perceptions of science teaching which elaborated that two thirds of senior school pupils think that “scientific lessons are not appealing enough” (European Commission 2001). And also the current PISA (Programme for International Student

Assessment) study corresponds with those previous research results. The way science is taught in many schools in Europe can be seen as “not appealing enough”: pupils have only rarely the opportunity to carry out experiments, to generate and test ideas of their own and to apply scientific knowledge to their everyday lives (OECD 2007). Langen and Dekkers (2005) could show that the decision in science education of teaching either broad-based interdisciplinary or narrow defined mono-disciplinary science classes with early specialisation has an impact on opting for science, engineering and technology degree courses in higher education.

Problem-based, inquiry-based learning, hands-on-experiences and learning by doing have proved to be successful didactical approaches (European Commission 2007). Education research has shown that explaining something to others, and to think about how to teach others (learning by teaching), is one of the most effective learning methods. That means connecting SET learning to pupils’ own knowledge and competencies is a logical next step. Thus, they can become aware of their implicit technological knowledge and can profit from their formal and informal acquired abilities (see also Thaler and Zorn 2009a, 2009b).



2 *Underrepresentation of women in SET*

The ongoing under-representation of women in SET fields is another field of action. While, in 2005, 75.7 % males studied engineering, manufacturing and construction, and 63.1% enrolled in the category mathematics, science and computing, only 24.3% (engineering) respectively 36.9% (science) females studied those majors in the EU-27 member states (Eurostat 2007). This gender imbalance is especially striking since we know that there are no significant performance differences of female and male pupils in science (OECD 2007a). The PISA study revealed that 93% of all pupils agreed with the fact that science is important for understanding the natural world and 92% uttered their consent on the item that “advances in science and technology usually improve people’s living conditions” (ibd.). But although both, girls and boys, are generally aware of the importance of science and technology in future times, only a minority of students see themselves doing science in the future (ibd.). This is underlined by the results of the Relevance of Science Education (ROSE) study, which pointed out that especially girls in wealthier OECD countries are more likely to reject science and technology careers for themselves (Schreiner 2006, Schreiner & Sjøberg, 2006). The gender differences in attitudes to science were most prominent in Germany, Iceland, Japan, Korea, the Netherlands and the United Kingdom. “The largest gender difference was observed in students’ self-concept regarding science. In 22 out of the 30 OECD countries in the survey, males thought significantly more highly of their own science abilities than did females” (OECD 2007a p. 30ff). And because we know that dream jobs of boys and girls are still in line with cultural embedded gender stereotypes, the risk of making study and job decisions on basis of gender stereotypes, and not on personal potential and performance, is always present (Cornelißen & Gille 2005).

This underlines the importance of promoting approaches in science education which support a positive development of girls’ self-concepts towards science and technology issues. Taking into account these gender differences regarding pupils’ self-concept is especially important because boys and girls showed no difference in science performance in the majority of the PISA countries (OECD 2007a).

One of the theoretical concepts which can explain how images of professions can influence professional choices of young people is the ‘self-to-prototyping matching theory’ (Hannover & Kessels 2004). It says that individuals imagine prototypical persons who would choose certain career options. The individuals prove how their self-images correlate with these corresponding professional prototypes. The higher the similarities, the more likely it is that the individuals turn to the fields of interests of the prototypical representative (Hannover & Kessels 2004, Rommes et al. 2007). This is especially important with regard to a study with interview results of 72 secondary school students, which found out that science teaching influences how scientists were perceived as persons (Cleaves, 2005). This demonstrates the importance of research of images of scientists and engineers and SET generally, and the question how they relate to those images.

Additionally to formal educational arenas, out-of-school science experiences and implicit SET-learning through media can be seen as influential learning factors. Especially youth relevant media, like TV, Internet, computer games and their implicit information about jobs and about SET as a field of (non-)interest, play a key role in the socialisation and educational decision processes of pupils in secondary school level. Thus, these media receptions can be seen as informal learning experiences, which form young people’s images of science and engineering, enhance SET-interests and young people’s self-beliefs as well. Whereas we are interested in construction and co-construction processes of technology and gender, other studies set a solely gender focus in their youth magazine analysis. Gitta Mühlen Achs (1996), for instance, criticized in her study that youth magazines emphasize “special female needs” and further stereotypical approaches. Parissa Chagheri (2005) evaluated two girls’ magazines feminist-linguistically and could show that the visual and verbal discourse of women in both magazines is far from an emancipatory approach. And Mareike Herrmann (1999) explored a German teenage girls’ magazine



and found a reinforcement of the femininity myth. The absolutely new research perspective in the MOTIVATION study and our paper is the analysis of science, engineering and technology and the gender analysis of those SET representations together. This

brings more insights about the role of media in the process of shaping stereotypical images of technology in youth's minds (Osborne, Simon & Collins, 2003), and help explaining effects like the declining of SET students.

3 Background: from "WomEng" to "MOTIVATION"

Besides the previous mentioned education-political discussions and its consequences, the idea for a project on the image of science and technology, and therefore the following deliberations based one of our own research results, which we gained in the WomEng study (for further information see: Dahmen 2006, European Commission 2006, Thaler & Wächter 2005).

Beside other methods, we did a survey where we asked 699 female and male European students out of different engineering majors and, as a control, group 637 students of different non-engineering majors (social sciences, humanities, economics, etc.) – among other things – about the image of female and male engineers.

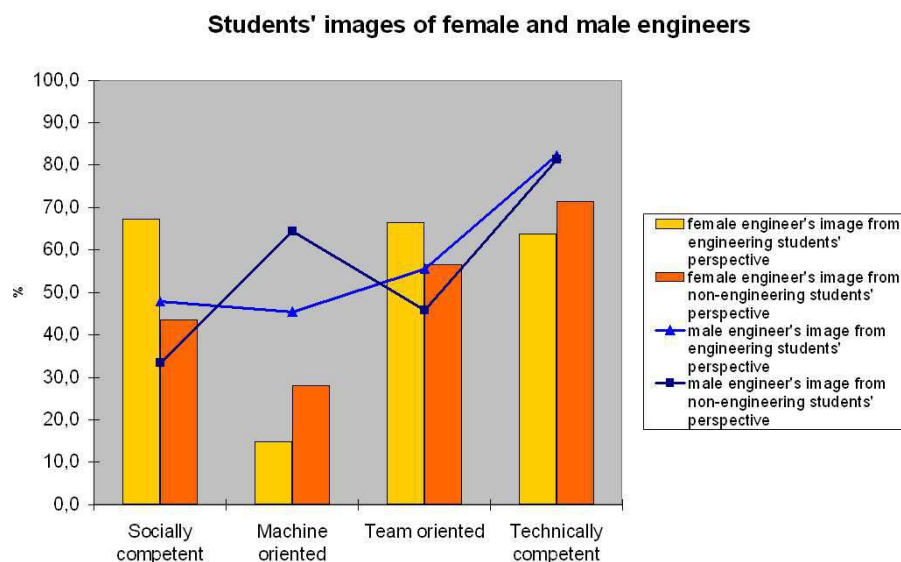


Figure 1: Engineers' images from students' perspectives

The diagram above (figure 1) displays the gender stereotypical image of engineers depending on the persons' study subject. While engineering students and non-engineering students both generally attribute more technical competence than team orientation to male engineers, non-engineering students ascribe

additionally more machine orientation and less social competence to engineers than engineering students do. Female engineers are rated as less machine-oriented as their male counterparts, but the machine orientation is overall lower rated by engineering students. That means that the image of engineering –



and we assume generally the image of SET – becomes more realistic and clearer in SET degree courses when students learn that engineering is “more than machines” and SET jobs include also social

competencies. In short, personal experiences help young people to overcome stereotyped SET images (Thaler 2005).

4 Methodology

The MOTIVATION study (2008 to 2010) used a set of different methodological measures; in this paper, we refer to the results of the content analysis of youth media research and to the results of the interviews with boys and girls in Austrian, French and German schools. MOTIVATION was funded as so called ‘Coordination Action’ within the 7th Framework Programme of the

EC. This funding scheme is not devoted to large empirical investigations; it aims at coordination and networking activities, like expert exchanges or support of other research schemes. Thus, the results based on the samples are rather small and have explanatory character.

4.1 Magazine analysis¹

For the analysis of popular youth magazines, a data sheet has been developed (Thaler 2009), including criteria and precise guidelines for all national team members on how to identify and describe relevant SET representations in their country-specific youth magazines. The data of each sheet submitted by the national teams was entered in SPSS as support for the statistical analysis. Supplementary, a qualitative content analysis of the detected gender representations in SET images was prepared by each national team. This should allow getting a wider impression of the magazines in the sample beyond counting and describing SET images.

Technology for the project purposes is defined in a layperson’s view: technological artefacts like machines, hardware, and software and SET professionals, for instance scientists, engineers, etc., in order to analyse technology representations, which would be recognised as technology by teenagers (ibid.).

“BRAVO” magazine, which corresponds to a complete analysis from July to December 2008. For instance in Austria and Germany, “BRAVO” is one very popular youth magazine for more than 1.6 million female and male readers weekly, and has been published since 1956. Of



the Austrian youth magazine “Xpress”, which is published monthly, six issues were closer examined from July 2008 to January 2009. Supplementary, and in contrast to the two other magazines which are focussing on the same audience, seven issues of girl’s magazine were analysed. The German magazine “BRAVO GiRL!” is published every second week and reaches 0.59 million readers per issue, of which the majority is female with 0.55 million (Bauer Media 2009).



¹ The results of the magazine analysis presented here are limited to the German and Austrian cases due to the larger samples in these two countries.



4.2 Soap analysis

Based on the methodology of Bohnsack (2007, 2009), detailed methodological guidelines have been produced to explain the general context of video-analysis and its gender-interpretative specificities (Thaler & Scheer 2009a). As result, a "Soap SET scene analysis sheet", similar to the magazine analysis data sheet, was developed and supplemented by further explaining soap analysis guidelines (Thaler & Scheer 2009b). The first quantitative analysis step compromised the classification of SET, its duration in a scene and if it is presented in foreground or background; in a second qualitative analytical step, these foreground SET scenes were interpreted in a descriptive and reflexive manner. This instrument was accompanied by a document "Soap opera analysis –

FAQ (Scheer & Thaler 2009a)" to enhance the comparability of country-specific soap opera research results. The following daily broadcasted soap operas were selected for the analysis, based on the popularity of each TV show among teenagers in each country:

- 23 episodes of "Anna und die Liebe" in Austria, duration of each episode 23-25 minutes,
- 10 episodes of "Gute Zeiten Schlechte Zeiten" in Germany, duration of each episode 23-25 minutes,
- 10 episodes of "Plus Belle La Vie" in France, duration of each episode 23-25 minutes.

4.3 Biographical interviews

For the exploratory SET school education analysis, 24 pupils of upper secondary schools in Austria, France and Germany have been interviewed about their experiences and opinions regarding SET in different settings like at their parent's home, at school, among peers, and in media. The informants were about 14-16 years old, half female, half male. Teachers helped to identify interviewees who are interested in SET and those who are not. We wanted to analyse how the opinions about SET differ within these groups, even though the sample was quite small.

The interview guidelines were structured in three parts (Rommes, Godfroy-Genin, Pinault, Davidsson, Dahmen 2008). In the first part of the interviews an adapted 'Draw-A-Scientist Test – DAST' has been included. The test was first applied by David Chambers (1983) for exploring stereotypic perceptions and views about scientists reflected in drawings of school pupils. In the beginning of our interviews, all girls and boys were asked to draw a person working in the area of science, engineering and technology who has passed the same educational training like the interviewees. The idea behind this wording of the task was first to broaden

the field from science of the traditional DAST to SET, the focus of our study. And the second part of the formulation "who has passed the same educational training like the interviewees" should make an identification of the pupils with the drawn person more probable.

The second part of the interview was designed as semi-structured interview, which allowed the interviewers to go deeper into a certain topic respectively to add questions which might be necessary for gaining a better understanding about the perceptions of the interviewees. The structure covered the following topics: biography, past experiences, school, inclusion initiatives, peers, their source of image about SET, and future occupation ideas. The interview started with the biographical background of the pupils, their family situation, parents' occupation and whether they would consider themselves as interested in science, engineering and technology or not. Follow up topic were the individual past experiences with SET the boys and girls have made at home, like favourite hobbies and toys,



division of chores between the family members, like who cleans / who repairs, the image of SET within the family, and the family members' opinion about SET competencies. The questionnaire continued with the school topic, why the informants like or hate certain subjects, in which subjects they are good in, which subjects they have chosen (if applicable for their curriculum); furthermore, they were asked about their experiences with SET lessons and teachers, what they like and dislike about SET in school, and if and how the way of teaching influences their feelings about these subjects. Additional questions covered information about the influence of so called inclusion initiatives like summer universities, job information days, internships or occupational information measures like the Girls' Day. Information about peer effects at school and in the private environment should be gathered by asking about the (un-)popularity of SET in the peer group and at school, how the (un-)popularity can be noticed and how the interviewee / the peer group thinks about persons interested in SET.

In the third and last part of the interview, the pupils were asked to describe one day of their future job. How do they imagine this job, which aspects are important for them?

By developing the interview guidelines, two content related goals should be reached; first, how relate the images teenagers have about professions in the field of SET to their images of what they want to become in their future, and second, what other factors may influence occupational choices of young people, e.g. family, friends, school, media, attitudes towards SET, including negative or positive experiences they have made with it (Rommes, Godfroy-Genin, Pinault, Davidsson, Dahmen 2008).

The interviews were transliterated afterwards, followed by a first analysis on a national basis which led to short summaries for each of the above mentioned interview points. This allowed to interpret the results with regard to the different national settings. Afterwards a second, cross-national analysis followed by the specific work package leader. The aim was to identify commonalities and differences as well as developing ideas for further research and recommendations for change.

5 Results²

In this paper, we concentrate on partial results of Austrian, French and German investigations in the first and second project phase, which include the analysis of youth magazines in Germany and Austria, and the

analysis of soap operas on TV as well as biographical interviews with female and male pupils at secondary schools in all three countries.

2 The magazine data in Austria was collected and analysed by Anita Thaler and Magdalena Wicher, in Germany by Jennifer Dahmen and in France by Cloé Pinault. Interviews with pupils in Austria were conducted by Sabine Stockinger, in Germany by Jennifer Dahmen, Felizitas Sagebiel and Christina Schultes and in France by Cloé Pinault. The interview guidelines were developed by Els Rommes, Anne-Sophie Godfroy-Genin and Cloé Pinault. The data sheet for the analysis of SET representations in youth magazines was developed by Anita Thaler.



5.1 Youth magazine analysis³

Altogether 801 representations of SET were analysed in the Austrian and German youth magazines. As the German "BRAVO" is weekly published, the majority of

images are connected to this magazine with totally 491 cases; that are averagely 22.3 SET images per issue.

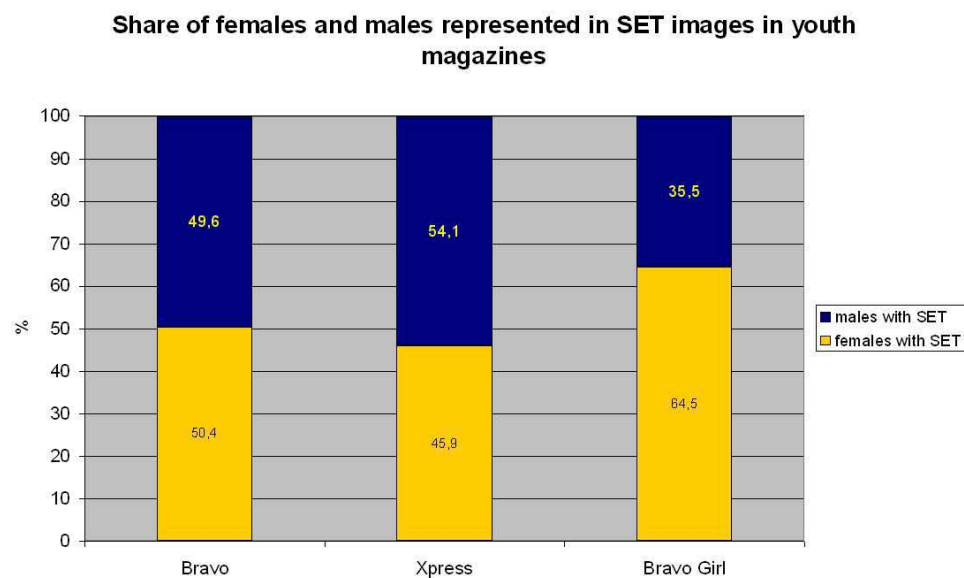


Figure 2: Gender distribution of SET pictures in youth magazines

The three analysed magazines have a different share of females and males represented in their SET images. While "Xpress" and "BRAVO" nearly equally often portray females and males in connection with science, engineering and technology, the girls' magazine "BRAVO GiRL!" certainly emphasize their female focus by presenting females in two thirds of their SET pictures.

One of the points we are interested in is what fields of technology are presented, and whether they vary from magazine to magazine, and if they are more or less

connected to females or males portrayed in the same picture. We can firstly say that the field which is presented in SET related images is very closely connected to topics typically presented in youth magazines. The mostly presented SET field is music technology (277), followed by vehicles (133) like cars or motorbikes, then other – not pre-defined – technology (125) like digital clocks. Images with cell phones/handhelds are common as well (115), followed by a little fewer camera/TV pictures (75), computers (41), and video games/toys (35).

³ A shorter overview of the Austrian and German results can be found in Dahmen and Thaler 2009 and Thaler and Dahmen 2009.



Besides asking which technology is shown in youth magazines, it is also interesting to look at differences

regarding the gender of portrayed persons in those SET images (figures 3-5).

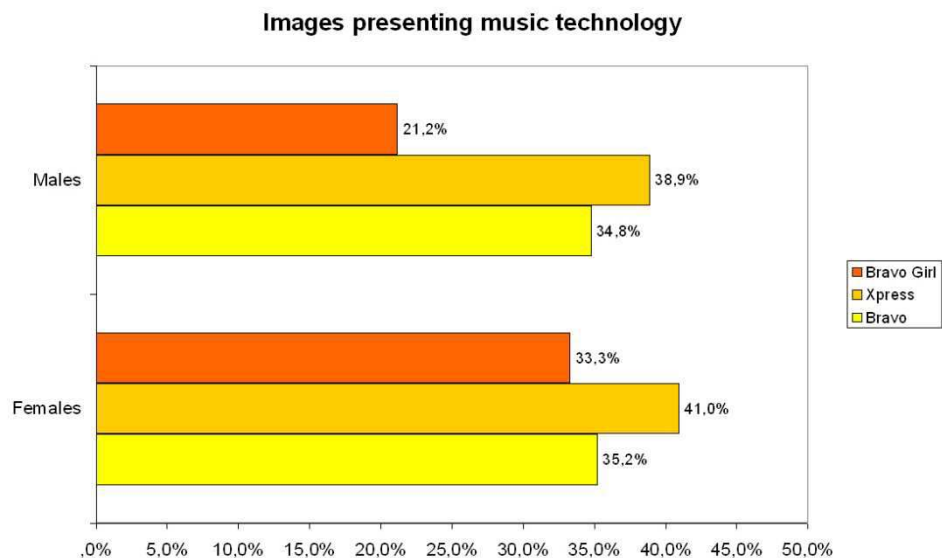


Figure 3: Gender distribution of music technology pictures

In the figure 3 above, it can be seen that pictures with males presenting music technology are relatively more often shown in "BRAVO" and "Xpress" – the magazines aiming at boys and girls – compared to "BRAVO GiRL!". On the other hand are images with females more often connected to music technology in the Austrian "Xpress" than in both German magazines "BRAVO" and "BRAVO GiRL!".

That means in short that first music technology is mostly presented in Austrian "Xpress", and the quantitative gender difference in music technology pictures of "BRAVO GiRL!" can be explained by their general over-proportional portraying of females in this girls' magazine.

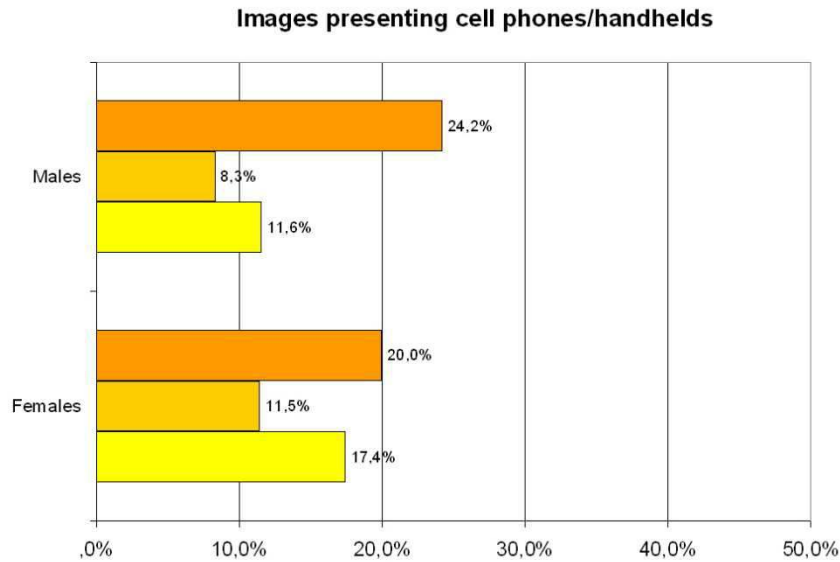


Figure 4: Gender distribution of cell phone pictures

Cell phone technology is relatively more often presented in "BRAVO GiRL!" than in "BRAVO" and "Xpress", but while these two "both-genders-magazines" connect cell phones a little

more often with females, the girls' magazine "BRAVO GiRL!" shows cell phones/handhelds more often in SET images with males than females (figure 4).

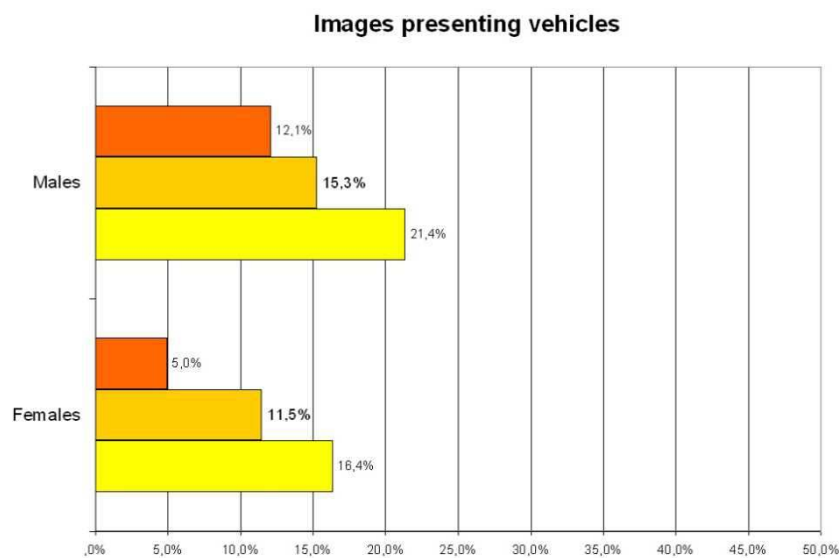


Figure 5: Gender distribution of vehicle pictures



Pictures displaying vehicles could be found mostly in "BRAVO", then in "Xpress" and least often in "BRAVO GiRL!", and in all three magazines vehicle images portray more males than females (figure 5). The gender difference is very obvious in "BRAVO GiRL!". Males are more than two times as often shown with cars and motorbikes etc. than girls and that in a magazine where overall only one third of SET pictures display males. This shows a very clear connection between technology and masculinity.

In the qualitative analysis of the two general youth magazines "Xpress" and "BRAVO", we focused on SET pictures portraying male and female persons in the same picture, so that we could say something about the represented gender relations. And we can shortly summarize, that both youth magazines have gender stereotypical and gender equal SET representations as well. But gender equal SET representations contain often unrealistic SET representations, using technological artefacts more as props of a scene than in their technological context (Thaler 2009). The degree of gender equality of SET representations differs between the two magazines. While in those mixed-gender-representations "Xpress" has less overt gender stereotypical SET representations but additionally some subtle forms as well, "BRAVO" has mostly overt gender stereotypical SET images.

Overall, representations of SET professionals are rarely to find, only about 3% of all analysed SET pictures show SET as a job and not as a product (Thaler 2009). A positive exception is the irregular published job special of "BRAVO" called "job attack" [German "Job Attacke"]. This initiative is a cooperation of "BRAVO", McDonalds, and the German employment agency and introduces so called dream job fields to young people, and informs about legal aspects of apprenticeships and ways to find the right job as well. This job special can on the one hand be considered as good practice initiative for SET job information and counselling, and it is more or less the only place in all analysed youth magazines where SET is presented as a job and not as technological product. Striking was the fact that the main headings or subtitles suggest that the presented jobs are 'cool' ones. Also the so called "CSI effect" (see for instance Rommes et al. 2007) is taken up by "BRAVO", too (issue 43/2008), regarding the work in forensics as a potential "dream

job". This effect sees a linkage between the popularity of the "CSI" series on TV and the increasing number of young people who opt for a career in forensic sciences and related technology fields like biomedical engineering. On the other hand this job section perpetuates certain gendered SET stereotypes, for instance portraying males with electronics and mechanical engineering, and females with chemistry and medical sciences.

Additionally, the German girls' magazine "BRAVO GiRL!" was qualitatively analysed with the aim to reveal the representations of SET in this youth medium which explicitly aims on young female readers. The magazine was first published in 1985 and on the publisher's website it's promoted as substitute or addition to real life companions: "With the core areas stars, fashion, beauty and boys 'BRAVO GiRL!' offers everything which interests girls. She has the closeness of a best friend and the knowledge of a big sister" (Bauer Media 2009).

And indeed, the analysis of seven issues in autumn 2008 confirmed this. The content of the "BRAVO GiRL!" magazine aims exclusively on young female readers. Beauty, fashion and lifestyle have been the most important topics in each issue, all three strongly linked to the "boys topic". Doing so, the magazine has a strong hetero-normative approach, it is all about girls and boys and their relationship to each other, respectively information and tips for girls how to appeal to boys and how to understand them. These tips were always formulated in a hetero-normative manner. In one issue, an interview with an openly gay living singer and moderator was about his personal experiences with coming out and being gay was included; but this was the only exception.

Coming back to our focus SET it is interesting that if a relation to SET is actively produced in the journalist magazine content, it is again related to the "boys topic" in most of the cases, like the following two headings illustrate: "Natural, sexy, shy – which internet profile appeals most?" (issue 19/2008, p. 68); it is a story about a girl, who tested three different internet profiles – natural, sexy and shy – in an internet community for pupils. "Boys & sms: what works, what not?" (issue 21/2008, p. 18), this article informs the female readers on the "tops and flops" of short messaging – again – in connection with boys.



5.2 Soap analysis

The analysed soap operas "Gute Zeiten – Schlechte Zeiten" (Germany) and "Anna und die Liebe" (Austria) are offering similar results to the magazine analysis: Technology is often part of the stage set and seldom used in a meaningful way. The positive exception of our soap opera analysis is the French TV series "Plus Belle La Vie", which broaches the issue of SET in various ways, mostly via female and male SET professionals and up to date scientific and engineering stories.

"Plus Belle La Vie" gathers around 5,5 millions of TV watchers every evening. One quarter of the 11-14, and 29 % of the 15-24 years old French population watch this daily soap and more than one quarter of the feminine audience.

"Plus Belle La Vie" is organised around different stories and characters, and presents, day after day, the live and events of different families living in an imaginary district of the city of Marseille "Le Mistral". The soap is organised through two main stories: The typical soap core around the personal lives of "Le Mistral" inhabitants, happiness and misfortunes, love, friendships, and criminal affairs. The "clever" part of this soap is to melt intimately the real life (e.g. 24th of December is coming, the Mistraliens are as well preparing Christmas) to each one of the scenarios. Each episode begins with breakfast, and ends with the night coming.

But all that would not make this French soap to a good practice in terms of science, engineering and technology. The difference to other analysed soaps is first that SET, for instance tools, are equally used by female and male characters. Those SET tools were very usual and of ordinary use (e.g. mobile phones, computers, printer) but surprisingly – and this is the second difference to other soaps – several SET jobs were represented as well, and that by male AND female characters.

Gender balance considering SET jobs is though quite harmonized, as female and male characters are represented and acknowledged in SET professions (e.g. contamination expert, engineer). Beyond representing several SET professions, and female and male equally using SET tools, "Plus Belle La Vie"

presents as well a quite revolutionary handling of some controversial society subjects (in France):

- homosexuality (men and women, with characters quite common, and love stories which go well (First homosexual kiss broadcasted on French television during prime time and crude sexual proposition, which is in France really breaking a taboo),
- gay and lesbian parenthood,
- marijuana used as medicine,
- drugs,
- euthanasia,
- environmental problems and how huge agro alimentary firms produced the mad cow disease.

Characters, "weak" and "strong" ones, are indifferently female or male, and professions usually traditionally taken on by female or by male are reversed (a woman as head of the police station, a man as a social worker for teenagers). Richard (2005) states that there are not so many gender differences concerning male and female teenagers' interest towards these programmes. Watching these programmes are real ritual moments for those teenagers, who insert them in their leisure time schedule. These are times of "singular/collective" coordinating use of cultural TV practices among teenagers. Pasquier (2003) identifies different positioning or preferences towards soaps more or less "sentimental affair" centred among female and male teenagers. Youth public develops a horizontal, very tense sociability through age groups, and individual commitments disappear confronted to a collective acknowledgement.

"Plus Belle La Vie" soap, as it handles common social and cultural representations considering jobs, gender, situations in an untraditional way, presents SET and SET jobs accordingly to its first way of dealing scenario.



The “Plus Belle La Vie” characters not only set gender sensitive situations (personalities, jobs, developing of the scenario...) but also both female and male characters deal with SET as tools, or as a job. As “Plus Belle La Vie” has a strong teenage audience, its positioning concerning SET, SET professions and gender represents a good practice case as soaps during teenage hood set up a “common territory of

practices” (Pasquier 2003). Insertion into social groups depends on the conformity of tastes and opinions of its members: these opinions are gendered, as neither boys nor girls could freely show his/her attachment to TV soaps without engaging its gender identity.

5.3 Interview results

The results of our twenty-four interviews can be seen as useful addition to our media analysis. We wanted to bring in teenagers’ voices to our research question about what images of SET exist and how they are constructed by media. Therefore, the following results should bring further clues for interpretation of our research topic. What do teenagers in Austria, France and Germany tell about their SET classes in school and what influences their interest and images in SET? To begin with, interest in SET turned out to be a rather complex concept. It is clearly influenced by practical experiences and personal connections. It does matter if parents tell about their SET profession at home, if children play with construction or other SET toys, if pupils experience hands on science classes with experiments and if they get to know SET professions in practice (internships, etc.). All those positively influencing factors were mentioned by pupils who described themselves as (quite) interested in SET.

The role of SET teachers seemed influencing as well, the popularity of a subject – especially in the German interviewee’s group – depends mainly on the (un-)popularity of the teachers regardless the subject they teach. This was also confirmed by teachers who were interviewed in Germany, like the following statement of a female SET teacher underlines: “It depends much on the teacher. That’s very different. In the 5th grade laboratory teaching is very popular because it is a very practical subject. In my 6th class English is also very popular, sports too.” And she also adds another important variable for the popularity of a subject: “Mainly those active subjects.” (GWT2_2).

A teacher who knows how to engage pupils through good didactical concepts contributes towards a positive perception of the subject and supports pupils’ will to learn. Like a French girl, who has chosen the scientific study stream, felt strongly supported by the attitude of her female physics teacher: “...she is very ambitious, and thanks to her, we can go further in our classes, to understand the mechanism, not only to apply stupidly formulas. It changes everything!” (FM_11). Although good teaching for the pupils means most of all having fun during the lessons, they also emphasise the importance of recognizing the sense of the subjects. One Austrian interviewee – who admitted in being not interested in SET – referred to the concept of meaningfulness generally, but even more important, meaningful for one’s own life. The classic dichotomy concrete vs. theoretical concerning school subjects is widely employed among the interviewed pupils. Main argument is that SET disciplines are not being of daily use, disconnected from reality, too much theoretical with “dry content” and though not bringing huge interest. A French female pupil in the economic study stream points out the teaching and learning dilemma: “...disciplines have to be taught lively to create interest! Like Einstein’s relativity, who could make people dream... physics that would make people dream! The problem of scientific disciplines is that they’re not taught as living disciplines” (FM_12). Above, the interviewed pupils described their science lessons partly very negative: demanding intensive learning by heart, harsh work and generally a huge



work load. In comparison to the German and Austrian interview results, the French pupils complained stronger about the workload, for instance, in physics and maths. A French girl who has chosen the literature study stream stated the following: "In physics there were million of things to learn by heart...and in daily life, it has no interest. You work a lot, you have a lot of homework, you get sad on Saturday night, you do maths, maths and maths!" (FF_11).

Pupils like hands-on work at school, they want to try out experiments in chemistry by themselves or construct robots, it is important for them to experience science by themselves and not only during lecturing lessons: "When we do something concrete, it really interests me. When it's really pure theory, like sometimes in maths, I don't like it at all" (Male interviewee from France FM2_1). Education research has shown that learning is most effective in settings where learners can act as teachers as well. Thinking about how to explain, for instance, science to others is a very effective learning strategy. Therefore, it can be deduced that especially SET learning should be connected up to contexts where pupils can see the relevance of school subjects and become aware of their implicit knowledge. For example, to realize that their often informally learned technology skills can help them with classes at school, by connecting SET with spare time topics like internet games or music technology (Gansmo 2004, Pitt 2004, Thaler & Zorn 2009a, 2009b).

Not being interested in SET also can be a result of identity processes and the conclusion that SET has definitely not the image fitting to an ideal self. This was the case for one Austrian girl who was very up

fronted with her disinterests in SET and said that she even hates maths and chemistry because she "doesn't see the point" (AFI_2). In biology, for example, she said about cell division: "I don't think that's necessary for my life". That seems to be an astonishing discourse. First, one might think that especially life sciences could be easily explained as relevant for all humans, and of course for all pupils in school. It seems sad that even biology, and especially the knowledge of the human body, cannot be explained in a meaningful and interesting way. But another interpretation of this girls' discourse is that she deliberately shows her SET-disinterest because she actually thinks that being good at school and especially being good at SET subjects (being "clever" as she ironically called it) can conflict the identity of a teenager, as she wants to present herself. SET-interest and SET-competence is certainly not appropriate for her self-concept. This possible conflict between the self-image and the public image of persons who like SET is underlined by the statements of a German girl, who sees herself as competent and really interested in science and especially technology and therefore sees herself confronted with stereotypes and prejudices also from the side of her class mates; on the other hand, she is constantly engaged in belonging to the 'cool' girls group of the class, who are not the ones who are in SET. But actually, she does not conceal her preferences in front of her friends and class mates, although she made the experience of not be taken seriously as a girl who likes technology: "If I tell in the breaks that I reassembled a mp3-player and it functions – I am totally proud – and the others say again 'you are kidding, you can't do that'." (GF2_2).

Excursus: The French speciality

The investigations in France highlighted the deep impact of the national school system towards the orientation of French male and female pupils. At the

age of 15 or 16, pupils have to decide which study stream (called *séries*) they want to progress in their last three years of high school education.



The streams⁴ are divided into:

- S – for natural sciences (*série scientifique*),
- ES – for economy and society (*série économique et sociale*),
- L – for literature and philosophy (*série littéraire*).

The crucial point lies in the societal and educational reputation of these three study options. The S-stream is acknowledged as being the “one and only”, the “excellence path”, which leads to prestigious studies, future jobs and careers. Thus, science and technology are used as selectivity tools, dividing the good from the bad pupils: the S-stream gathers good pupils, which are not only the ones who are interested in sciences but also the non-interested pupils who have to choose this stream because of parental pressure or for keeping career options open. The ES-stream is though known as the second choice, while the L-section sees its pupil population decreasing dramatically since years, as its acknowledged teaching content opens a very few doors on prestigious studies, and drastically limits any applying to numerous jobs. Gender has a deep impact on pupils’ choices and repartition between those three possibilities: L-stream is composed by 80% of girls, ES-stream by 62% and S-stream by 45% of girls (MEN- DEPP 2005). When male pupils think they are

very good in literature and the French language, one out of ten boys would choose the L option, while, being in the same case, three of ten girls would choose the L section. Considering the science stream, eight out of ten boys would attend S when they think they are good in maths, while at the same time only six out of ten girls would choose like this (MEN-DEPP 2005). S stays over invested by boys and is the “excellence” section, the one which is closing or opening gates to pupils’ (male and female) studies expectations, while mathematics has become the first elected selection discipline. Good pupils would concentrate in the ES-section and peculiarly in the science (S) stream, even if they are inhibited literary pupils, because of the poor job opportunities of the L-section. The latter one is known as restricting and even erasing any possibilities considering studies and jobs. Its attractiveness dramatically decreased these last ten years.

In conclusion, it can be said that choosing to attend the scientific S-stream is not a real choice, but a compulsory one:

- if you’re a good pupil,
- if you want to attend acknowledged higher education curricula,
- if you want a wider job opportunity.

But being interested in science and technology is not the primary reason for choosing the S-section.

6 Discussion

Contrary to the efforts of the European Union to strengthen its reputation as scientifically and technologically innovative and knowledge based society, the declining number of students in SET degree courses and gender imbalance in SET bears a need for on-going improvement, especially of SET education and public understanding of science. We

could show that several studies revealed that, although students agreed on the importance of science and technology (OECD 2007a, European Commission 2001), only a minority of them thinks about a career in SET. Additionally, school education, informal science education and implicit SET-learning through media are very

4 These terminology and curricula appeared through the Secondary High School’s 1992 reform: Classe de Seconde was reformed in 1992, Classe de Première in 1993, and finally Classe de Terminale in 1994.



influencing. Therefore, the European research project MOTIVATION wants to explain some interdependencies of school and out-of-school factors, which influence the image of SET, and how this knowledge could be used to attract more young people for a SET career.

Regarding our research question about genderedness of SET images, the most relevant result is probably the following: We found gender equal representations of science, engineering and technology, but they represent SET very often in an unrealistic manner, using technological artefacts as props of a scene and not in a meaningful technological context (Thaler 2009).

Science, engineering and technology is not an unusual topic in youth magazines. But opposite to official SET job brochures, youth magazines embed SET mostly in other leisure topics, like music or movies and gossip about famous persons in those businesses. Is technology in European youth media – a missed chance? Youth magazines and soap operas have lots of different possibilities to embed SET as meaningful topics because science, engineering and above all technology are already represented broadly in those media. But only few producers use the chance to connect the existing potential of SET images, like in a job special section of the German youth magazine "BRAVO" or for an explosive storyline in the French soap opera "Plus Belle La Vie". Especially the analysis of this soap opera could prove that including SET topics in the story does not necessarily have to bring boring results. On the contrary, our newspapers are full with thrilling stories around science and technology; youth media could use that to equally promote gender equality in SET as well as enhance discussions about SET and its impacts. But that is wishful thinking, most youth media represent SET, and predominantly technology in an accessory-style, like clothes or furniture they are used in the stage set of TV scenes or magazine pictures to represent modernity, where unfortunately the message too often is that possessing is more important than using and understanding (Thaler 2009).

These results strengthen current SET education approaches which want to use leisure topics of teenagers as a vehicle to transport SET in a more (for pupils) appealing and meaningful way (Gansmo

2004, Pitt 2004, Thaler & Zorn 2009a, 2009b). Uttered didactical preferences of the pupils for hands-on work, experiments and interactive exchange of course cannot be implemented without knowing and transferring the necessary concept behind, but for the young people, this necessity and meaningfulness is often not comprehensible.

About the genderedness of SET images in youth magazines, we can conclude on two different levels. Quantitatively, the proportion of portrayed females and males in SET pictures is nearly the same in the girls' magazine; the female share is even higher because this reflects the magazine's direction as a "female medium". On the quantitative and even more on the qualitative level, we found out that gender stereotyping takes place in reinforcing the female or male connotation of certain technology fields. The over-representation of female portrays with cell phones and under-representation of vehicles in the girls' magazine – compared to both general youth magazines – can be seen as one indicator. The quantitatively higher proportion of males connected to vehicles and qualitatively analysed relationship of gender and vehicle usage (males are more often presented as drivers while females stand outside or beside vehicles, using them more as props) is another one.

Representations of SET professionals are rarely to find in the youth magazines, 97% of all analysed SET images show technological products. But a positive exception is the irregular published job special of one youth magazine. This job special can be considered as good practice initiative for SET job information and by connecting SET to this dream and "cool" job section, SET degree courses can only hope for a certain "CSI effect" (like Els Rommes called it, see, for instance, Rommes et al. 2007), where a connection of the popularity of the "CSI" series on TV and the increasing number of young people who opt for a career in forensic sciences and related technology fields like biomedical engineering is considered. The fact that, at least in the German sample, the interviewees referred mainly to SET teachers at school or at university, lets our hopes not grow too much. It underlines two important aspects: first, there seems to be lack of diversified job information for SET professions and second, the high visibility of teachers serves as SET role models for their pupils. The latter point leads to



another, the importance of positive attitude towards SET on both sides – on the teachers' as well as on the pupils' side: Teachers who transmit liking their job and having fun to teach seem to be a high motivating effect for engaging pupils in the class room. Teachers have to become aware of their powerful positions during the socialisation process of young people on the content level of SET and on the social interaction level as well. Teachers and counsellors should carefully reflect how they possibly perpetuate certain assumptions and (gender-) stereotypes of the 'hidden curriculum'. Ignoring gender and intercultural issues in science education reinforces stereotyping and, for instance, can lead especially to self-underestimation of girls' performances in science (Whitelegg 2001) or weaken girls' science-related self-efficacy (Hackett 1997). As a result, girls are censoring themselves refusing to challenge boys on their pretended territory

of science and technology; so the phenomenon appears that girls tend to choose SET subjects in schools (and later also as study subjects) only if they are very good pupils, while boys would choose these trainings even if they are average students, as they are supported by teachers and parents, and also some kind expected to do so (Duru-Bellat 2004). Thus, girls and boys incorporate so called masculine and feminine job representations concerning science and technology, which partly still remain a masculine dominion (Cockburn 1985; Faulkner 2000; Gill & Grint 1995). In France, mathematics is peculiarly deterring girls, lacking of self-confidence it is regarding this queen-said and very selective SET discipline (Fontanini 2006).

7 Conclusion

The qualitative research undertaken in MOTIVATION covers a small sample; nevertheless, the above presented partial results could give impetus for further research in the area of young people's images of SET and its consequences for occupational decision making processes.

Attractive science curricula can support the popularity of the SET but this does not guarantee that pupils would choose professions in these fields (Sagebiel et al. 2010). Nevertheless, raising the attractiveness at least could help to support SET as possible occupational option instead of excluding it right from the beginning because of negative teaching and learning experiences. Efforts on changing existing SET curricula are currently discussed and developed in several EC funded projects on science education. This shows the importance of finding new ways for teaching science appealing children and youth. Teacher training is necessary especially for rising gender awareness and, furthermore, their pedagogy with regard to their huge influence on pupils.

The quantitative results of the magazine and soap

analysis proofed that there is room for improvement connected to the integration of more diverse and realistic job images. To change the situation, editors and producers should look for industries' and universities' support, especially for avoiding the stereotypical reproduction of SET subjects and SET professionals. At the same time, youth media responsables should be aware of their influence on perpetuating stereotypical gender knowledge. Further research in this field should focus on media effects of SET presentation on teenagers' gendered attitudes and choices (see Sagebiel et al. 2010).

Attempts to highlight the successful and innovative inclusion of science and technology topics, also in the genre of drama and docu-drama, have been undertaken for the second time in 2012 through the award of prizes on the "Science TV and New Media Festival". Additionally, in the category 'Science in society', a special award is given to the best presentation of a woman scientist or engineer. The awarded productions could serve as good practice examples for producers and editors.



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