PRO ICT

„FEMALE STUDENTS MAKE IT IN IT, BUT CHANGE NEEDS A CHANCE!“

Barriers and needs of female students following a lifelong career path in Information Communication and Technology (ICT) and the role of change agents in this process.
Recommendations for professional gender-sensitive teaching, training and consultancy.

WWW.PRO-ICT.NET

Leonardo da Vinci

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1 Introduction

By Veronika Hornung-Prähauser, SRFG

1.1 The problem

For some years Jacqueline Hey has been one of only a few women present at Information and Communication Technology (ICT) industry forums in Australia. “It has certainly changed in the last 10 years,” says Hey, director of the Vodafone customer unit at Ericsson. “Now there are 20 or 25 per cent there. So it’s still not an equal balance, but it’s certainly going in the right direction.” (Careerone, 2004/1).

Representatives from the field of gender research and national labour force agencies reflect on the same picture of an unequal gender balance in computing all over the world. The cornerstone of these reflections can be traced back to three observations:

Women are generally under-represented in ICT sector employment, counting an average share of 20-30% of the workforce in the European countries in the aftermath of the internet hype. Figures reproduced in this discussion need to be taken with care though because ICT jobs are not confined to the ICT sector, but also in other sectors of economy which use rather than produce ICTs (e.g. finance sector). The weak statistical indication at European level is due to the fact that the categorisation of ICT professions differ from country to country (see Eurostat, data from the Labour Force Surveys (ISCO/NACE) http://europa.eu.int/comm/eurostat/, and also see http://www.ict.org).

Women are even more under-represented in ICT core professional occupations and still do not reap the benefit from higher skilled and higher rewarded jobs such as IT professionals and engineers. Data from the United Kingdom indicate that 1999 was a peak year for women’s employment in the professional areas of ICT occupations (20%), but since then the number declined (Millar and Jagger 2001).

Women have technical competences and gain enjoyment from working with computers, but still seem to slip away from the ICT career domain. This can be observed by the low participation rate in professional computing courses and academic studies and high number of patchwork careers and drop out rates. Those women who enter the male IT world, do not find working conditions attractive and therefore tend not to follow a continuous ICT career path (Millar and Jagger 2001).

1.2 Explanation for this phenomena

The research community searching for explanations to this problem has grown rapidly during the last few years involving experts from fields of educational science, psychology and gender studies. The experts have an unanimous agreement that it would be too easy to suggest a single factor explaining the women’s difficult situation (Margolis, 2002). Therefore, we would like to draw attention to three key issues that may have a decisive impact on the career and job situation of women in ICT. In this project these key issues are commonly referred to as the 3M-scheme: mind – match – market:

Mindset

"There is no female mind. The brain is not an organ of sex. As well speak of a female liver."
Charlotte Perkins Gilman
(Source: http://www.wisdomquotes.com/001244.html)

Following this quotation one might also say: "Computers have no sex!" Therefore girls should have a fair chance to go for a technology-driven career path and play an active role in a professional IT job. Such a positive mindset towards the female capabilities from a girl's social environment (e.g. parents, peers, youth workers, educators, IT colleagues) is essential to overcome traditional stereotypes and role models.

Match

The "mismatch" of the more "application-oriented" way of learning and handling ICT of women with existing curricula at schools and academic educational institutions has an impact on the early drop out rates. Present courses were designed by men for men and need to move from "programming oriented" curricula to more application-oriented education scenarios. A new match is needed!

Market

The ICT market is a fast changing one and job profiles from the past do not fit those for the present time or the future. A lot of misconceptions about the real job opportunities and evolving mechanism, such as mentoring schemes are simply not known. Thus women are likely to retreat because of lack of professional gender-sensitive coaching and guidance for female graduates at the time when they first enter the "male world" of IT (enrolment and adaptation to a male working culture).

The 3M-approach provides the structure that will be used for categorizing the recommendations at the end of this study and it offers some orientation for the users of the platform to find modules that correspond to specific learning objectives. This also drives the PRO::ICT approach towards a direction that can be used in practise.

The PRO::ICT approach and research questions

Moving into IT and staying there the ICT career path spans over a ten year period in a woman's life (approximately from the age of 13 to 23 years onwards). Therefore, choosing a career is one of the most important decisions one has to make early in one's life. Given due consideration and bearing in mind the outlined three influential factors, the PRO::ICT project proposes a solution that would require not only a change in the mindset of a girl/female student, but also of all the persons and organisations involved in the decision process of promoting uptake of an ICT career path. It is only with a focused effort to change peoples mindset, and endeavour to avoid practical mismatches, and prepare the individual for a position in the IT world that there is a good chance for changing or improving the situation.

We propose to introduce professional, gender-sensitive training and consulting along all stages of a woman's professional ICT career. These stages can be described in three main transition phases:

- Development of the idea of a technical ICT career path,
- Enrolment and study on computing courses and at higher academic institutions

- Entry into an ICT company, which is often perceived with a male dominated working culture

As lots of studies state the influence of parents and teachers in primary schools is very important regarding the development of mindsets of girls and boys as well as the effect of role models. Though to cover this specific period it would need another project, since the factors of influence are multi-various and ask for an approach that involves sociology as well as psychological and educational sciences.

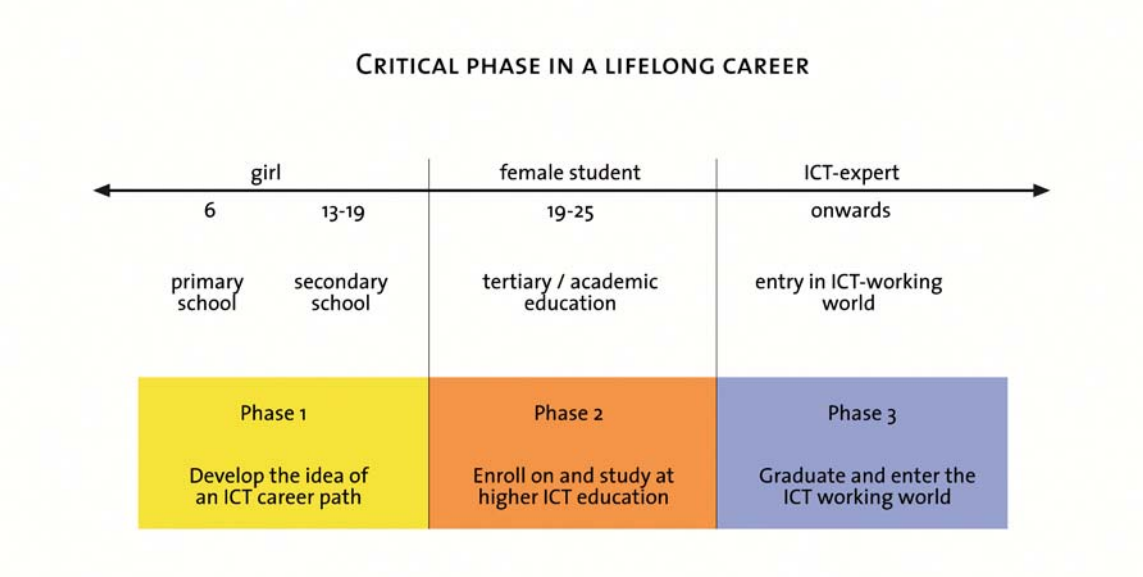
Despite the differences in the educational systems amongst the European countries, the important milestones in planning a career would include the phases previously outlined which can be adjusted to the age of the female students.

Phase 1: Developing the idea of a technical ICT career path takes place around the age of 13 years. It is at that age that the first choice for specialisation in educational programmes is available (transition from secondary to tertiary education). At this stage peers have a high impact in informing the students` programme selection.

Phase 2: Enrolling on computing courses and studying computing courses at higher academic institutions at the age of 19 years (transition from tertiary to university education). Then the alternative choice about further education and/or entrance into vocational training has to be chosen at this stage. Parents, career advisors and image of potential universities essentially influence the decision process.

Phase 3: Taking the first steps into what is commonly understood to be a relatively male-dominated working culture may occur from the age of 23/25-27 years when graduating from university. These graduates make the transition from tertiary education to employment and vocational training (transition to work).

Graphic: The critical phase in a lifelong career path



All those stages can be carefully directed by change agents, such as teachers, educationalists, career advisors and/or human resource managers who empower girls to stand up for their interests. However, it should be noted that more than one actor is needed to support girls and students especially at the time when they plan their professional life and need to take important decisions.

Our hypothesis is that given these three transition phases, profound and current information about the ICT labour market (anticipation of future development), a good match of female skills and ICT courses and studies and well focused training in the empowerment of girls will meet the challenge of moving more women into highly skilled, high paid IT jobs.

1.3 Research questions

At the present time little research has been done to highlight these three transition phases. Further, solutions and recommendations have been proposed to address the barriers and needs that change agents need to address when coaching female students along their career path, but these have not yet been carefully implemented across the EU. It has been suggested that it is not only the girl/female student that needs support, but also parents, peers, educators, vocational service, personnel managers in companies who are already aware of the problem.

Some questions for further research are:
What does the IT market offer for occupations and how does the educational system provide chances for women to fit into these occupations, and why should girls be motivated to go along this path? What empowerment do female employees in ICT companies need to reach jobs at the executive levels?

What does a typical ICT career path for a female student look like, and what are the differences to a male one? Why do women have difficulties following a more sequential oriented IT career path? What needs do female graduates have for identifying female role models aligned to the ICT career?

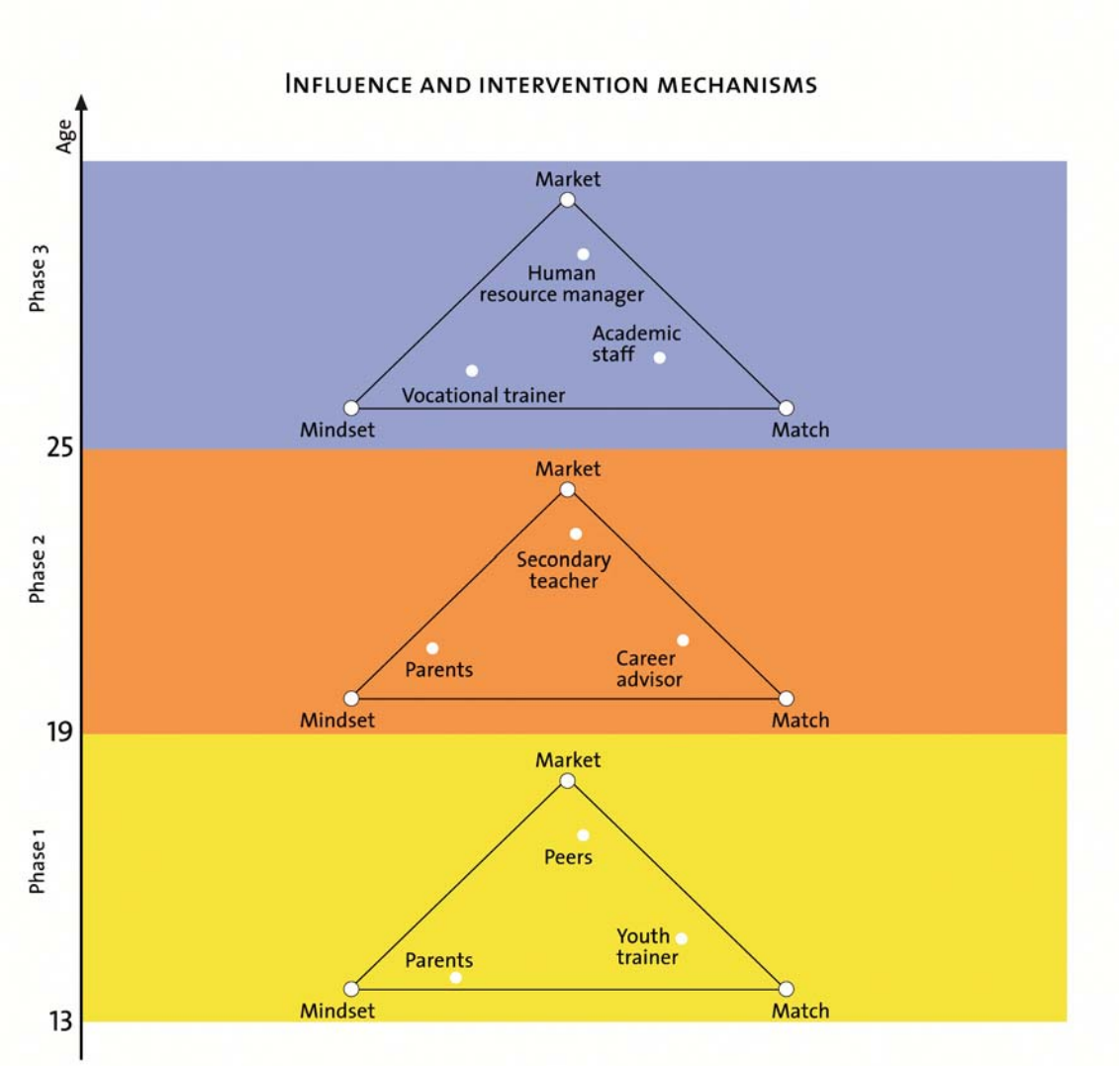
What type of intervention mechanisms are useful, and for what purpose? Do we understand fully the role of the change agents in the three phases of guiding the students? What type of individual support is needed for change agents to coach students at the points of transition from one educational step into the next one and finally into professional life? What recommendations can we provide for them?

Can we observe general European trends in relation to the definition of the problems and the elaboration of recommendations especially in relations to the situation that exists in rural areas and the newly reformed countries?

The EU research project called PRO::ICT intends to implement the intervention mechanism not only as an exercise for knowledge gathering, but also as a guide for action. In doing so the study results form the scientific framework for developing a set of training material and modules for different types of change agents. The materials should include sensitivity material, workshop designs, information material about the ICT market and occupations, handbook and guidelines for organisational interventions, and case studies of successful women. This material will then be used in practice by the various change agents in interaction with students along their ICT career path. These gender-sensitive training material and e-learning modules will be publicly available on a web based learning environment at: www.pro-ict.net.

The following graphic shows the influence and intervention mechanisms on girls and female students along their way through all three transition phases.

Graphic 2 Influence and intervention mechanisms of change agents in the three transition phases



1.4 Methodology

Following the approach described earlier, the project applied diverse instruments of socio-economic research:

Desk research - secondary material of studies from the fields of educational, psychological, social and socio-economic research;

Interviews with girls and students representing the three transition phases at all age levels;

Interviews with change agents from different European countries involved in the three transition phases such as teachers, educationalists (UK), human resource managers (Austria/Germany/Switzerland/Denmark) and consultants who play a (non-profit-oriented) role in the vocational guidance process (Netherlands/Bulgaria);

The findings relate to the countries involved in the project and thus it is possible to highlight country-specific problems (e.g. low rate of female ICT work force in rural areas e.g. Denmark and Welsh region; vocational career advisory systems in the accession countries or reformed communist countries e.g. Bulgaria).

As a main task the project partners worked on a collection of best practice examples of innovative and process oriented approaches. The latter refers to the pedagogical methods used. The design of the best practise examples should aim at supporting a target group in being able to set actions relevant to follow the ICT career path. This includes both a "learning process of orientation" and "education/training to be better qualified" for an ICT career. We are interested in projects aiming at orientation and qualification on ICT careers.
The findings from these interviews, secondary study material and international best practice examples provide the basis for supporting recommendations to these change agents, and will guide our work in developing gender-sensitive training material in the future.

The recommendations are done in the 3M-scheme again:

- Mindset relates to images, ways of thinking, attitudes and ways of dealing with ICTs, especially with respect to following an ICT career path (for example self-esteem, role models etc.).
- Match relates to the transfer of these mindsets to conditions of access and educational environments in the field of tertiary education in ICT (for example curriculum, study environment, study profiles etc.).
- Market relates to the move of graduates to recruitment strategies, demands and perspectives on the relevant labour market (job profiles, maternity leave strategies etc.).

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2 Following an ICT-Career Path

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At the moment a deep gender imbalance in ICT professions, of which are only about 15% occupied by female employees, has occurred. At the same time there exists an unsatisfied demand for ICT professionals at intermediate and high levels of the labour market. Although the subscribed situation varies in different sectors and European countries, a gender imbalance and a professional skills shortage are common features of the ICT labour market in Europe. This development of the ICT labour market inhibits a prosperous development of the knowledge economy. At the same time it is an obstacle to the development of social cohesion in education and on the labour market (Guffens, 2003).

This chapter will describe the problems and needs of girls and women to follow an ICT career path. It will firstly describe the barriers and needs to follow and continue ICT education. As known, female students are under-represented among ICT students in advanced and academic ICT education. They still not feel attracted to ICT education, mostly because they think it will be to difficult and boring for them. Once they have decided to choose for an ICT education, some of them drop-out for various reasons which will be described.

Later on this chapter will describe as well problems and needs of women who actually graduate in ICT education and start to follow an ICT career path. Why do so many of them choose for another career path after a certain period of time? Working and employment conditions seem to play an important role in the decision to choose for another career. Moreover, the dominant professional culture relies on male-dominated behaviour, values and expectations. The exclusionary culture of ICT reinforces the structural factors that disadvantage women. Women in ICT have to cope with this male dominated professional environment.

2.1 Female students in secondary schools

2.1.1 The image of ICT education/ professions

Former trend (mostly qualitative) studies show that most young girls (and boys) in secondary schools do not know what ICT means. After a short explanation they usually understand quickly what it means. ICT is considered as an important sector by young people. At least a few years ago it was associated with good future opportunities, high salaries and good professional prospects (AXIS, 1999).

In order to enrol into ICT advanced or academic education young female students in secondary schools usually think they have to possess technical and creative skills. They expect to do technical subjects and a large share of mathematics. The image of advanced or academic ICT education is based on the idea that you work on computers and will be working on them all day. Regarding job profiles in ICT, (female) students mostly do not have any concrete ideas of what kind of jobs ICT professionals fulfil. Qualitative research shows job profiles are usually connected to ‘working a whole day on a computer’ and ‘earning a lot of money’ (Imago van I, 2001). Other research showed that female students could name a few standard job profiles e.g. web designer, software developer. Overall, they do not mention any consultancy or management related job profiles (AXIS, 1999).

Female students in secondary school seem to orientate themselves already in the first three classes of secondary education. In general they orientate themselves in an earlier stage during secondary education than their male co-students. It can be considered as a task of secondary schools, advanced ICT education and the work force in ICT/new media to inform this potential group of girls who may choose for an ICT career path later on.
At the moment the interest of young girls for ICT advanced education is minimal. Study results in The Netherlands show an interest of 2% of the girls towards an interest of 33% of the boys in secondary schools. The professional area and job profiles are the two most important factors which prevail in the decision-making process for an advanced education. Unfortunately, ICT job profiles are still unclear for female students in secondary school education. Information about the particular content of ICT education and following job profiles is important to spread among these girls in secondary schools. Mentors of secondary schools should also inform and offer this information on ICT education and future job prospects to female students (Imago van I, 2001).

2.1.2 Attitudes of female students

Another theme which relates to the lack of enrolment of female students for advanced ICT education are attitudes (e.g. self-confidence, appreciation of ICT) of female students in secondary school.[1] They often consider ICT as difficult and complicated and think they can not choose for an ICT study (and career path) unless they have very high level scores for mathematics, physics and so forth.

Computer attitudes of female students differ from their male co-students in the sense that they appear to have little self confidence in working with ICT and making future plans to follow an ICT career path. Comber et al. (in Van Eck and Volman, 1999) researched computer attitudes of students in the age of 11 till 16 years. In their research they applied sub scales of self confidence, appreciation, usefulness and sex bias in computer attitudes. In all age categories male students appreciate the usefulness of computers more than their female co-students. However, girls of 11 think more positive than girls of 16. Female students reject the idea that computers is more male than female related. Their male students responded neutral on this question. Moreover, male students gave themselves better results in the estimation of capacities of computer-use than their female students. During interviews female students presented themselves as a layman, while their male co-students emphasised their professional capacities in ICT (Van Eck and Volman, 1999 and 2002).

It is recommendable to motivate female students in their computer attitudes. In that case the experience with ICT is important. Female students should receive good guidance and experience with computers during (the start of their) secondary education. In the end this may have a positive spin-off effect: improved school results will have an effect on computer attitudes.

2.1.3 Mentoring and guidance of female students in secondary schools

In order to give female students in secondary schools a more clear view on ICT job profiles they could be provided with a mentor, an experienced female engineer in ICT. There are many examples of mentoring programmes in which female students in secondary education go out into the technical field for a day with a

[1] Several scientists developed instruments to measure attitudes of girls towards computers. Klopper and Schleyper (1990) developed an instrument which can measure three components in attitudes: an affective, cognitive and conative (to react in an expected way) component. Research showed that secondary school education can influence computer attitudes of girls in secondary schools.

female engineer in order to get a realistic view of her work. The female engineer may talk to small groups of school girls about what is involved in her job on a day to day basis, the qualifications she required, the choices she has made, etc. This may support and encourage female students in secondary schools to choose for an ICT career path. Mentoring may also strengthen the position of women and girls and enable them to expand within the situation of being a minority in technical and ICT professions. Furthermore, mentoring can break the often solitary position of female engineers by means of offering shining examples, recognition and practical experience (VHTO and UETP, 1998).

A good example of mentoring for young female students in secondary education is 'Take your daughter to your workplace' or 'Girls Day' programmes. A female engineer (in ICT), the so called mentor for a day, may function as a role model for young girls in secondary education. They will see her participate in an usual working day. By actively taking part in a 'Girls Day', female students shall be particularly motivated and encouraged to seize their career options and to decide in favour of qualified education, possibly in ICT. Role model projects as a 'Girls Day' are based on the belief that the low numbers of school girls opting for careers in certain ICT functions, such as engineering and science, is partly due to the lack of female role models in those areas. In the period when they establish their gender identity it becomes difficult for female students to opt for careers that are perceived to be male. In this way female students will be supported to choose an occupation in a professional area which is presently not typically female (Mac Keogh, 2003).

A 'Girls Day' usually needs support of very different organisations: educational institutes, employers, employees, governmental organisations. Since all participants which are needed in organisation will benefit, a 'Girls Day' has proven to be a successful way to inform female students about technical or ICT education and professions. In general, the concept of a role model could play an important role in dismantling occupational stereotypes and segregation in the science and technology sector (Mac Keogh, 2003).

2.1.4 Attractiveness of interdisciplinary education and professions in ICT

If female students in secondary schools have to choose for advanced education they also seem to value interdisciplinary courses in ICT as 'Human Technology' or 'Media, Design and Technology'. An interdisciplinary study in ICT which combines technical and social (e. g medical, creative) skills proved to be successful in the enrolment of female students into advanced ICT education. These courses usually do not appeal to specialised knowledge about ICT, but focus more on the applicability of this ICT knowledge. Students will therefore need their ICT knowledge more implicitly within another work field e.g. medicines, art (AXIS Verkenning, 1999).

Mac Keogh also claims that girls in secondary schools usually not only have little knowledge about ICT education and career options, but they may also have poor and negative knowledge. One respondent in her research reported that one of their technical courses seemed popular because symbolically it appeared to connote a course in the area of communications:

"…maybe because we are not a hard engineering school – we have a programming course but it is multimedia and I think that maybe makes a difference – it attracts girls…audio, video, media technology course does get a lot of students – they think it is a media course, but it is not (Mac Keogh, 2003: 10)."

This tendency to explore interdisciplinary areas of ICT is also relating to developments on the ICT labour market. Especially the computing discipline increasingly connects with languages, music and art. These have traditionally been areas associated with women and increasing numbers of women may become involved in computing through the involvement of these disciplines (Richardson, 2002). The multi-faceted nature of many ICT courses and professions does, however, tend to emphasise the types of skills that are traditionally associated with girls and women. But, the purpose may be less to show girls and women that they can deal with these subject areas than to show them that changes in ICT education and professions are afoot that will make it more attractive and achievable for them.

2.2 Female students in advanced ICT/new media education

2.2.1 Female drop-out students in advanced ICT education

If female students decided to choose for a study in ICT, it does not necessarily mean they will choose for a follow-up ICT career path. For instance in The Netherlands many (female) students drop out of ICT education during the first year. Studies have shown a relatively high percentage of drop-out students in ICT advanced education. In 2000 the enrolment of girls in higher ICT studies[2] in The Netherlands was 191 of whom 35% of the girls dropped-out in the first year. The motivation to drop-out frequently mentioned were that they did not enjoy the study itself e.g. the curriculum. It is highly regular to teach many programming languages (JAVA, SQL) during the first year. This seems to form an obstacle for female (and male) students to continue their ICT study. A better arrangement of the curriculum may help to prevent this large proportion of female student drop-outs (AXIS/VHTO, 2002).

When students were asked how they had informed themselves about the study 77% mentioned written information leaflets, 72% went to an information day in advanced education institutes and 49% had visited the website of the advanced education institute (VHTO, 2002). (School) friends, acquaintances and parents seem to have as well a strong influence on choices of female students for their follow-up advanced education.

2.2.2 Role models for female students in advanced ICT education

In an earlier stage mentoring and offering role models to female students in secondary education was recommended. Though, role models and mentoring for female students in advanced ICT education is also recommendable. Since drop-out rates among female students in advanced ICT education are relatively high, it would be advisable to offer role models and mentoring to female ICT students as well.
Female students in ICT may be coached by an experienced female engineer during the transition from education to employment. This will help and encourage them to proceed their study and to proceed an ICT career path. A

[2] This percentage does only involve higher technical education institutes. This excludes university level.

female role model (mentor) may advice students on how to cope with studying and working in a male dominated environment. Female mentors can fulfil a supportive role as inspiring role models, skilled experts and sounding boards during crucial moments in the career development of their students. A mentor (role model) may increase the self- confidence of female students to proceed an ICT career path. During this period the female students will complete their education, apply for jobs, enter the employment market and experience the first month(s) in a position as a female engineer. Moreover, junior female engineers will most likely be confronted with various problems in the beginning of their careers. Aside from the fact that they, just like any male counterpart, have to find their own place within the organisation, they also have to stand their ground as 'intruders' in a male dominated environment (VHTO and UETP, 1998).
In the selection process of role models (mentors) for female students certain aspects might involve more attention. The age of the role model seems to be rather important. A role model who participated in a research of Mac Keogh (2003: 13) claims that:

…the role model is very powerful, but interestingly enough- and there are all kinds of politically incorrect things that happen around a role model- the young people need to see role models that are young –closer to their own age- ones we get best feed back on tend to be closer in age, tend to be very glamorous, because I do not want to be a mechanical engineer and be unattractive- and I think that is something about being able to take on a science and engineering role without compromising your femininity.

This quote emphasises the core perception among young female engineers that these subjects are dominated by male connotations and that an interest in this work field may be in conflict with their identity as a female.
Furthermore, it would be advisable that the role model (mentor) would be so far advanced on her own career path that she is able to give her student a sufficiently broad perspective and yet, be close enough to the student with regard to age and/or lifestyle to be able to recognise experiences and expectations of the student and constructively direct them. Above all, a role model should be able to communicate well and engage with the concerns of students. The search for role models tends therefore to be a time demanding aspect (Mac Keogh, 2003).

2.3 Young women entering ICT professions

2.3.1 The transitional phase of a female student into the ICT labour market

Looking into starting career paths of graduated female students in ICT at an advanced level (higher vocational or academic level) they predominantly work in one of the mentioned professional areas:

- As producers ('developers') of software
- As intermediaries; they render ICT services to the business community, government, etc.).
- As end-users (e.g. in financial services, education, governmental institutes)

Research indicated that young women frequently start with a database oriented function. In the beginning, shortly after they graduate, they predominantly use their technical oriented knowledge of programming and system analysis. In the above mentioned categories they work in the beginning of their careers mostly as producers or developers of software. Generally, after two to four years of working experience in ICT they prefer

to change to the category of intermediaries in which they combine their ICT knowledge with professional personal competences e.g. oral and written communication skills, negotiation skills, advising/coaching skills (VHTO, 2003). In this perspective a gender segregation in ICT occupations has occurred since the beginning of the nineties. Women predominantly work as intermediaries and/or as end-users. The proportion of women in ICT in these categories is much higher, approximately 50 percent, than in the category of producers.
Other statistics indicate that one fourth of women in ICT professions work as a system or network controller. For the men this percentage is relatively higher: 43.3%. Another one forth of the women works as an IT analyst/designer. 14% women comparing to 7.6% men work as a ICT consultant. More women than men work as a helpdesk worker.

Table 1 ICT professions (bron: Loonwijzer 2001-voorjaar 2003)3

	numbers	%	female	% female	male	% male
unit/cluster/ team leader	43	2,2	14	2,5	29	2,0
programmer	102	5,1	29	5,2	73	5,1
system analyst	28	1,4	6	1,1	22	1,5
application controller	41	2,1	25	4,5	16	1,1
appl/software-developer	15	0,8	4	0,7	11	0,8
appl/software-tester	6	0,3	4	0,7	2	0,1
consultant	186	9,4	78	14	108	7,6
helpdesk worker	114	5,8	62	11,1	52	3,7
project leader	31	1,6	13	2,3	18	1,03
system- of network controller757	757	38,2	141	25,3	615	43,3
system designer	10	,5	3	0,5	7	0,5
IT-analyst/designer	577	29,1	144	25,8	433	30,5
other categories	71	3,6	35	6,3	36	2,5
total	1981	100	558	100	1422	100

The changed entry qualifications in ICT opened up opportunities for women to enter ICT professions. Nevertheless, women still face the glass ceiling if they want to fulfil (higher) managerial IT professions (Van den Brekel, et al.1999).

2.3.2 Working in a male dominated culture

Middle and high management levels in ICT associate with a male dominated working environment in which flexible working schedules and well organised terms of employment for women (e.g. childcare arrangements)

[3] This research is based on 1981 respondents who were working in ICT professions in The Netherlands.

are a rare phenomenon. ICT professions generally associate with a technical world; mathematics; a world of fast men; status is important; long working days; no possibilities to work part time; difficult to combine work and family life. These stereotypical images are created by men and women, although the ICT sector is indeed a male dominated environment. Due to the rapid development of the ICT sector and because of massive competitive pressure among ICT companies, work organisation and personnel policies (human resource management) have been neglected (Van den Brekel, et al.1999). Of course this aspect will differ per company and type of ICT profession.

In general, female IT professionals face a male dominated culture in which they have to adapt in order to stay in this occupational group. Due to the lack of part-time work possibilities (flexible working hours) and favourable terms of employment some women tend to leave the ICT sector in their mid thirties at the time they start a family. They seem to fail to combine a professional career in ICT with their family life (see section 3.3). Working part time still has a negative impact on careers. Moreover, it is women themselves too who adapt to these stereotypical images of the ICT sector e.g. long working hours, difficult to reconcile work and private life, high workload, etc. (Van Oost, 2002). In order to avoid these working conditions some women are inclined to rather look for an ICT profession in a non-ICT sector e.g. governmental institute, education. In these sectors terms of employment, part-time working hours are more regular than in the ICT sector itself (VHTO, 2003).
In The Netherlands, relatively many (female) employees work in a part-time engagement. Yet, part-time engagement in the ICT-sector is still unusual and shows gender segregation. In table 2 the 1981 respondents were questioned about their engagement in office.

Table 2 Fulltime/part time engagement in office (bron: Loonwijzer 2001-voorjaar 2003)

	female	% female	male	% male
fulltime	428	77	1318	93
part time	129	23	102	7
totaal	557	100	1420	100

Table 2 clearly shows a discrepancy in percentage between women and men concerning part time job engagements. Furthermore, it appeared that hardly any system and network controllers worked in a part time engagement. The women who worked in a part-time engagement all mentioned reasons that referred to the reconciliation of work and family life. Although this research covers 1981 respondents, the results generally depict the general situation in The Netherlands. By far more women than men work in a part-time engagement and this is also reflected in ICT professions.

2.3.3 Working in the ICT sector: under which circumstances?

Research among employees in the ICT sector in The Netherlands indicates several wishes concerning terms of employment in ICT (Tijdens, University of Amsterdam, 2000):

- 70% of the women (and 46% of the men) would prefer to work in a part time engagement. Women and men are usually hesitative to debate with their employers about part time working hours. The main reason for this

hesitation is the working culture within the ICT sector; you have to work long hours and in order to keep good career possibilities it is not sensible to discuss a part time engagement.

- A second important wish (82% of the total respondents) of women and men in ICT is that employers in the ICT sector should compensate overtime working hours either in money or in leisure time. Especially female employees (48%) prefer to compensate their overtime working hours with leisure time. In some ICT companies overtime working hours are a more a daily practice than an exceptional situation. ICT employers may hesitate to ask compensation for these overtime working hours because 'no one asks for compensation'. It became part of the working culture of ICT to work in overtime.
- 66% of the respondents (female and male) considers it as important that companies deal with the time pressure, deadlines etc. Employees should not be overburdened.
- Especially women would prefer child care arrangements within their company (53% of the women towards 26% of the men). In The Netherlands some employers pay one third of the childcare arrangement costs.
- 45% of the women (and 22% of the men) would like to have arrangements for income-compensated parental leave.

The above mentioned statistics indicate that not only female professionals in ICT prefer the above mentioned arrangements, the percentages of men who prefer these kind of arrangements are relatively high as well.

2.4 Summary and preliminary suggestions in accordance to the 3-M approach

Within PROMICT the focus is on the 3-M approach: mindset, match and market which are explained in the introduction**????!!!!**. In this summary this approach is used to categorise the different barriers and needs for female students and women in ICT.

Regarding to the mindset approach different issues are important to mention:

The image of ICT education professions

In order to change the existing image of ICT –boring, difficult, 'you work alone on the computer the whole day'- it is necessary that teachers and other vocational trainers inform (female) students about ICT. In general, female students in secondary school do not have a truthful image of ICT education and professions. It is recommendable to disseminate information on to female students about training courses and professional job profiles in ICT via vocational and academic teachers, human resource managers etc.

Attitudes of female students

The attitudes towards computer-use -e.g. self confidence, positive attitude towards usefulness, sex bias- are overall not positive. In a way this leads to a self fulfilling prophecy: when female students lack a positive attitude, their results will reflect this. Research indicated that female students who spend more time with a computer and who are able to work in single (female)sex groups improve their school results in computer education.

Mentoring and guidance of female students

There are many examples of mentoring programmes ('Girls Day', 'Take your daughter to your workplace') in which female students in secondary education go out into the technical field for a day with a female engineer in

order to get a realistic view of her work. The female engineers may talk to small groups of school girls about what is involved in their job on a day to day basis, the qualifications they required, the choices they have made, etc. This may support and encourage female students in secondary schools to choose for an ICT career path.

The match approach of PROMICT emphasizes different aspects . Firstly, it refers to different types of educational concepts for ICT related courses. These kind of educational concepts (e.g. Human Technology and Media, Design and Technology) seem to attract more female students than regular ICT courses in which hard skills (e.g. programming, database design) are more required than soft skills (communication, presentation, knowledge of other disciplines).

Furthermore, it is important to show female students that once they are graduating in ICT they will not necessarily work in an ICT work setting. They may also work in an ICT related job in e.g. a hospital, governmental institute or university.
Secondly, match also refers to the interaction process between the ICT courses curricula and the demands and trends on the ICT labour market. Curricula of ICT courses may be evaluated by their alumni who already work on the labour market and can reflect on their knowledge, skills and competences.

Summed up the following issues seem to be important regarding the match approach:
Attractiveness of interdisciplinary education and professions in ICT
An interdisciplinary study in ICT which combines technical and social (e.g medical, creative) skills appeared to enrol more girls into advanced ICT education. These studies usually do not appeal to specialised knowledge about ICT, but focus more on the applicability of ICT knowledge. Educational curricula and job profiles in ICT should reflect this knowledge.

Drop-out rate of female students in advanced ICT education
Due to the monotonous curriculum during the first year e.g. subjects in programming, many female students drop out during or after the first year of their ICT education. A better arrangement of the curriculum may help to prevent this large proportion of female drop-outs.

Role models (mentors) for female students in advanced ICT education
Female students in ICT may be coached by an experienced female engineer during the transition from education to employment. This will help and encourage them to proceed their course and to proceed an ICT career path.

According to the market approach research indicates that most women in ICT prefer jobs with managerial tasks (e.g. project management, communication, business economics). Women in ICT have difficulties to enter (high) management levels within companies.
Regarding a Dutch study among women in ICT the women themselves gave the following suggestions to attract more women for the ICT labour market:

- Employees of ICT companies should have the opportunity to work in part-time engagement
- ICT employers should compensate overtime working hours (either in money or) in leisure time
- ICT companies should better arrange their time pressure, without overburdening their employees

- ICT companies should bear responsibility for childcare arrangements and income- compensated parental leave.

Finally, looking into ICT education and professions/careers one can conclude that the ICT sector still shows all the features of a male profession, in terms of division of labour as well as the work culture. The dominance of masculine values and practices is seen as the most important reason for the lack of women in ICT education and ICT professions. To involve more women in ICT educational curricula should be restructured and work practices should meet more the interests and needs of girls and women.

2.5 Summary of barriers and needs of female students and women to follow an ICT career path

Barriers of female students to follow an ICT career path:

Attitudes of female students (see 2.2.2):

self confidence

learned helpless

Attitudes of parents

Extended information for parents on ICT/new media courses is important, because parents have a large influence on the attitudes of their children. Stereotypes on ICT may be passed through in a negative way.

Attitudes of teachers and staff:

gender sensitivity of teachers and staff

Image of ICT

appreciation of ICT

social relevance

Unattractiveness of curricula of ICT courses

Little knowledge of possible ICT professions and careers

Lack of role models

Needs of female students to follow an ICT career path:

Mentoring and guidance activities

Role models

Interdisciplinary courses in ICT (ICT & design, ICT & management, ICT& health care)

A gender sensitive vision on curricula of ICT courses. Does it involve enough practical input, does it involve interdisciplinary subjects?

Gender sensitivity among teachers and staff

Barriers for women to follow an ICT career path

ICT refers to (false) conceptions of high workload, making overtime. These conceptions are based in most cases on lack of information about the ICT sector.

(Non compensated) overtime hours

Difficult sector to negotiate about part time contracts

Male dominated work environment

Male dominated working conditions

Low career prospects. Women in ICT often have to cope with the 'glass ceiling' if they want to apply for (high) management jobs.

Needs of women to follow and ICT career path (see 3.4)

Career development guidance by female professionals (mentoring)

Favourable terms of employment (flexible working hours, part time contracting, child care arrangements)

Equal remuneration

In general women earn lower wages compared to their male colleagues

Upgrading of social competences within ICT professions

Empowerment of ICT women

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3 Chapter 3 Barriers and needs for supporting women

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3.1 Target group I: female students at the age of 13 – 16 years and at the age of 16 – 19 years.

3.1.1 Short summary

The purpose of this chapter is to summarise the main research on the problem of under representation of girls in technical IT studies. Further on interviews with the target group have been described and analysed. Out of these findings the main issues have been worked out and reflected and transferred into recommendations.

3.1.2 Introduction

At present time, especially after the turn of the millennium, one might expect a general gender balance in the fields of following an ICT career path, considering working on computers to become a widespread medium in various spheres of life.

Following current studies on female students entering ICT educational facilities, the results show an extremely unbalanced state between male and female students. As the decisions for a special path of education takes place (according to the educational systems in Austria and Germany) at the age of around 14 years or/and at the age of 18 or 19 years, it seems obvious to take a look at these two phases of female student's life.

This chapter will provide a general survey on recent studies and publications, concerning with the gender imbalance, and with the theoretical background on barriers for young female students, further give an analysis on interviews made with representatives of the identified target group and finally frame some recommendations on the fields or themes, the development of special training modules for young female students should take into account.

3.1.3 State of the art

Proceeding in accordance with the so called "Concept of capability" (Potentiale-Konzept) that assumes fundamental concurrent capabilities of either gender (Hirsch, 2002:30)[4], there are certain questions to be asked. The systematic follows the report of Hirsch (2002:29ff):

- Access of female students to computer (usage, knowledge)
- Computer culture (logic base vs. creativeness, competitive behaviour pattern, barriers on the job market)
- Concepts of educational work with female students.

To complete this systematic there should be added the problems of

- Self concept, and
- Role models, that is to be find as a topic in the interviews, taken for this report.

[4] Translation of all literature, referred to, was done by the author of this chapter.

3.1.3.1 Access of female students to computer

Usage

According to the data of Statistik Austria in the period of questioning (2002 and 2003) 1.6 millions of the private households are equipped with a computer (PCs or laptops), that meets a total coverage of 49%. 80% of all students in Austria use the internet regularly, and as the following table indicates, there is almost no gender imbalance to discover, following the age group of people between 16 and 24 years. Even though there is almost no gender imbalance to detect (the young women are located with some lead of 0.2%) anymore, it should be mentioned that only two out of three persons of this age group actually use the internet, which leaves 1/3 out of class!!!

Table 1: Usage of computer and internet, in terms of gender and age group.
Data source: **http://www.statistik.at/fachbereich_forschung/ikt_tab1.shtml** [190304]

Usage of computer and internet, in terms of gender and age groups			
Structure	All persons	Persons, who did ever use a computer	Persons, who used the internet between March 2002 and March 2003
		%	
Women in terms of age			
16 to 24 years	424.336	90,9	68,5
Men in terms of age			
16 to 24 years	452.606	90,6	68,3
All persons in terms of age			
16 to 24 years	876.942	90,7	68,4

More detailed information on the usage of computers and the internet in Austria provides the
4. Report on the situation of young people (4. Bericht zur Lage der Jugend, Themenschwerpunkt: Jugend in der Informationsgesellschaft), created by the Bundesministerium für Soziale Sicherheit, Generationen und Konsumentenschutz in 2003.

Table 2: Access to computer in terms of gender
Data source:
http://www.jugend.bmsg.gv.at/cms/site/attachments/6/6/3/CH0243/CMS1059132341344/jugendbericht_09_03_04.pdf, folia 55 [190304]

Gender	Living in a household with computer	Have access to their own computer
Boys (age 14-19 years)	82%	47%
Girls (age 14-19 years)	76%	33%

Now, this shows quite a difference on behalf of having access to an own computer:
In contrast to being a boy between 14 and 19 years, who has a chance of 3,29 out of 7, being a girl gives you a chance of 2,31 out of 7, which means: starting from a group of seven boys and seven girls of the relevant age, three boys, but only two girls have actually access to their own computer. That states a gender imbalance, that should be notified, and, as can be shown in the following chapter, has a deep impact on where young students get their computer skills from. As a consequence it has to be assured, that all students have sufficient access to computer facilities in school. Perhaps even there should be certain opportunities (special time-periods) only for female students.

Computer knowledge

Results in more early studies indicate no gender imbalance between female and male students at the age from 6 to 14 years concerning general computer skills and usage of standard software (COMPED cf. Haider, 1994). Nevertheless there is a big gender difference, where female and male students gain their computer competences: as table 3 clarifies, almost 80% of the female students use school facilities, whereas male students use school facilities (66%), as well as private study (53%) and friends/partners (42%). This corresponds to the fact, that also a higher percentage of male students have access to a computer of their own.

Table 3: Learning computer soft skills
Data source:
http://www.jugend.bmsg.gv.at/cms/site/attachments/6/6/3/CH0243/CMS1059132341344/jugendbericht_09_03_04.pdf, folia 56 [190304]

Age: 14 to 19 Years	Female students	Male students
In school	79%	66%
Private study	32%	53%
Friends/partners	27%	42%
Youth-centre	42%	27%
Special courses	4%	3%
Relatives	23%	9%
University/Work/Others	10%	8%

There are comparative data reported by a study made in Germany in 1998-2000 (Schulz-Zander 2002:255), that points out the importance of school experiences for female students in comparison to their male colleagues, as table 4 indicates:

Table 4: Significance of school education in behalf computer and internet skills
Data source: **http://www.e-nitiative.nrw.de/download_pdf/Gender/Nyssen.pdf** [190304]

Age: all schools (N=943)	Female students	Male students
First use of computer in school	30,4%	11,7%
First contact with internet	55,6%	33%
Basic skills gained in school	47%	33%

As it seems remarkable, almost three out of ten female students need to gain their first experience with the usage of a computer in school, whereas only one out of ten male students has to rely on school facilities to train his computer skills, obviously because there are lots of other opportunities, that are at their command.

3.1.3.2 Computer culture

Hirsch refers to different authors (Schelhowe 1992, Collmer 1997, Hapnes/Rasmussen 19991), who point out a possible context between the culture of computer studies and the quota of female students in these studies. They identify three topics that mark computer culture to be a dominant male culture: logic base vs. creativeness, competitive behaviour pattern and barriers on the job market. At least the first two domains meanwhile are subjects of extensive discussion of gender experts as summarized by Dickhäuser (2001:51). His conclusion made after evaluating various studies is, that the empirical data base available so far does not back any theory on gender differences in this field. Schinzel (2000:11) emphasises the fact that informatics per se is a technology open to be developed, with no specific gender connotation. But single side male dominant engagement could take it over. So it is very important to assure a gender balance.

3.1.3.3 Concepts of educational work with female students

Similarly the discussion was going on following the question: do female students learn in a different way from male students? Also the empirical base is not acceptable enough for quantitative statements, except on the field of written language and interests/orientation of values (Richter 1997). Hirsch (2002:39, 59ff) still contrast the 'trial-and-error' method (focused as male way of learning) with the 'holistic method' (described as the female way of learning). The very important result of her considerations is, that 'both ways of learning enable to work with a computer and solve problems'. These findings encourage giving way to a gender sensitive education which enables to deal with individual requests on the process of learning and respect the diversity of ways of learning and interests. Since there are very few studies on the subject of e-teaching, Remmele suggests a process-oriented method of developing gender sensitive designs (Remmele et al 2002). Environments need to be arranged that allows learning in experimental and explorative ways, always focusing the individual female/male student and present multifold perspectives of complex subjects (Schinzel 2003:7). Schinzel makes an additional suggestion: Instruction methods that include female students should also offer abstraction with a context instead of pure instruction, which corresponds with a larger amount of cognitive strategies of learning anyway.

3.1.3.4 Self concept

Attribution

Earlier studies follow the theory of a dominant andro centrism in technical sciences, which implicates the problem for female students, that they might be sensed to be unfeminine when they get interested in this subject (Ritter 1994:16f). But, as Nelson and Cooper (1997:264) found in their research, "that there is no evidence that this stereotype actually causes girls and women dislike or avoid computers."

Self-efficacy

Several studies report (Margolis et al. 2002, Fischer et al. 1999, Durndell et al. 2000) a very amazing observation: as soon as female students receive pejorative comments on her abilities with computer from male students, they loose their faith in their skills and soon diminish their interest in the whole subject, even if their own expertise is beyond doubt. Therefore, as Ambrose (WWW-ICT 2002:74) describes the concept of self-efficacy to depend on four factors: "one's performance and accomplishments, the possibility to observe and to learn from others, freedom from anxiety when working, and support from others", these factors have to be taken into account when educational environments are built on a gender sensitive base.

3.1.3.5 Role models

'Role models are described as those individuals who we "aspire to" and who provide strong and achievable targets that individuals can emulate in pursuit of their career aims.'[5]

As mentioned above Hirsch (2002:39) points out the fact that female students in classes on informatics in general have to deal with male teachers. Not very often they work with female teachers who they can take for orientation and identification. Rarely can they go back to models in their families or friends. This means, when a female student decides to follow an ICT-career path, she has to cope with traditional role ascriptions without the support of a real person female model. (Wächter 2002:53).

As family influences and social expectations also take effects in some subtle ways (not only in the process of decision making) they act as role models, or some times as anti-models, for their children. Fontanini (2001, in WWW-ICT 2002:101) reports a survey organised in an engineers institute in Paris, examining the girls orientation: 35% of the girls had an engineer father (boys 12%), 43% of the girls had a scientist in their relation or close family.

3.1.4 Interviews

To analyse the findings in the relevant literature now the analysis of the expert interviews follows. First of all they shall be thanked for their willingness to take part in this study and giving their time to this project.

[5] http://www.e-skills.com/cgi-bin/wms.pl/293

As the structure of the Austrian school system suggests, the target group has been divided into group I: female students at the age of 13 – 16 years, and into group II: female students at the age of 16 – 19 years. Table 6 gives a general overview on the sample, which was a controlled one:

Table 6[6]

Group (N=6)	Code	Type of school	Main focus	Mode
Group I 13 – 16 years	Kathrin	Hauptschule	techniques	by phone
	Julia	Gymnasium	mathematic	individual meeting
	Susanne	Gymnasium	informatics	individual meeting
Group II 16 – 19 years	Verena	HTL	informatics	individual meeting
	Micky Mouse	Gymnasium	informatics	individual meeting
	Christina	Lehre	informatics	by phone

3.1.4.1 Translated Interviews

Each interview lasted about 30 minutes, was structured by the predefined guidelines (s. tools), and recorded with a common tape recorder. The answers have been summarized into the main topics, leading the study.

Table 7 gives the translated answers, structured into the two groups and the themes, guiding the interviews.

Table 7

Topic	**Group I 13-16**	**Group II 16-19**
Influence of parents	♀No, not at all. ♀Think, that I am pretty good at it. ♀If I had a daughter, she can decide on her own, what career she wants to follow.	♀You will earn a lot of money, they tell me. ♀No, either the other way around. ♀You have to test it, go ahead.
Influence of teachers	♀Well, some talk to us about careers and so on, but they don't know much about it. ♀No, they don't say anything. ♀No, I don't know.	♀Yes, in school we have to do practical trainings in different companies, and they advise us to Siemens, IBM, … ♀Yes, we talk a lot about jobs after finishing apprenticeship, but it will be difficult, especially for girls because of getting babies …

[6] Names have been changed by the girls themselves!

Influence of friends	♀We like to play games or listen to music or chat a little (ha ha ha !) in the internet. ♀We use it for homework or doing projects, mhmh … ♀I like to make pictures. ♀Sometimes I draw a new picture for the desktop with my friend. ♀We want to go to upper secondary school together.	♀We all don't know, what study we will go on, it is not easy to decide. ♀Now I am online, so I can chat with my friends after school more time. ♀None of us knows what to do next year.
Self-concept	♀When I have a problem with my computer first I try and try and try, and sometimes I pull out the trigger. ♀I started at the age of four to play around with my dad's computer – but he didn't like it. ♀When there is a problem with the computer I call for my brother or my father.	♀My computer has a problem then I call my boyfriend, because he works for an IT company! ♀Very often the computer does not what I want him to do – and then I strike back: I open every programme as long as he quits! What I mean with that: nothing goes and then I cut him off. ♀Sometimes I try new games, and I become pretty clever at them, sometimes not, but sometimes I think they are not really interesting.
Special trainings	♀Only in school. ♀In school, as an additional subject, since we are a technical school. EDV, in school. ♀No, but my dad shows me tricks sometimes.	♀No, just in school. We sold our toys when we were five, does that count? ♀No, I cannot think of any. ♀No, only what my boyfriend shows me.
Access to computer and internet	♀Since I am 11 I have my own computer; internet I am only allowed to use after 6pm al my parent's computer. We don't have computers in our class, there is a computer class where we can work during the pause, but it is for the whole school.	♀I got my own computer when I was 16, we don't have a computer in our class room, but we shall get some next year. ♀When I was 13 my dad gave me his old pc and rebuilds it from time to time (new printer, new screen). We have lessons in

	♀I don't have an own computer, but we have one in our class room, though it is very often occupied. ♀I don't have my own pc, but we have three computers in our class and a computer class for lessons. Sometimes my dad Classes only for girls: no, that sounds very boring!	computer classes where we work in pairs with one pc. ♀My family works all together on one computer which makes it hard to organize. We have two computers in the class room to work with when we are through with our lessons.
Role model	♀No, I cannot think of any. ♀No, not really. ♀No, none! ♀We have a female teacher in our EDV class, but she doesn't feel very competent: every time there is a problem, she asks Thomas (who is our only boy) for help and then he gives us the right instructions.	♀No, mhhh! ♀No, I don't think of a special woman. ♀Yes, my girl scout leader.
Perspectives on own career path	♀I think I could do what I like to do. ♀Anything I choose will work out somehow. ♀I will try different options and then choose the most interesting one.	♀When I find the right path I am sure I can do it. ♀I think I will become an opera star. ♀I will study mathematic, because I like it and you can work in very dissimilar field like insurance companies, genetics, informatics …
Knowledge of ICT career path	♀No, I don't know a company.	♀Microsoft and IBM to earn lots of money!

3.1.4.2 Analysis of the Interviews

Following the topics identified in the relevant literature the analysis of the six expert interviews figures out the following results:

Access of female students to computer

Table 8 gives an overview on the places where female students have access to computer:

Table 8

Group (N=6)	Code	Type of school	Main focus	Access at home	Access to own pc	Access in school
Group I 13 – 16 years	Kathrin	Hauptschule	techniques	x	x	x
	Julia	Gymnasium	mathematic	x	-	x
	Susanne	Gymnasium	informatics	-	-	x
Group II 16 – 19 years	Verena	HTL	informatics	x	-	x
	Micky Mouse	Gymnasium	informatics	x	x	x
	Christina	Lehre	informatics	x	x	-

Comment:
The results of the interviews confirm the data reported in the study almost at the congruent percentage:
33% of the female students have access to their own computer;
83,33% of the female students live in a household with computer;
83,33% of the female students have access in school.

Still only 1/3 of female students have the opportunity to use a computer of their own, which leaves them to the situation to gain access either at home or at school, where they have to deal with other 'competitors'.

Usage

Table 9 provides data what are the main interest in using computers.

Table 9

Group (N=6)	Code	Type of school	Main focus	Computer	Internet
Group I 13 – 16 years	Kathrin	Hauptschule	techniques	Games, music (CDs), homework	Music, projects, chat
	Julia	Gymnasium	mathematic	Homework, design	Music, projects
	Susanne	Gymnasium	informatics	Games, music	chat

Group II 16 – 19 years	Verena	HTL	informatics	Homework	Homework, information
	Micky Mouse	Gymnasium	informatics	Homework, games	Homework, using search engines, buying things;
	Christina	Lehre	informatics	Homework Games	Games, music, information, projects

Comment:

The students taking part in the interviews obviously use computer and internet for various purposes. They seem to have gained a lot of soft skills on computer and internet usage. About the question how fit or interested they are in hard skills, no direct information is available, but all of them learn at least some basics in schools.

66% use the computer for playing games;

83,33% use the computer for doing their homework;

83,33% use the internet for support on their school projects;

33,33% play games, listen to music and chat in the internet; they also listen to music using the computer;

16,66% use the internet for homework, and design with the computer.

Since the sampling is very small, this usage might not be representative, but it shows a large variety of usage by the relevant target group.

Computer knowledge

Table 10 shows the sources of computer knowledge the female students reported:

Table 10

Group (N=6)	Code	Type of school	Main focus	School	Parents	Friends	Self-study
Group I 13 – 16 years	Kathrin	Hauptschule	techniques	x	-	x	x
	Julia	Gymnasium	mathematic	x	-	x	-
	Susanne	Gymnasium	informatics	x	x	-	x
Group II 16 – 19 years	Verena	HTL	informatics	x	-	x	x
	Micky Mouse	Gymnasium	informatics	x	-	x	x
	Christina	Lehre	informatics	x	-	-	x

Comment:

All of the students gained their computer competence at a rate of 100% in school, but contrary to the results following the relevant literature 83,33% learned on their own and 66% studied with friends. The importance of

parents is very small. Now all of the students taken part in the interviews decided to go to a school putting a main focus on IT, therefore the results certainly don't match with the corresponding peer group. Still the important role of school training has to be mentioned.

Self concept

The next table reports the rating the female students did on questions about their self concept.

Table 11

Group (N=6)	Code	Type of school	Main focus	Confidence in own capacity[7]	Problem support
Group I 13 – 16 years	Kathrin	Hauptschule	techniques	5	One self
	Julia	Gymnasium	mathematic	5	One self
	Susanne	Gymnasium	informatics	5	Dad or brother
Group II 16 – 19 years	Verena	HTL	informatics	5	One self
	Micky Mouse	Gymnasium	informatics	5	boyfriend
	Christina	Lehre	informatics	5	One self

Comment:

The rating on the female students self concept is very impressive as it concerns confidence in one's own capacity as well as solving problems occurring in connection with computers. But, whenever they have to rely on someone else, they obviously turn to male support!!!

Role models

Asked about a female idol, who works on a job they would like to do also, the following table shows the very striking results:

Table 12

Group (N=6)	Code	Type of school	Main focus	Role model
Group I 13 – 16 years	Kathrin	Hauptschule	techniques	-
	Julia	Gymnasium	mathematic	-
	Susanne	Gymnasium	informatics	-
Group II 16 – 19 years	Verena	HTL	informatics	-
	Micky Mouse	Gymnasium	informatics	Girls scout leader
	Christina	Lehre	informatics	-

Comment:

None of the female students could name one single female idol working on a desirable job, only one girl named her girls scout leader who actually stands for activities during leisure times. As Wächter (2002) and Fontanini

[7] One a scale from 1 to 5 (is the highest score): how is your confidence on your own capacity to make an unconventional career-choice?

(2001) already elaborated the problem of coping with traditional role ascriptions seems to be of a more subtle way and therefore measures working on this subject have to be developed on a large-scaled base.

3.1.5 Summary and preliminary recommendations

3.1.5.1 Access of female students to computer

School equipment seems to have an important role in providing female students with computers to gain IT skills. Therefore there are two aspects to be mentioned:

- Schools have to match the needs of the students in terms of providing a sufficient number of equipment for all students.
- In different ways there must be assured that female students actual get access to the equipment in relations to their needs.
- The relevant age seems to be group I, which should draw the attention to lower secondary schools.

3.1.5.2 3.1.5.2 Usage

Female students at the age from 13 to 19 years use computer and internet for various purposes. Since a clear majority reports to take computer and internet as an important support for doing homework and realising school projects, it seems to be rather important to provide sufficient equipments and training for all students to prevent a two class society in school life.

3.1.5.3 Computer knowledge

Again the important role of school training has to be taken into account and the general concept of training in the field of IT should be reconsidered, under a gender sensitive aspect of course.

3.1.5.4 Self concept

As the reports from the interviews suggest, these students have no problems with their self concept. But focusing the detail, to turn to someone to get support they chose male persons. Remembering the concept described by Ambrose in chapter 3.1.3.5 the recommendations for building educational environments on a gender sensitive base are:

- providing supplements to allow students to gain performance and accomplishments
- possibility to observe and to learn from others
- freedom from anxiety when working (no pejorative comments)
- support from others.

3.1.5.5 Role models

The study reports and the results from the interviews emphasise the necessity of developing modules for working on the missing female role models female students could possibly follow. Any initiative that directs attention to women following an ICT carreer path successfully should be supported.

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3.1.7 Tools

Interview guidelines (students age 13 years to 19 years)[8]

Did parents/teachers advise you against choosing an overly technical career?
Name one argument, they had!
On a scale from 1 to 5 (is the highest score): how high is your confidence in your own capacity to make an unconventional career-choice?
Did you have any vocational training? Name them, please!
At what age did you start to use computers?
What for did you use it mainly?
Name your favourite computer-game, you like to play with! (not for 19+)
When a problem with your computer arises, what do you do first? Whom do you call for help?
Have you taken part at any computer courses?
Name an IT- company, you would like to work with?
What courses at your class are given by female teachers?
What kind of equipment for working in IT-fields is available at your class? Would you like to have any others?
What kind of IT-Course would you like to have? (collect subjects)
Would you like to have classes only for girls, working on IT-Subjects? Why/why not?
Name a female idol, who works on a job, you would like to have?
If you had a daughter, what kind of career you would her support to go?

About your personal background:

Your name:

Your age:

School, you currently attend:

Studies/apprenticeship you would like to continue:

[8] © michaela luckmann 2003

3.2 Target group I: female students at the age of 16 – 19+ years

Target group 2: female students at the age of 19+ years finishing University

Roisin Mullins, UWL, Chapter

3.2.1 Short summary

The purpose of this chapter is to summarise the main explanations that have been put forward that relate to barriers and needs of females, and the under representation of females in the IT industry. A number of pilot studies were conducted with students at school and University and with teachers in school and University to ascertain what barriers and needs exist for females confronted with unconventional career choices. A number of best practice recommendations from various authors are proposed to explain how these barriers and needs may be overcome at school and University. As yet there are no statistics to demonstrate the success or failure of these recommendations.

3.2.2 Introduction

Under representation points of interest

The under representation of females in the workforce has become of great concern in the EU and globally. Research reported by Millar, J., and Jagger, N. (2001) focuses on 6 countries: UK, US, Canada, Ireland, Taiwan and Spain. They suggest that women are "severely under-represented in IT jobs in all countries and their participation is decreasing. In fact 13% of women working in ITEC jobs in UK in 2000 – down from 16% in 1999. This is much lower than US Canada and Ireland". These are alarming statistics and it shows that the gender gap is much wider than it should be given the relative proportions of men and women in the graduate population and the workforce as a whole.

- On the same theme Douglas Alexander MP – Former Minister of State for E-Commerce Competitiveness, gave a speech at the Women and the IT Skills Gap Policy Debate, at the Fabian Society, London. (2001). The key issues from the debate are summarised below:
- Women today make up only 21% of computing graduates in the UK.
- Across the IT, telecomms and electronic sectors as a whole, women account for only 9% of those who actually relate to the development and production of technology, wheras in the US the figure is significantly higher at 21%
- An Industrial Society report "dot bombshell" suggests male domination of UK businesses continues in the New Economy, men dominate in Internet start-ups; men control venture capital and investment decisions; women face greater obstacles to raising capital, are more restricted by family responsibilities and suffer from certain stereotypes.
- Research from MORI for e-skills national training organisation suggests that young girls regard IT professionals as male, nerdy, work obsessed and boring; and the research also reveals that young mothers take an equally negative view of IT as socially alienating and corrupting, for example driven by stories of the paedophile abuse of Internet Chat Rooms.

- There is a need for communicating positive messages about IT, of advice and guidance about the reality of working in IT and role models and mentors who influence attitudes and opinions over the years to come.
- These issues obviously raise the equality agenda – but they also impact directly upon business competitiveness and productivity. The E-Skills
- national training organisation says an extra 1 million IT workers will be needed over the next 5 years. While these jobs are going vacant, contracts are lost, projects delayed and service levels compromised.
- More than just practical solutions are needed – need to improve the image of IT for girls and women to appreciate the potential of it. The business culture that mitigates against women's recruitment into and retention within ICT employment. Better careers advice is needed – to show the exciting and valuable path of IT opportunities.

Another report was published by Labour Force Survey for the Women and Equality Unit Gender Briefing (August 2003), highlights fey facts and about women work patterns in the UK. For example;

- Of those women in employment, 43% of them work part-time. Part-time working is much more common for mothers: two-thirds of women with children under 5 who are in employment work part-time (67%).
- Overall, 61% of working mothers with children aged under 16 work part-time, compared with just 7% of working fathers.
- Women are paid less than men on average nearly £3 less per hour.
- Women are significantly less likely than men to work as managers or senior officials.
- If females expect that they may be a failure at some subject they tend not to show any interest toward the subject.
- Women may fell discouraged to take up technology-based subjects because they think they may find the values in that workplace or career structure somewhat distasteful.
- Around two thirds of women in employment work in either 'public administration, education and health' or 'distribution, hotels and catering'. By comparison, men's employment is more evenly spread across the industrial sectors.

So what are the reasons for this under representation?

It is of course unreasonable to point at one or two tangible issues that contribute to this factor. However, as early as 1993 and before that time many authors were proposing **reasons that should be carefully addresses at school and university level.** It is perhaps because little attention was paid to these reasons that we are confronted with this problem today. For example, Gill and Butler (1993) explained that females tend to:

- Show greater organisational commitment then men in similar IT roles.
- Posse's critical skills – a combination of technical, managerial and business skills. Very useful as regards being the hybrid worker.
- Focus on the application of technology rather than the technical bits.

Therefore, the ways in which women see themselves as being useful in IT careers is often different to men, where women find they are more suited to the application of computers rather than possessing programming or technical competences. These issues were further examined by Joy Teague (1997). She reviewed the reasons for the under representation of females in computing.

- Girls have the perception that an IT career is highly technical or means work done in isolation.
- Girls believe they do not have the ability to work in or study computing.
- Girls believe it is to mathematical
- Computing careers, as girls perceive it does not interest them.
- Parental and peer pressure often encourages girls to take up conventional courses or careers.
- Stereotyped advice.
- Lack of role models
- Negative classroom experiences

Further Debbie Clayton and Teresa Lynch (2002) provided reasons they identified as contributing to the under representation of females in computing courses:

- False perception of what a career in IT entails.
- Courses and careers in computing require a strong mathematics background.
- Women are not encouraged to study computing.
- Tendency or female to follow a stereotyped careers
- Women have less access to computers than men.

Marc J Natale (2002) suggests that "females tend to be turned off due to the male stereotypes and marketing associated with games and thus begins the gender gap". Additional studies by Phoenix Moorman and Elizabeth Johnson (2003) suggest "Computing continues to be closed to females, if not by physical barrier, then by social misconception. Women in computing still perceive themselves as strangers in a strange, male dominated land". There are a number of issues associated with these misconceptions and two interesting approaches to understanding these misconceptions were discussed in a paper by Joshi and Kuhn in (2001). They examine self-concept and career values of IS professionals. They examined "the attitudes, values, and beliefs that underlie the attraction to IS as a career choice, and specifically gender differences in these factors and their relative importance". They explained that "The IS and management literature suggests two beliefs that may affect an individual's attitudes towards an IS career – self-efficacy and work value congruence". Self-efficacy here refers to an individual's perceptions about her computer related abilities. Self-efficacy has an importance influence on choice of and persistence in careers. Low self-efficacy is expected to lead to negative attitudes towards IS as career.

Work value congruence is explained as the instrumentality of the occupation for attaining outcomes valued by the individual. A female may value certain outcomes e.g. job leading to increased income and providing intellectual challenge, but be dissuaded if she values social interactions and perceives that the IS career might lead to isolated work.

They also explain the image of IS careers. "The IS profession suffers from a negative image and this is due to its perceived similarity to computer science and associated stereotypes

The concerns highlighted by the above authors including Gill Butler (1993) and Joy Teague (1997) seem to be expressed in similar vein by students at school and university in Wales in 2004.

3.2.3 Interviews

The structures of the interview questionnaires are provided in the Annex. Two questionnaires were designed. One questionnaire was distributed to students in school aged 19+ years known as target group 1, and students in University finishing their degree in IT and Business Management known as group 2. The second questionnaire was sent to teacher in secondary schools in west Wales and University lecturers at University of Wales Lampeter. The questionnaires were translated into Welsh because the area of Wales under study is primarily Welsh speaking.

The analysis of the expert interviews follows. First of all they shall be thanked for their willingness to take part in this study and giving their time to this project.
The target group has been divided into
group I: female students at the age of 19 + years, and into
group II: female students at the age of 21 + years.

Table 1 gives a general overview on the sample, which was a controlled one:

Table 1

Target group 1 - Eleven female students 19+ onwards applying for University
Target group 1 - Three male students 19+ onwards applying for university
Target group 2 - Four female students, graduating from University
Target group 2 - Two male students, graduating from University
Transition phase - Two male secondary school teachers and one male University academic
Transition phase - Two female secondary school teachers and two female University academics

3.2.4 Translated Interviews

The questionnaires were sent to the target groups and transition phase participants. The questionnaires were followed up with short interviews. Each interview lasted about 15 minutes, was structured by the predefined guidelines (see. tools). The answers have been summarized into the main topics, leading the study.

The summarised translated answers from the interviews are provided below and the full interviews are provided in the Annex.

Main themes arising from the school teachers and University lecturer interviews

- *Specific areas of IT that female students find more challenging than male students.*
  Teachers at school and University all agreed that any **modules relating to programming** was perceived as more challenging. Females appear to find browsing the Internet more challenging than males. Males enjoy jumping from one link to another; females appear to have the need to go straight to the desired page.
  At Further Education College women find **accounts/spreadsheets very challenging**. This may be because all the female students are mature and when they underwent education there was a greater emphasis on what were then considered solely feminine skills and less emphasis on practical/scientific skills. They also express

problems with **understanding the terminology** (but so do some of them men) and both state it is like having to learn a new language.

- *Areas of IT that female students find less problematic than male students.*
  At University the females find **spreadsheets** such as Microsoft Excel and theory based units such as Internet Marketing quite easy.
  At school, Further Education College and University female's students appear to enjoy **visual and design** tasks, i.e. designing of posters. They spend more time on layout and formatting tasks than males.

- *Female students may require different approaches to explanation of topics and this has to be accommodated.*
  The teachers explained that equal approaches to teaching both genders are provided. However, it has been noted that females appear to prefer to learn a task in a logical, step-by-step approach. They are **less likely to experiment and explore**. They see IT as a tool and not as an enjoyable stand-alone subject. Sometimes females require a little bit more mentoring, tutorials and reassurance.
  Males appear to enjoy the challenge of exploring different aspects of IT.
  Mature females returning to Further Education College require the teacher to be re-assuring and patient in explaining each stage. My best student insisted on writing down each key to be pressed and each mouse operation, before she would try it herself and then she would follow the notes over and over again until she got it. Men liked to try for themselves with the minimum of instruction.

- *What social and cultural barriers do females cite toward them achieving in IT*
  No cultural barriers were cited.
  Social barriers cited were in relation to one-parent families who are struggling to complete assignments against all odds, or those who have to juggle childcare arrangements to attend college, other family commitments, and for some no formal education since leaving school at age 16 years was perceived to be a social barrier.
  Older students feel **IT to be male orientated and a tool targeted at the young**; they have bought computers for their children but had never considered buying one for themselves. Some also see more advanced computer skills as a male preserve – anoraks, geeks etc!
  Some younger female students have stated that their parents have purchased a computer for the family, but it is used primarily by brothers (to play games) or fathers (to browse the Internet). **Students do not have a mother who uses a computer at home for enjoyment purposes**.
  One of the part time female lecturers explained that in her experience when she applied for a full-time IT position she was the only female interviewed out of 5 – and there was only 1 female on the interview panel. This makes one feel less confident if the panel does not have an equal gender balance.
  Also there is some identified perception that the man goes to work all day then has the time to play on the computer in the evening, maybe games with the children or surf the Internet, whereas the female has other housekeeping/parenting priorities so **the computer is more of a useful tool to her, rather than a tool for relaxation.**
  One male lecturer explained that he was not aware of any barriers but explained that he has a son of thirteen and he noticed that computer games are very male orientated--- **the word mouse or joystick is very anti female**.

- *More specific career guidance regarding the breath of careers available in IT might increase female participation.*

Female students study IT merely as a support for their main subject areas more commonly than male students do and females see IT as a tool to aid preferred subjects, i.e. word-processing, English essays, and **do not see it as a stand alone subject**. This maybe because they have already been influenced to feel that IT is a male dominated field and that they would prefer to follow a more appropriate career. However, it may be that most females are interested in how they can **use computers to their best advantage** and are not interested in the developmental side.

Main themes arising from female and male students at school and graduating from University.

- *The overall view of female students is that IT is a male dominated area.*

Females at school and those females undertaking a University degree in IT expressed similar views. They feel that IT is a male dominated area even though there is an equal split of females and males on the IT degree.

- *Most important role of IT.*

The most important role for IT as ranked in order of priority by School girls and boys

Females	**Males**
Communications	Design
Education	Education
Science and technology	Communication
Design	Small business
Small Business	Improving quality of life

The most important role for IT as ranked in order of priority by University females and males.

Females	**Males**
Communications	Communication
Education	Education and Recreation
Small Business	Banking
Science and technology	Enhancing wealth generation in the economy
Enhancing wealth generation in the economy	Design

Both the females and males (University students) ranked education and communication in their top three highest roles of IT. The females at school and University viewed a similar role of IT.

The females selected Science and technology but the boys did not select this. Whereas, the boys selected improving quality of life but the females did not rank this highly.

- *Most attractive areas of IT*

The most attractive areas of IT as ranked in order of priority by School girls and boys

Females	**Males**
Training	Network and Communications
Web Development	Web Development
Multimedia/Computer Graphics	Computer Graphics
Network and Communications	Multimedia
E-Commerce	Design (Architectural and Engineering)

The most attractive areas of IT as ranked in order of priority by University females and males

Females	**Males**
Computer Graphics	Training
Web Development	Web Development
Training	Design (Architectural and Engineering)/e-Commerce
Multimedia/programming	Network and Communications
Network and Communications	Computer Graphics

Generally the females and males at University selected the same roles of IT as those females and males in secondary school. It appears that the school pupils and university students' views change very little over time. The only difference was that females at University selected programming to be included in the list, but not as a priority. As expected the males rated networks and communications much higher than the females, and this is a trend often recorded and evident from such studies.

- *Use of IT*

100% of the University females and males agreed they would use IT every day, and that it would be central to their career plans, however, only 55% of female school pupils said IT would be of some importance.

The females who studied IT at University level view it as being central to their future career plans. They are very positively influenced to stay in the IT profession. However, it seems that the female school pupils do not understand the extent of use of IT, or are not interested in IT at this age.

- *View of IT*

100% of University females and males believe that IT is most like a tool. Whereas only 18% of female school pupils believed this and 73% suggested it was more a qualification.

Those females who associate IT with being most like a tool are probably the ones most likely to be interested in working with IT or studying IT at University or professional levels. This is a good question at searching out likely candidates for IT jobs or those who may study an IT degree.

- *Exposure to IT*

The female University students only began using computer from age 16 onwards whereas the female school pupils all began using computer between the ages of 9-12 years. The school pupils did not undertake any work placements involving IT and were unaware of the general and practical uses of IT. Therefore, learning

computers earlier in life did not suggest that they were any more interested in using computer in the future. Early exposure to IT is one thing but creating the right sort of interest is the challenge.

- *Main purpose for using computers*

Each of the four female IT University students suggested a different purpose. To become a teacher, work in computer graphics, a researcher and a programmer. The students displayed a wide knowledge of the types of jobs available to them as a result of their high level of IT skills.

However, 45% of the female school pupils said their main purpose was to gain more knowledge and further their career prospects. 27% of females suggested it was for high school work tasks. 19% of females said for the workplace, and 9% of females said to communicate via email.

As with the female school pupils all the female University students selected very practical reasons for using computers.

- *Interest in computer games*

50% of the female University IT students and 45% of the female school pupils like to play computer games. So games are not just a male interest. The games selected by the females are often to do with skills and strategy, and the games do not include violence or aggression.

- *Solving computer problems*

100% of female IT University students try to fix computer problems themselves whereas only 36% of female school pupils try to fix the computer problem. This suggests that females who have IT skills are competence in solving computer problems.

- *Name an IT company*

When asked to name an IT- company, they would like to work with. 50% of the female University students said they had no preference, 25% said IBM or Microsoft and 25% said any graphics company.

In general all the female University IT students would like to work in IT but do not have any strong preferences for a particular company. This compares with 64% of school females who said they could not name any IT companies. 18% of females said they would not like to work for an IT- company, and 18% of females said any IT company but it must be linked to education.

There is a lack of knowledge about the existence of IT companies. One of the students expressed an interest in working with an IT company linked in some way to education but could not name any. Attention should be given to highlighting local, national and global companies and their purpose.

- *Access to IT resources and IT courses*

The female IT university students were happy with the IT resources available to them and suggested they would like more computer graphics and networks tuition.

All the females at University and in schools said the computer resources were sufficient for their learning. However, suggestions at the school levels included introducing video conferencing because they have heard about it but never seen it, and the University students suggested they would like more computer graphics and

networks tuition. 75% of the female IT University students suggested more web and computer graphics tuition and 25% suggested more programming.

The female school pupils explained that they require more help with searching and researching using the Internet, email, graphics and desktop publishing. The female's school pupils would like access to information relating to these topics and perhaps useful Internet sites where on-line tutorials exist may be a useful sign post for them. The interests of the school and university students are very similar. The students show an interest in learning skills that provide up-to-date job opportunities.

- *Separate females from males in IT classes*

The female University IT students responded very favourably to having female and males taught together in IT. They suggested that the gender gap would probably become worse if girls were separated from boys and classes should be mixed because boys are not any different from girls. The school and University students agreed that mixed classes are important for socialising. A small percentage they would prefer female only because females in IT tend to be less patronising.

- *Make an unconventional career choice*

On a scale from 1 to 5 (1 is the highest score): how high is your confidence in your own capacity to make an unconventional career-choice?

The female school pupils responded with 64% selecting number 3. This would suggest that they are not over convinced or that they lack self-confidence in their ability to make an unconventional career-choice.

The female university students responded with 75% selecting number 1 and 25% selected 2. This would suggest that they are quite convinced in their ability to make an unconventional career-choice.

The highest score selected by the females suggests that once females are sure of their abilities especially working with IT then it appears they are confident in making unconventional career choices.

3.2.5 General suggestions and specific recommendations resulting from this study.

Wendy Curkier (2002) explained that "much of the discourse regarding IT skills equate IT with computer science or electrical engineering, all of which tend to be male dominated". This has the effect of reinforcing and perpetrating the exclusion of women.

There does appear to be a real need to broaden the definition of IT, and communicate the various skills and roles in a way that encourages male and females to take up IT positions. The current definition of IT does not help to address the issue of the 'skills gap'.

Therefore, again there is a need to match the females discourse about things they like and communicate the skills set associated with the IT job requirements. For example a paper by Greenhaus *et al*., (1990) and Igbaria and Wormley (1992) expressed that IT career experiences could be best described from the following perspectives

Feelings of acceptance i.e. more people oriented

- Job discretion
- Met expectations
- Sponsorship i.e. mentoring
- Career satisfaction

- Organisational commitment

Based on the interviews with the students and teachers a number of career path tools were evaluated to determine which would be most useful for highlighting IT careers. A useful career path book called *Inside Careers* is published in association with the British Computer Society. Students in the UK at secondary school level would have access to this book in their schools career guidance area. As it happens one very useful on-line tool was identified, namely the online prospects planner career-path tool given the acronym, AGCAS. This on-line tool is particularly extensive and is located at the following URL, http://www.prospects.ac.uk. The IT section contained in AGCAS lists 27 IT careers. A recent observation shows that the IT section includes job profiles which were previously listed in the "Creative Arts, Design and Crafts", "Administration", "Information Services" and "Transport and Distribution" sections. For example, the IT and Management services section taken from the online Prospects Planner career-path tool (www.prospects.ac.uk). The six main heading are 1) Computer Operations, 2) Computer Systems Sales and Services, 3) Economic and Statistical Services, 4) Management services, 5) Programming, Systems Analysis and Software Engineering, 6) Technical authorship.

Another source for IT job profiles is described in Peter Denning's paper (2001). Peter Denning does not provide a definition of IT and explains that a definition is required so that a clear distinction between IT and computer science and engineering may be made.

Extract of the table of IT Professions presented in Denning, (2001, p.16)

IT specific Disciplines	IT Intensive Disciplines	IT Occupations
Computer Science	Aerospace Engineering	Computer Technician
Computer Engineering	Bioinformatics	Help Desk technician
Computational Science	Cognitive Science	Network technician
Database Engineering	Digital Library Science	Professional IT trainer
Computer Graphics	E-Commerce	Security Specialist
HCI	Financial Services	Systems Administrator
Network Engineering	Genetic Engineerig	Web Designer
Operating Systems	Information Science	Database administrator
Performance Engineering	Information systems	
Robotics	Public policy and privacy	
Scientific Computing	Instrumental design	
Software architecture	Knowledge engineering	
Software Engineering	MIS	
System Security	Multimedia Design	
	Telecommunications	
	Transportation	

The IT professions are not explained just listed, and the rationale for the grouping of the professions into the three categories is not explained.

Margolis, J and Fisher, A. (2002) explain how to build on female self-esteem at an early age. One way to do this is to run all-girl computer events at school designed to build self-confidence in girls. Another way to do this is to set up a mother-daughter computer club that provides a chance for those mothers who are not computer savvy to become computing mentors for their daughters, and to continue that role in the home.

Joy Teague (1997) suggested that during the university-computing course

- Encourage group work and cooperative learning.
- Show girls practical examples of IT or computing in the workplace. Townsend, G. (1996) suggests that videotapes after viewing, has been shown to exert a positive impact on girls attitudes towards computer science.
- Highlight the benefits of good salaries, job security, together with job satisfaction.
- Tell students about initiatives in the workplace
- Flexible working hours
- Opportunities to work from home
- Carer break schemes
- Provide network opportunities with local and national job agencies and employers.
- Provide role models for students, Görer, D and Camp, T. (2002). Ask females to return to the university to tell the other students about their enjoyable working experiences.
- User friendly software
- Interest and challenging projects
- Increased respect from doing a job well.

Debbie Clayton and Teresa Lynch (2002) provided three types of best practice initiatives or strategies

<u>Strategy to attract female's school leavers to university computing courses</u>

- Staff visits secondary schools and in addition, students brought on campus for an IT day or week.
- Provide a career information pack containing
    - Videos,
    - Interactive software on computing career options,
    - Pen portraits of recent graduates,
    - Course information,
    - Eye catching posters

<u>Strategy to attract mature females to university computing courses</u>

- Encourage females to enrol on pre-university courses often called foundation courses to provide them with the necessary pre-requisite skills to enrol in computing courses.
- Have a female as the teacher in rural or remote locations.

<u>Strategy to decrease attrition i.e. drop-put rates of mature females in university computing courses</u>

- Provide more practical classes associated with the theory to equip the females with the necessary skills.
- Equip females with contacts to ensure positions in the professions.

- Staff development activities for academics examining the different learning styles amongst students.
- Staff awareness raising seminars where academics discuss their research with students using eye catching posters or explaining how they worked with industry on the research projects.
- Workshops to improve graduates interview and job seeking skills. These workshops should aim to help females overcome the problems that women often have in:
- Self-promotion,
- Undervaluing their skills,
- Undervaluing their abilities
- Establishing of networks through the use of email. Email was seen as a highly effective way of communicating with and supporting female students, especially those females who were in remote locations or were not able to attend lectures due to family commitments.

In similar vain, Janice Cuny and William Aspray (2002) published a report entitled "Recruitment and Retention of Women Graduate Students in Computer Science and Engineering". The report considers evidence and lists a number of explicit recommendations and sketches out implementing mechanisms. While there are causes in early socialisation and primary educational experiences – academic departments at the university level nevertheless can have an effect. In order to treat all students fairly, educators must pay attention to gender-based traits. There is strong evidence for example, that women, even though they perform at the same levels as men, they have less confidence in their abilities and accomplishments then men. Women are often less aggressive than men in promoting themselves. There is evidence that women come to computing as only one interest among many and are thus less single-minded than their male counterparts. Often women report feeling "out of place" in the male-dominated, hacker culture." Following this report Janice Cuny and William Aspray (2002) suggests 12 recommendations to retention of female students in computing courses at university.
Broaden criteria used in admissions to be flexible.

1. Encourage re-entry students
2. Provide bridging opportunities to re-entry (conversion) graduate students
3. Include diversity considerations.
4. Inform undergraduate students about rewards and opportunities
5. Be positive in making recruitment contacts.
6. Provide undergraduate females with exposure to computing research.
7. Review department's publications for text/images containing overt messages that may discourage applicants.
8. Give individual encouragement.
9. Provide female role models.
10. Be diligent at mentoring female graduate students.

Recommendations from School teachers and University lecturers observed during this study.

- Introduce basic IT skills at school level to enable faster learning of terminology.
- Introduce applications such as spreadsheets, graphics and design applications, logic and programming at an early stage to take away the fear of what is generally perceived to be the learning a new language.

- Encourage females to learn through exploratory approaches encouraging them to experiment and explore IT.
- Promote IT as a tool that can be used for work and leisure so that females do not associate IT to be male orientated and a tool targeted at the young.
- Highlight role models to females especially those students who do not have a mother who uses a computer at home for enjoyment purposes.
- Ensure that any interview panel should include females so as not to lower self-esteem during the interview process.
- Request societies in IT and computing to consider alternative names for hardware peripherals for example, the current word mouse or joystick is very anti female.
- Provide more appropriate IT specific career guidance to highlight the breath of careers available that require intensive and less intensive use of computers.

Recommendations from school pupils and University students observed during this study.

- Discourage the view that IT is a male dominated area.
- Develop meaningful perceptions of computing careers.
- Stress areas where IT has a definite role for communication, education and improving quality of life, so that then role of IT is clearly balanced between work and leisure activities.
- Provide more information for female school pupils about the extent of use of IT including areas such as, research and development.
- Determine what school pupils view of IT is at an early stage. Establish their view of IT as a tool, a qualification or a language. Explain how useful IT is as a tool rather than a complementary qualification or just a language as perceived by a programmer.
- Provide access to work placements involving practical uses of IT.
- Early exposure to IT is one thing but creating the right sort of interest is the challenge.
- Encourage female students to try computer games that involve skills and strategy.
- Create awareness and knowledge about the existence of IT companies. Attention should be given to highlighting local, national and global companies and their purpose.
- Teach relevant skills that provide up-to-date job opportunities.
- Build self-confidence to ensure females are capable of making unconventional career choices.
- School girls should believe that computing will not be of interest to them
- Build computing experience to reduce a lack of confidence in choosing IT subjects.
- Females should believe that the role of IT is to improve the quality of life.

3.2.6 3.2.6 References

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3.2.7 Annex

Interviews with School teachers and University Lecturers in Wales.
(The questions are formatted in Italics).

Describe the number of male/females pursuing IT courses at your school/University.

Female views
Summary of the male/female students on IT courses
E-Business and System support classes had a split of 84% male and 16% female.
AVCE IT had a split of 67% male and 33% female.
Advanced IT had a split of 71% male and 29% female.
ECDL had a split of 25% male and 75% female.
Further education courses – variety of IT subjects had a split of 5% male and 95% female. Many of the women were excellent at wordprocessing courses and excel programmes, whilst the men seemed more interested in the design packages.
All University IT courses had greater female than male registration, generally 60% female and 40% male.

Male views
Students selecting IT courses had a split of 17% male and 83% female.
At another school students selecting IT courses had a split of 30% male and 70% female.

Do you perceive a difference in the attitude of male and female students towards IT?

Female views
Females tend to be more hesitant at first often more nervous & unsure to start with. The majority of the further education students are female returners who have spent a number of years at home with children. Often such short courses are their first experience of IT. Males tend to be more confident!
Males perceive IT as a 'fun' whereas females perceive IT as a tool to aid other aspects of their course, i.e. wordprocessing essays, spreadsheets for numeracy, etc.
Males do tend to have more enthusiasm for the subject, but the females do put more effort into the work.
Men tended to explore the various programmes and to want to talk about the various programmes, especially games, etc. They always tended to make it appear to be very complex and skillful. Whereas the women tended to use the computer for work, and did not use it for pleasure as much as the men. A female student (who worked at a Bank in Lampeter) once put it to me that it was the women who were expected to use the computers for the boring everyday work, whilst the men did the more exciting processes!

Male views
On university courses females tend to take learning more seriously than their male counterparts.
On the further education courses there is a less confident attitude towards IT from female students.

In school girls were more in awe of IT but perhaps we inadvertently reinforce this by making IT seem like engineering or a very male thing.

Are there any differences in demonstrated ability between male and female students?

Female views

50% of the females suggested no difference explaining that both male and female are equally capable of undertaking set IT tasks.

At further education college and University we have found that females do need the subject explained in more detail before they understand the topic.

On further education courses women tend to think that computers are highly technical and complex. It was very important to make women feel confident and to reduce each process to its most basic level - but once they had mastered the process their skilfulness and understanding was equal to if not superior to the male students.

At further education college women returners always appear to be terrified of the computer until it is explained that it was no more complicated than a modern washing machine, and that if they looked at their children on computers they would realise how easy it was. It would be interesting to do a study on students' level of self confidence/self esteem and their ability to master computers.

The difference between males and females on computers I feel is more to do with macho traits than gender differences.

At further education college and university they explained that once the females get started on their IT course they often perform better than the males – they are more thorough when it comes to exams – the males tend to rush through the papers & make 'silly' mistakes.

Male views

At school and further education college the female students usually lack self-confidence and are not as I.T literature as the males.

Are there specific areas of IT that female students find more challenging than male students? If so what are they?

Female views

At further education college and university all agreed that any modules relating to programming was perceived as more challenging.

Females appear to find browsing the Internet more challenging than males. Males enjoy jumping from one link to another; females appear to have the need to go straight to the desired page.

Females do not really find IT concepts challenging after they have been explained. An example from a further education college lecturer. Women learn computers in order to do a job of work, men do it to fulfil their competitive male egos! An example: A new wage programme was added to a business accounting system. The women trying to work the new system found that it kept crashing and they were accused of being too thick to be able to work the new system. They obviously talked amongst themselves about the problem and went to a female manager and told her why they thought the computer kept crashing. She decided to investigate it. She

found that indeed when using the new programme the computer crashed, but when she deleted the new programme the computer ceased to crash. It appeared that technically the computer could not accept the new program. I do not think the computer manager ever actually apologised to the women. This is a very good example of how frequently the women would work out what needed to be done to get around a problem, but they would not be able to talk about it technically so that frequently they were not listened to.
Specific areas generally include having to use maths – as in the more complicated spreadsheet formulas.

Male views
At further education college women find accounts/spreadsheets very challenging. This may be because all the female students are mature and when they underwent education there was a greater emphasis on what were then considered solely feminine skills and less emphasis on practical/scientific skills. They also express problems with understanding the terminology (but so do some of them men) and both state it is like having to learn a new language.
At further education college and university all agreed that programming and more technical aspects tend to worry the female students more than the males.

Are there areas of IT that female students find less problematic than male students? If so what are they?

Female view
At University the females find spreadsheet such as Microsoft Excel and theory based units such as Internet Marketing quite easy.
At University females students appear to enjoy visual and design tasks, i.e. designing of posters. They spend more time on layout and formatting tasks than males.
At further education college women know how to use their computers to do the jobs they want to do - they have the patience to try different methods to achieve their ends. They do not have to be able to explain what they are doing technically, but just do it.
At further education college females are usually more precise & accurate, their presentation is neater, and they enjoy wordprocessing.

Male views
At further education college and university all agreed that females generally find anything to do with graphics/design easy.
Females find it easier to organise workloads and knuckle down to the work.

Do female students require different approaches to explanation of topics? If so how is this accommodated?

Female views
Two females said no because equal approaches to both gender are made and no problems.
Females appear to prefer to learn a task in a logical, step by step approach. They are less likely to experiment and explore. They see IT as a tool and not as an enjoyable stand alone subject. Males appear to enjoy the challenge of exploring different aspects of IT.

Differentiation in worksheets and explanations during theory lessons. Yes I would agree that with women you have to be re-assuring and patient in explaining each stage. My best student insisted on writing down each key to be pressed and each mouse operation, before she would try it herself and then she would follow the notes over and over again until she got it. Men liked to try for themselves with the minimum of instruction.

Male views

At further education college the lecturer suggested sometimes more explanation required by females but not often. This is overcome by relating the problem to a physical example. Eg. Your computer is this filing cabinet, this drawer is a drive, this pocket hanging in it is a folder, the papers in it are files.

Sometimes they require a little bit more mentoring, tutorials and reassurance.

Do female students ever cite social and cultural barriers toward them achieving in IT? If so what are they?

Female views

No cultural barriers cited. Social barriers only with relation to one parent families who are struggling to complete assignments against all odds, and have to juggle childcare arrangements to attend college

Older students feel IT to be male orientated and a tool targeted at the young; they have bought computers for their children but had never considered buying one for themselves. Some younger female students have stated that their parents have purchased a computer for the family, but it is used primarily by brothers (to play games) or fathers (to browse the Internet). Students do not have a mother who uses a computer at home for enjoyment purposes.

Many women seemed to think that it was too complex and technical for them, until they were shown how easy it was. I used to get very cross whenever any of the male students tried to show the women what to do and frequently just made them feel inadequate by going too fast or talking in too technical a language.

Sometimes the female's partner is not as supportive as they perhaps could be – they can see personal development as a threat – especially if it means their partner may end up with a better job than them (it's a male ego thing!)

One of the part time female lecturers explained that in her experience when she applied for a full-time IT position she was the only female interviewed out of 5 – and there was only 1 female on the interview panel. This makes one feel less confident if the panel does not have an equal gender balance.

Male views

All males explained that childcare, having a quiet time/space to study, having to cook the evening meal and care for the family after school.

Single parents, family commitments, no formal education since leaving school, etc

Some males consider IT to be a female 'hobby' closely related to the old typist/secretarial image.

Some females like the female group image also but this has to be carefully controlled to stop the classes turning into a sort of Women's Institute!

Some also see more advanced computer skills as a male preserve – anoraks, geeks etc!

Some younger women are also put off computers because they see so many of their close young male associates playing war/bang bang games on computers. Also there is some identified perception that the man goes to work

all day then has the time to play on the computer in the evening, maybe games with the children or surf the Internet, whereas the female has other housekeeping/parenting priorities so the computer is more of a useful tool to her, rather than a tool for relaxation.
One lecturer explained that he was not aware of any barriers but explained that he has a son of thirteen and he noticed that computer games are very male orientated--- the word mouse or joystick is very anti female.

Do female students express interest in pursuing IT after leaving school?

Female views
One lecturer said that many students who have progressed to University to undertake IT courses.
Another lecturer said that all the ECDL students are mature adults and are looking to get some sort of job using IT.
The female students in Further Education did not enroll voluntarily on the IT course and none see themselves ever working in IT – they all see how useful IT can be for any future employment, i.e. database of customers, spreadsheets for accounts, wordprocessing letters, etc. They have not expressed an interest in it.

Male views
Yes - as reflected in the high enrolment of mature female students. They often express the notion that they have to master this computer stuff to ever stand a chance of getting a job or even keeping up with their children, who, as they put it, talk a different language and have a chip born in them.
Yes, more mature female students expressing an interest.
One lecturer explained that he does not get to find out what happens when they finish on my course.

In your opinion are there distinct male and female traits that affect progress in IT disciplines?

Female views
Yes, male students are too laid back, the women are much more serious and motivated to achieve. They also strive perfection.
Females appear to prefer to communicate face to face and are less competitive than males; males appear to enjoy experimenting and exploring such IT disciplines as the Internet.
Men find computers exciting and challenging and that is why they enjoy computer games and the way in which computer programmes keep changing and developing all the time. Whereas women like the fact that computers can produce such excellent material and are so efficient in getting work completed correctly. They like the efficiency of the computer.
Females tend to go for the lower paid jobs – such as office work, especially if they have children to look after. They may also be prevented from going for promotion if it means moving away from their home – children having to move schools, partners having to find new jobs elsewhere, etc.

Male views
One lecturer explained that the female students are more consistent, attend more regularly and take the opportunity to learn as a mature adult far more seriously, even though many are past working age. They basically

want to learn and improve their skills, but not with the objective of gaining any form of accreditation or employment. Consequently I have considerable difficulty in meeting current funding body requirements (they need to see proof of achievement via modules completed and accredited). Consequently I am considering other forms of devolving learning.

Is a perceived lack of female role models in IT a potential impediment to female students?

Female views

No, in fact in our establishment there is only 1 colleague who is male!!

Yes: the majority of younger students state that whilst in school, IT was taught by males. They believed they were at a disadvantage compared with the boys, i.e. disciplines were taught in a more male orientated way, i.e. war games, killing etc.

Within this school IT is supported by both male and female teachers.

It seems that there are more women actually working with computers in the work place than men.

Amongst teachers there seems to be an equal number of male and female teachers.

It is in the field of technical development, repair and marketing where men excel. And in this area I would agree that the lack of female role models in IT maybe a potential impediment. I am not sure whether this will ever be overcome completely as male and female approaches are different. And when this happens the competitive assertive environment of men, eg in garages, mines, etc, women are naturally excluded. This seems to have developed within certain aspects of the IT world and it means that a female has to be particularly assertive and competitive to be able to compete with men and to cope with the male environment in order to do well in these areas within IT.

One female lecturer was not sure – I think it depends on the determination of the particular student more than anything.

Male views

It could be but is not evident in the places I teach. If however, a female student wanted to pursue a career in computer programming I feel certain she would have a hard time, especially in the Further Education field!

Possibly! And a lack of information relating to this issue.

No, apart from a socialisation process which I believe determines male/female attitudes to computers. which in turn determines student attitudes towards IT. This is just a feeling and I cannot support it with evidence.

Do you think that more specific career guidance regarding the breath of careers available in IT might increase female participation?

Female views

Yes definitely, although in our University the career guidance is excellent

Yes: many were guided towards such careers as Beauty/Hairdressing as this was deemed a career where females could work part time/from home in the future.

Yes - but it means that perhaps within certain areas of IT girls should be trained separately from men until their confidence and enthusiasm has developed sufficiently in order to be able to ignore and cope with the male dominated environment.

Male views

Yes. In remote rural areas such as these, access to such information is always problematic and could be addressed by bodies such as Careers Wales taking a more active part in arranging seminars and 1 to 1 counselling to cut through all the paperwork and leaflet reading.

Yes. Also, marketing geared towards females who might want to study I.T, but are unaware of the possibilities.

Do you feel that female students study IT merely as a support for their main subject areas more commonly than male students do?

Females views

Yes: females see IT as a tool to aid preferred subjects, i.e. wordprocessing English essays, and do not see it as a stand alone subject.

Teacher 3

This maybe because they have already been influenced to feel that IT is a male dominated field and that they would prefer to follow a more appropriate career. However, it may be that most females are interested in how they can use computers to their best advantage and are not interested in the developmental side.

Teacher 4

Yes – I would assume that more males study the more technical aspects of IT than females.

Male views

Yes to some extent. For example, they need the word processing skills for their reports and essays, or if their main subject area is work they need additional skills in other programmes

Do you feel that female students pursue IT less commonly as a main subject area?

Female views

Yes. At Ceredigion Training there was no choice and all the women and men trained with computers and the majority were very successful, but their approach and interests were different.

Male views

All the male lecturers agreed.

The participants included:

Eleven female students 19+ onwards applying for university
Three male students 19+ onwards applying for university

Analysis of results

The analysis following the questionnaire surveys and interviews.

Females expressed greater concern that IT is a male dominated area whereas the males strongly suggested that there is no gender bias in IT.

The female school girls were split on their views as to whether they believed it is more difficult for male or female students to excel in IT. They felt it was more difficult for females or neither, whereas the males felt it was more difficult for males or neither! So no clear distinctions coming though except both genders feel it is more difficult for their gender or neither. So perhaps this is not an important issue.

The most important role for IT as ranked in order of priority by School girls and boys

Females	**Males**
Communications	Design
Education	Education
Science and technology	Communication
Design	Small business
Small Business	Improving quality of life

Both the females and males ranked education and communication in their top three highest roles of IT.
The females selected Science and technology but this was not selected by the boys. Whereas, the boys selected improving quality of life but the females did not rank this highly.
It could be suggested that females view the role of IT being important for pragmatic reasons, for example by their selection it could be summarised as solving day-to-day questions and for scientific advance, but not for improving quality of life!
There is a lack of knowledge about the role of IT for improving quality of life.

The females and males both felt they would use IT every day or occasionally.
With regard to IT skills, 55% of females suggested that IT would be of some importance to their career plans, and 36% felt it would be of significant importance to their career plans. Whereas 33% of males agreed that it would be central to you career plans, and 67% of males felt it would be of significant importance to their career plans.
The females do not view IT as being as central or significant to their career plans as the males do.

When asked what they felt IT is most like. 9% of the females felt it was a language, 73% of females felt it was more a qualification, and 18% felt it was more of a tool. This is in stark contract with the males who agreed 100% that IT is more like a tool.
The implication here is that females view IT as a means to getting something i.e. a qualification for a job, and do not have a strong perception of it being useful as a means for doing something.

When asked if they intended studying IT further after school. 73% of females said Yes, 27% said No, and 9% said they would but only if the job demanded it.

When asked what areas of IT do they find most attractive

The most attractive areas of IT as ranked in order of priority by School girls and boys

Females	**Males**
Training	Network and Communications
Web Development	Web Development
Multimedia/Computer Graphics	Computer Graphics
Network and Communications	Multimedia
E-Commerce	Design (Architectural and Engineering)

Both the females and males selected web development and computer graphics as their second and third choice. The females selected training as the first choice, whereas the boys selected Networks and communications. The girls did select Networks and Communications before E-Commerce so they may view E-Commerce as highly technical.
The females showed a greater attraction to IT roles in areas of training and creative areas, and showed little interest in highly technical areas such as Design (Architectural and Engineering) and programming.

The female students were asked if parents/teachers advised them against choosing an overly technical career. 10 females said No, and explained that the decision was based on my own choice. However, 1 female explained that she was very bad at mathematics and her parents advised her against IT.
In the situation where the single female was advised against IT it was because her parents/teachers were ill advised as to the nature and roles available in IT that do not require mathematics or skills in logic.

On a scale from 1 to 5 (1 is the highest score): how high is your confidence in your own capacity to make an unconventional career-choice?
64% selected number 3.
This would suggest that they are not over convinced or that they lack self-confidence in their ability to make an unconventional career-choice.

Did you have any vocational training? Name them, please!
90% of the females did not have any vocational training.

This would suggest that they have not undertaken any work placement in school and would not be aware of the general and practical uses of IT.

The majority of females began using computer between the ages of 9-12 years.
In the UK all school children have access to computer from infant school. This is a UK policy.

When asked what is your main purpose for using computers?
45% of females said to gain more knowledge and further my career prospects. 27% of females suggested it was for high school work tasks. 19% of females said for the workplace, and 9% of females said to communicate via email.
All the females selected very practical reasons for using computers. However, the majority felt it would increase their career prospects.

The females were asked to name their favourite computer-game that they like to play with! 55% of females agreed that computer games are of no interest to them. In fact 1 of the females used the word detest computer games when asked the question. 45% females liked computer games and named Solitaire, Racing and Horse Racing Manager.
The majority of females showed a distinct dislike to computer games, but those who liked games selected non aggressive games.

When a problem with your computer arises, what do you do first? Or whom do you call for help?
55% of females said they immediately ask help from a tutor (teacher). 36% of females said they try and fix it themselves, and then I phone an IT person/friend. 9% of females said "I shut the computer down – depending on how much work I have done, and leave it for someone else to figure out".
The majority of females explained that they do not have computers in the home. They only use computers at school for their school work. As a result they do not feel they have to solve a computer problem because they are within the school environment, and plenty of help is at hand. However 36% suggested that they try and fix it themselves so they are not afraid of tacking the problem.

When asked if they have taken part on any computer courses. Interestingly 90% of females said yes, and all of those stated that they attend extra evening classes in IT, and 10% said no.

When asked to name an IT- company, they would like to work with. 64% of females said they could not name one. 18% of females said they would not like to work for an IT- company, and 18% of females said any IT company but it must be linked to education.
There is a lack of knowledge about the existence of IT companies. One of the students expressed an interest in working with an IT company linked in some way to education but could not name any. Attention should be given to highlighting local, national and global companies and their purpose.

What kind of equipment for working in IT-fields is available at your class? Would you like to have any others?

90% of females think they have adequate resources. However, 10% would like to see how video conferencing works because they have heard about it but never seen it.

Females were asked what kind of IT-Course you would like to have. The students explained that they require more help with searching and researching using the Internet, more advanced IT than what they covered in GCSE, email, graphics and desktop publishing.
The females would like access to information relating to these topics and perhaps useful Internet sites where on-line tutorials exist may be a useful sign post for them.

When asked if they would you like to have classes only for girls, working on IT-Subjects 90% said No, because it is important to have mixed classes for socialising. However, 10% said they would prefer female only because females in IT tend to be less patronising.

Name a female idol, who works on a job, you would like to have?
The majority of females, 55%, stated that they do not have any female idols. However, 27% females named Cat Deeley (Top of the Pops and Children's ITVchannel presenter – very popular), 9% named Isabella Rossellini (fashion model) and 9% named their mother and the learning support unit in the college.

All the courses they are pursuing are given by female teachers. However they did not suggest any of them as role models.

The females were asked if they had a daughter, what kind of career they would support her to pursue.
64% females, agree that they would support whatever she chooses. 9% female said anything cultural.
9% female said IT, 9% female said marketing or finance, 9% female lawyer.
The majority of females agreed they would support any decision about career choices made by their daughter.

The participants included:

Four female students, graduating from University
Two male students, graduating from University

Analysis of results

The analysis following the questionnaire survey and interviews.

Females expressed greater concern that IT is a male dominated area whereas 50% of the males suggested that IT is male dominated and the other 50% suggested that there is no gender bias in IT. The females and males participating in this survey are in the second year of their degree in IT.

The females believed more strongly (75%) that it not any more difficult for male or female students to excel in IT, and 100% of males agreed with this. Only 25% of females said it was more difficult for females. So perhaps this is not an important issue for either gender.

The most important role for IT as ranked in order of priority by University females and males.

Females	**Males**
Communications	Communication
Education	Education and Recreation
Small Business	Banking
Science and technology	Enhancing wealth generation in the economy
Enhancing wealth generation in the economy	Design

Both the females and males ranked education and communication in their top three highest roles of IT.
The females selected Science and technology but this was not selected by the boys. Whereas, the boys selected improving quality of life but the females did not rank this highly.

100% of the females and males agreed they would use IT every day, and that it would be central to their career plans

The females who studied IT at University level view it as being central to their future career plans. They are very positively influenced to stay in the IT profession.

Both females and males believe that IT is most like a tool. Those females who associate IT with being most like a tool are probably the ones most likely to be interested in working with IT or studying IT at University or professional levels. This is a good question at searching out likely candidates for IT jobs or studying an IT degree.

100% of the females and males agreed that they intended to study IT further after University and when asked what areas of IT do they find most attractive. They responded:
The most attractive areas of IT as ranked in order of priority by University females and males

Females	**Males**
Computer Graphics	Training
Web Development	Web Development
Training /	Design (Architectural and Engineering)/e-Commerce/
Multimedia/programming	Network and Communications
Network and Communications	Computer Graphics

Both the females and males selected web development and computer graphics as their second and third choice. The females selected training as the first choice, whereas the boys selected Networks and communications. The girls did select Networks and Communications before E-Commerce so they may view E-Commerce as highly technical.
The females showed a greater attraction to IT roles in areas of training and creative areas, and showed little interest in highly technical areas such as Design (Architectural and Engineering) and programming.

The female students were asked if parents/teachers advised them against choosing an overly technical career. 3 females said No, and 1 said Yes. However, 1 female explained that she was told by a family member that she would not need to have any IT knowledge, and that they could not see any reason for her doing something that would not give her a job afterwards.

On a scale from 1 to 5 (1 is the highest score): how high is your confidence in your own capacity to make an unconventional career-choice?
75% selected number 1 and 25%said 2. This would suggest that they are quite convinced in their ability to make an unconventional career-choice.

The highest score selected by the females suggests that once females are sure of their abilities especially working with IT then it appears they are confident in making unconventional career choices.

Did you have any vocational training? Name them, please!
100% had completed various types of vocational training including IT, management and nursing.

The females University students started using computers from age 16 years on average.

When asked what is your main purpose for using computers?
Each of the four female IT University students suggested a different purpose. To become a teacher, work in computer graphics, a researcher and a programmer. The students displayed a wide knowledge of the types of jobs available to them as a result of their high level of IT skills.

2 of the females do not play computer games. One plays Solitare and the other plays Command and Conquer.
The games selected by the females are often to do with skills and strategy, and the games do not include violence or aggression.

When asked when a problem with your computer arises, what do you do first? Or whom do you call for help?
100% of the female IT university students explained that they fix it themselves and often explained in detail the method by which they achieve the result.

When asked if they have taken part on any computer courses. 100% of females said yes, 25% said that it is not through formal means but they learn from web tutorials and freely available Internet courses.

When asked to name an IT- company, they would like to work with. 50% of the female University students said they had no preference, 25% said IBM or Microsoft and 25% said any graphics company.
The fact that only 25% of the students named an IT company could suggest that there is a lack of knowledge about the existence of IT companies.

What kind of equipment for working in IT-fields is available at your class? Would you like to have any others?
The female IT university students were happy with the IT resources available to them and suggested they would like more computer graphics and networks tuition.

Females were asked what kind of IT-Course would you like to have.
75% of the female IT University students suggested more web and computer graphics tuition and 25% suggested more programming.

Females were asked what kind of IT-Course would you like to have.
75% of the female IT University students suggested more web and computer graphics tuition and 25% suggested more programming.

The female IT University students were asked if they would you like to have IT classes only for girls? 25% said No, because boys are not any different from girls.
25% said No because the gender gap would probably become worse if girls were separated from boys.
25% said No mixed classes are great, variety is the spice of life.
25% said did not mind either way, but do like a female oriented group and see how IT is important to a lot of my female friends.

Name a female idol, who works on a job, you would like to have?
The majority of females, 75%, stated that they do not have any female idols. However, 25% females named their mother.

50% of the courses the female University IT students are pursuing are given by female teachers. However they did not suggest any of them as role models.

The females were asked If they had a daughter, what kind of career would they support her to pursue?
100% of females agreed they would support any decision about career choices made by their daughter.

3.2.8 Tools

Interview guidelines

Questionnaire for Secondary School Teachers and University Lecturers

PROMICT Project – (Promoting ICT to Female Students)

1. What is the male/female balance of pupils pursuing an IT course at your school?
2. Do you perceive a difference in the attitude of male and female students towards IT?
3. Are there any differences in demonstrated ability between male and female students?
4. Are there specific areas of IT that female students find more challenging than male students? If so what are they?
5. Are there areas of IT that female students find less problematic than male students? If so what are they?
6. Do female students require different approaches to explanation of topics? If so how is this accommodated?
7. Do female students ever cite social and cultural barriers toward them achieving in IT? If so what are they?
8. Do female students express interest in pursuing IT after leaving school?
9. In your opinion are there distinct male and female traits that affect progress in IT disciplines?
10. Is a perceived lack of female role models in IT a potential impediment to female students?
11. Do you think that more specific career guidance regarding the breath of careers available in IT might increase female participation?
12. Do you feel that female students study IT merely as a support for their main subject areas more commonly than male students do?
13. Do you feel that female students pursue IT less commonly as a main subject area?
14. Can you suggest any best practice solutions to promoting female involvement in IT?
15. Describe practices that you know about that have increased the number of girls selecting a computer science or IT course/career path?
16. From your experiences as a teacher do you have any ideas about how female involvement in IT could be improved in the future?

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17. Would you be interested in the results of our project surveys?
18. Would you be interested in any materials that are published as a result of this project?
19. Would you be happy for us to send you a survey for the male and female students to complete?
20. Would you be interesting in testing the products produced as a result of this project?

Please email r.mullins@lamp.ac.uk your completed questionnaire by 23rd December 2003.

Interview guidelines

Questionnaire for Students age 16+ years or those finishing a University degree

1. Are you Male □ or Female □ (Please tick the appropriate box)?

2. Which one of the following statements do you feel is most true
   (Please tick the appropriate box)

   - □ IT is a male dominated area
   - □ IT is a female dominated area
   - □ There is no gender bias in IT

3. In general, do you believe it is more difficult for male or female students to excel in IT?
   (Please tick the appropriate box)

   - □ Male Students
   - □ Female students
   - □ Neither

4. What do you believe is the most important role for IT?
   (Pick five with a descending score.
   For example, 5 for the most relevant, then 4,3,2 and 1)

   - □ Communications
   - □ Small businesses
   - □ Education
   - □ Improving quality of life
   - □ Banking
   - □ Enhancing wealth generation in the economy
   - □ Design
   - □ Recreation
   - □ Improving representation of certain groups of people
   - □ Science and technology

5. On leaving school / University do you believe that you will use IT
   (Please tick the appropriate box)

   - □ Every day
   - □ Occasionally

- ☐ Hardly at all

6. Would you regard IT skills as:
   (Please tick the appropriate box)

   - ☐ Central to you career plans
   - ☐ Of significant importance to your career plans
   - ☐ Of some importance to your career plans
   - ☐ Of no real importance to your career plans

7. For you, is IT most like

   - ☐ A language
   - ☐ A qualification
   - ☐ A tool

8. Which areas of IT do you find most attractive?
   (Pick five with a descending score.
   i.e. 5 for the most relevant, then 4,3,2 and 1)

   - ☐ Web Development
   - ☐ Programming
   - ☐ Design (Architectural and Engineering)
   - ☐ Training
   - ☐ Multimedia
   - ☐ Computer Graphics
   - ☐ E-Commerce
   - ☐ Bioinformatics
   - ☐ Network and Communications
   - ☐ Financial Services

9. Do you intend studying IT further after school / University?

3.3 The situation of vocational counsellors- especially in reformed countries

Svetoslav Dimov, SCAS

The current state of the young women chosen the ICT career path could be described as unstable and requiring much support, comprehension and concrete actions on behalf of all parties engaged in the process.
The opinion and observations of **vocational counselors** working with female students, who have chosen the ICT career path, is of substantial importance for providing relevant information and exploring the barriers and needs for supporting these young women. However, these consultants are facing a wide range of challenges with respect to not only to the technical provision of consultant services, but also correlated with the lack of relevant materials to assist them in providing their female clients with efficient consultant service for realization on the labour market in the field of ICT. The aforementioned reasons, together with some other ones, which will be analyzed in the current section, pose the question of what steps should be undertaken in order to improve the situation. Identification of the concrete needs and barriers requires special attention. It is the basis for embarking on adequate and efficient stets in order to provide the female students with the viable opportunity to follow the ICT career path.

3.3.1 Introduction

The role of the **vocational counselors** is of crucial importance for efficient and thorough analysis of the obstacles, as well as the specific needs of young women in the field of ICT. Only then these consultants would be able to contribute effectively to the significant improvement of the situation of the female students.

The situation differs with respect to the various socio-economic, cultural and political conditions in the different countries and regions in the world.

3.3.2 Context - general overiew of the situation in the region of south eastern europe

In an attempt to present the state of young women, chosen the ICT career path in the region of South Eastern Europe, there are several preliminary specifications to be taken into consideration.

Until 1990, under the Council for Mutual Economic Assistance (CMEA) Bulgaria was the only country in Eastern Europe that specialized in high technologies. Three generations of Bulgarian professionals gained recognition in Western countries in the field of mainframes of 5th generation, high-speed matrix processors and parallel systems. In the established research and development institutes a number of groups were organized to work in the area of software development, firmware, system hardware, digital and analog PC design, etc. In the past Bulgaria was called “the Silicon Valley of Eastern Europe” because of its strategic specialization in high-tech and ICT products.

After the political and economic changes in 1990, the powerful Bulgarian electronic industry lost many of its traditional markets and the production was dynamically restructured. The big state-owned electronic enterprises collapsed and at the same time a great number of small and flexible private companies appeared on the Bulgarian market.

The introduction of market economy was among the greatest changes that nationals of these states had to accept. It was in complete contradiction with the existing up to then planned economy. The thoroughly altered principle of functioning and organization of the economy brought about confusion and uncertainty in large percentage of the population in these countries. In spite of the difficulties and the quite long period of transition, the situation has entered into a stage of sustainable and positive development. This process could be seen more or less in any field of life. It also had its impact on the ICT sector, where the western information and communication technologies were widely introduced and began their implementation.

Labour market trends during the 1990s indicate that although men and women were affected by the loss of job security and employment cuts, until recently women took over a large share of the adjustment costs. This could be explained by the horizontal and vertical segregation of women's jobs but also by their position as secondary earners, inherited pattern of male dominated labour market institutions (trade unions, chambers of commerce) and policies. The latter reflected a traditional male breadwinner approach to employment despite high levels of women's participation in the labour market in the past.

Women had fewer opportunities to start their own business due to gender specific barriers in access to information, networks and collateral. Similar patterns of male advantages could be observed in other regions (Elson, 1999). Establishing gender sensitive policies supporting women development in the ICT is thus an important priority of economic policies in transition countries.

The ICT sector rapidly gained much popularity and a larger number of young people were tempted to choose this career path. Of course, this process could not leave apart the girls. Although before 1989 there were female students studying ICT, this sector became pretty much attractive in the 90ties of the XX century and thereafter. But these young women have been facing grave obstacles, barriers and challenges of any kind in the process of realization in this field. They need special support and much more attention in comparison with the male representatives. It is the task of vocational counselors to provide this support and contribute to the efficient realization of these women.

From a gender perspective, one very important issue is women's access to a "male" education profile, which includes most of the ICT related subjects. Though women are often better educated than men, their education profile remains "female". In most countries in the region of SEE women are a majority among university graduates, but in only some countries is their share in commerce, law, mathematics and computer sciences close to that of men's. Women continue to choose a "female" education profile, which locks them into "female" segments of the labour market. Among university graduates, they still dominate in arts and humanities, social services and medical studies. To meet the challenge of new information and communication technologies (ICT) more investments in women's education is required.

But, vocational counseling of women in the field of ICT in the SEE countries is still in the phase of initial development. It has not gained the required impetus, self-confidence and support (both technical and know-how) in order to improve effectively the situation.

In the contemporary life of advanced implementation of modern media and information and communication technologies, the relevant and satisfactory education of female students in this field becomes more and more important. It requires specific attention and deliberation with respect to the certain barriers posed in front of these women, who have chosen the career path of specialists in the ICT branch.

The ultimate aim of the information society is the empowerment of all its citizens to access and use this knowledge, but there is concern that some people, including women, are more distant than others from the opportunities presented by the changes being brought by ICT. Thus, although the Internet has been hailed as an emancipating and democratizing force, it is not gender-neutral and it has been suggested that the information society is becoming increasingly divided.

For a long period of time there has been a concern that women are excluded from computers and thus from the information society. Still, women are relatively absent from computer science and the design of ICT products. However, there are important changes going on: the transformation of ICT and their penetration into the home, education and the workplace means that the level of use of computers, the Internet, mobile phones and other systems by women and men is converging.

Nevertheless, there are still numerous types of barriers that hamper the process of vocational realization of female students in the ICT branch.

3.3.3 Overview of the situation in Bulgaria

3.3.3.1 Background

Bulgaria has had a tradition of excellence in producing information technology products. During its affiliation to COMECON the country specialised in production of mini computers, processors, peripherals (magnetic disk and tape memory devices), teleprocessing systems and devices, and personal-professional computers. Bulgarian computer exports amounted to 48 percent of the entire COMECON market in the 1970s. This market share was maintained until the early 1990's. According to official statistics for 1989, electronics and telecommunications accounted for 25 percent of Bulgarian industrial production. A total of 130,000 people were employed in this sector, of whom 8,000 were highly qualified engineers.

According to independent sources, in 1989 about 95 percent of the total production in this sphere was sold on the COMECON market, mostly to the former Soviet Union. In the late 1980s Bulgaria was the leading supplier of 5th generation computer systems to Soviet research institutes. Bulgaria also covered a large share of the Soviet markets for personal computers5. Many of the PBX systems for the COMECON region were also produced in

Bulgaria. These markets were artificially protected and Bulgaria's ICT industry suffered a serious shock with the political transformation and the transition from centrally planned to free market economy after 1990.

A number of factors such as global competition, poor corporate management of local enterprises, lack of government support and funding, and disintegrating mechanisms of supply and demand within COMECON led to a dramatic decline in production capacity and severe drop in export figures. The country lost most of its markets in the former Soviet Bloc countries. This led to serious social problems and disqualification of the labour force.

Since 1997 the Bulgarian economy has been going through a period of structural adjustment. In a stabilised macroeconomic environment, characterised by a low level of inflation, an effective currency board, and hands-off approach of the state toward economic activity, ICT has been one of the most dynamic sectors of the economy.

Bulgaria is still at a relatively early stage of preparedness to utilise the benefits which information and communication technologies can offer for achieving economic growth and competitiveness, for enhancing the quality of the education system, or improving the efficiency and transparency of government operations.

3.3.3.2 ICT and Higher Education in Bulgaria

Most **Bulgarian universities** and colleges lack the amount of computer resources, although the necessary investments in hardware and connectivity are becoming more common. An accurate assessment of the current state of ICT infrastructure in universities is seriously impeded by the lack of reliable and up-to-date information on the availability of personal computers and Internet connections. Among some of the reasons for that are the academic autonomy of the schools and different management schemes make the collection of such data a very difficult task.

In addition to the limited access to technologies, the qualification of university professors is one of the most serious problems facing higher education in Bulgaria. About 70% of young professors in the field of modern technologies have left the universities. The "brain-drain" works in two directions: internal migration towards the private sector and emigration to universities and private companies abroad. Enrolment in post-graduate programs, particularly in the field of ICT, has also declined and the situation is not likely to improve in the near future.

Bulgaria has had a tradition of excellence in science and technology education. But many technically educated Bulgarians emigrated after the onset of political nd economic transition in 1989, drawn by better employment opportunities in other countries. Some proportion of teachers has also joined to emigrating aboard.

Currently, 29 Bulgarian universities offer programs in fields related to ICT. The number of students in this area of study is currently 6,48521 (about 3% of the total number of students). Additional 221 students are enrolled in

post-graduate education programs. The number of doctoral students at the research institutes of the Bulgarian Academy of Sciences is only 59.

Different surveys indicate that 90% of the students in Bulgarian universities use ICTs and about 50% are enrolled in some sort of ICT training. A number of universities have achieved successful co-operation with the private sector on specialised education or professional training programs but, due to the general economic situation in the country and the existence of certain legislative barriers, the private sector has little interest in co-operating with universities or supporting university research programs in the field of ICT.

There are 47 Universities in Bulgaria, located in 26 cities and towns. Around 50% of them have computer specialities (*ICT Development Agency – MTC Republic of Bulgaria*). Over 6,000 Bulgarian students are currently majoring in Computer Science; another 5,000 have chosen electric engineering, mathematics, physics and biotechnology. The research and development in the area of ICT is concentrated in the Schools of higher education and the scientific laboratories of the Bulgarian Academy of Sciences.

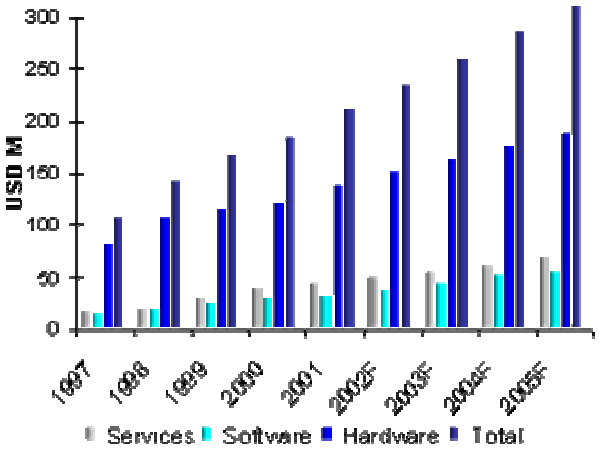
3.3.3.3 3.3.3.3. ICT employment opportunities

According to Vitosha Research data 186,000 people in Bulgaria currently have high education related to information and communication technologies, and 565,000 have formal computer training. A quarter of those with high education in ICTs had further or parallel computer training. Around 443,000 people trained themselves, either at the job or assisted by friends. **It could be concluded that some 16.2% of the population is computer literate.**

Assessment of the labour supply related to production of ICT goods and services is a difficult task and often subjective.

Experts estimate IT specialists (incl. Software developers, Internet applications and design, system administration and hardware assembling and support) in a wide range from 4,000 to 15,000. In the most popular site for IT jobs (www.itjobs.bg) 2,000 actively seek employment out of 9,000 registered IT professionals.

3.3.3.4 ICT branch in Bulgaria



Source: ICT Development Agency – MTC Republic of Bulgaria

According to research of the IDG group, the yearly growth of the IT sector in Bulgaria is about 35%. IT spending for 2001 is about USD 188.4 million and estimated total revenues will be around USD 270 million.
The IT companies in Bulgaria cover almost the whole spectrum of IT development activities and services. Few specific areas could be mentioned, regardless of the fact that some of the IT companies work in more than one area:

- software - computer system software, networking software and web-design, CAD/CAM/CAE software, telecommunications and wireless development software, application software, firmware;
- hardware - computer and systems assembling, digital and analog printed circuits design, PCB manufacture, analog mixed engineering;
- microelectronics - design ASIC's, front-end and back-end microelectronic activities;
- Automation - systems for industrial automation.

3.3.4 Analysis of the situation of the needs and barriers for supporting women

Vocational counselors are those who often identify these barriers in the process of providing advice and consultations to their clients - young women who plan to follow the ICT career path. These experts face the real situation of ensuring the most appropriate opportunity for the vocational development of the client in the presence of obstacles of different origin and importance. They need to respond to the challenge of implementing different strategies with respect to the concrete needs of the client.

Concerning the different approach that vocational counselors undertake towards male and female clients, it should limit itself only to the diverse initial state and preliminary adjustment inherent to the representatives of the two sexes demonstrate. Men are usually well-aware of what they want and how to achieve it in the ICT sector, while female students are much more confused, they do not have clear vision of what will be their

concrete career path in this branch. That is why it should be the obligation of the counselor to ensure the confidence building of the female client.

However, there should be no different approach with respect to the application criteria, skills required or any other conditions that provide for unequal treatment towards men and women. They should be treated on equal basis as regards to their professional capacities. Only then there could be unbiased and professional evaluation.

In order to create a clear vision of the concrete situation of the female students in the ICT sector in Bulgaria, here is a representative statistic, maintained and provided by one specialized center supporting and encouraging student labour - the Student Labor Center in Sofia.

During 2003 (*Student Labour Center* – Sofia, ANNUAL STATISTICS, 2003), until the beginning of December 18 573 students /male and female/ visited the Center for assistance in finding a job. The number of students in the ICT sector is 1412 /which are 7, 6 % from the total/. Female students are 620, which is 43, 9 % form these 1412 persons.
The number of those who managed to find the appropriate job position are 438, which is about 70 % of those who decided to use the services of this center.

Having made this specification, as well as the general description of the situation, here is a list with **the main barriers that female students in the ICT branch meet:**

- Society and the public opinion as a whole fail to combat the prejudice and stereotypes, imposed and developed throughout the years that women are not capable of attaining high goals and professional realization in the ICT field.
- Female students experience difficulties in their professional orientation in the ICT branch because they have built up psychological barriers. They underestimate their capacities and usually lack self-confidence.
- There is substantial lack of cohesion between the offered education and the requirements of the labour market with respect to the capacities of the candidates. Universities do not provide for development and acquisition of relevant capacities. As a result, female students meet with the disappointment of failure to get certain job, because of the improper preparation.
- Women need information about the broader concept of ICT - its potential relevancy and potential capacity. In many cases ICT is presented in quite a narrow meaning, without taking into consideration that it encompasses much more - multi-media, multi-faceted approach.
- Women are not trained in a constructive way that helps them build on their skills. Furthermore, there is a lack of concrete strategy to support them.
- There is need to integrate ICT and gender recognition into a broader range of sector and regional policies. As well, ICT and Gender policy should be developed at all levels - regional, national and local.

Although women represent increasingly large proportion of Internet and IT users, they are underrepresented among designers, leaders, and managers in the IT world. Women with the necessary skills training and education

for IT employment and careers, with open doors for advancement, are still minority, and data available suggest that this pattern is hardly improving.

3.3.5 Vocational counseling services

The long transition period in Bulgaria had as a consequence slowing down of the initial impetus gained after the fall of the Iron curtain. That is why, there was a process of falling behind in many areas, including vocational counseling. As a follow up, this kind of services is now in an emerging state, attempting to bridge the strong market needs with the wide number of candidates.

The current state of vocational services in Bulgaria as a whole in the field of ICT is in a phase of initial development, where the consultants meet obstacles of different origin in the process of providing their clients with the relevant service. The situation is even worse when observing and analyzing the work of consultants of female students chosen the ICT career path.

3.3.6 Interviews with vocational counselors

Following the main goals of the PROMICT project, vocational counselors have been interviewed in order to share their opinion and views about the specific needs in supporting female students in the process of their professional realization on the labour market in the field of ICT.

The interviewed consultants have been selected after conducting preliminary survey of the existing consulting services in the field of ICT in the region of activity of the organisation. The main objects of research were the public employment agencies, non-governmental organisations, associations providing such kind of service. On the basis of the results, two consultants have been chosen. For the aim of the project, these were representatives of the the both sexes. The interviewed vocational counselors (for those interested, transcripts of the interviews could be found in the Annex of the current section), are professionals with large experience in the field of consulting. On the basis of the well-grounded theoretical knowledge, these experts further improved their capacities. They have developed important practical skills and a set of pragmatic approaches to efficiently provide the consulting service.

On the basis of the impression from the interviews with these professionals, they could be described as people, having the following charactersitics:

- high-quality theoretic capacities and expert knowledge in the field of consulting;
- experience in efficient application of the person-oriented approach towards female clients;
- wide and deepened view over the real needs of the female students – gathered during their daily communication with young women.
- Willingness to improve the quality of the offered services;

3.3.7 Analysis of the Interviews with vocational counsellors

The main accent of interviews was concentrated on the specific obstacles these professionals meet in their work with young women chosen the ICT career path. Furthermore, these consultants were encouraged to present their personal point of view for the improvement of the process by means of providing recommendations, based on their experience, observations, theoretic backup and practical skills.

Analysing the interviews with these professionals, the following could be concluded:

- These **consultants lack different types of support**, materials and informarion resources to assist them in providing relevant services to their female clients. **Good practises** are also missing. They need to have at permanent disposal easy-to-reach supporting materals **– on-line modules, tutorials to provide guidance and instructions for the optimisation of their work.**

- These consultants affirm the strong need of detailed strategy so as to ensure the best services to these young women.

- The current state of **promotion of ICT to female students in Bulgaria** has its own specifics with respect to the conctere socio-political, economic and cultural environment, as well as the level of development of the computer technologies and modern communications;

- **Vocational counselors** meet quite a lot of obstacles and challenges in the process of preparation and conduct of consultations with female students in the ICT branch.

The concrete **obstacles,** that vocational counselors working with female students in the ICT sector enumerate, are mainly the following:

- There is lack of public and professional support for the promotion of female specialists in the ICT branch;

- Stereotypes and prejudice still prevail over the rationalist tendency of ensuring equal gender basis for career development in the sector. For instance, it is a common thought that women lack the capacities and skill required to work in the field of computer technologies, computer science;

- Existence of psychological barriers on the side of the female clients themselves. Most of these women feel uncertainty and are kind of afraid of following this career path. It is due to the fact that such negative agents as stereotypes and prejudice influence on them.

- Some of them do not have the necessary motivation and are unable to determine their concrete interest, as well as provide detailed description of the job position they would like to occupy. This dangerous and annoying fact needs analysis and building relevant strategy to overcome this negative tendency;

- Some companies in the branch turn a blind to the professional skills of women only because of the gender prejudice;

- Companies that have vacancies and use the services of different HR agencies and Labour Centers, state it clearly that want to recruit only representatives of the "stronger sex". Of course, when the vacant position is announced, there is no any formal gender requirement posed, but " de facto" it exists;

- There is lack of strategic and innovative way of thinking with respect to assessing the applicant on the base of his/her skills and aptitudes;

- Gender-sensitive awareness and information on this topic is highly unsatisfactory. Gender –sen sitive materials reveal the equality of men and women and provide for concrete positive in this direction.

- Another barrier springs from the very fact that the promotion of ICT to female students does not have substantial background. It has become popular during the last decade. So, girls are to make timid steps ahead without having good practices examples;

3.3.8 Recommendations:

Having enumerated the barriers and needs for female students in the quest for realization in the ICT sector, we propose a list of recommendations drawn from both the analysis of the literature used and the interviews with the vocational counselors.

I. On the basis of the analysed literature:

The situation requires development and in this connection there are several recommendations that could be proposed in order to facilitate the process of vocational realization of female students in the field of ICT sector:

- Implement developed on-line modules and other supporting materials to assist the vocational counselors in providing efficient consulting service;

- Establish and maintain a full set of regularly updated statistics on women with professional realization in the ICT sector;

- Promote the employability and the access of women to ICT jobs, particularly by increasing the participation of women in relevant education and training;

- Women should be better represented among people benefiting from proactive measures. In this respect encourage measures to promote lifelong learning and access to the active labour market for women;

- Support further development and coordination of national statistical systems, where required, in order to allow for better monitoring of gender related issues in the European Employment Strategy;

II. Based on the analysis of the interviews with the vocational counselors:

The experience of these professionals is among the best means of providing realistic and applicable proposals with respect to the concrete political, social, economic and cultural environment in the country. These recommendations are:

- Increase the personal self-confidence of the female students, who have chosen the ICT carrier path.

- Introduce best practices as successful mean in carrying out vocational counseling. Use the positive and useful experience other countries have gained, as well as their models that proved to efficient and expedient;
- Provide these clients with detailed description of the labour market in the field of ICT – what are the tendencies, what are the companies that best meet their requirements. To this end counselors should be well acquainted by reliable information resources;

- Organize on regular basis seminars, workshops, training for education of consultants working with female students in the field of ICT so as to keep them in pace with the modern methods and practices acquired and evolved by the world leaders;

- Overcome the negative notion that women are unable to compete with men in the field of ICT. This could be attained by means of compiling and presenting "true stories" of women who have gained success and respect as ICT professionals.

- Raise the awareness of the society on the promotion of gender equality, including in the field of ICT sector. There is visible lack of gender-sensitive materials and pressing need for annihilating the existing prejudice that women are the "weaker sex" and have nothing to do with the implementation of modern technologies, computer science.

In an attempt to make a conclusion, it could be pointed out that there is craving need of developing a detailed and working strategy for supporting female students, who have chosen the ICT career path. Only when it is duly implemented and followed by the respective parts engaged – ICT companies, government, applicants themselves, vocational counsels, university authorities – could the situation with professional realization of female students in the ICT sector really be improved.

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3.3.10 Annexes:

Annex I: Interview with a female vocational counsellor

Q: Which professional background are you coming from?

V.C: Master degree in "Economics and organisation of labour market" and I have been working as consultant for more than 9 years.

Q: Did you personally ever think about taking up an ICT career path? Name arguments for and against.

V.C: Well, not actually, I am pleased with what I am doing and would like to further develop my skills in the field of consulting.

Q: What experiences do you have in motivating your female clients to choose a technical courses or carrier (next job)

V.C: As I have already mentioned, the years I have spent in the consulting sector have provided me with the necessary observations and conclusions, which support me in doing my job better and better.

Concerning my concrete experience with female clients in the ICT sector, I could say that daily from 5 to 10 young women turn to me for advice and assistance.
The same sex provides for the easier predisposition and facilitates the communication process. In fact, most of these women are looking for professional development, not for attending technical courses.
Although I have not graduated technical subject at the university, I underwent specialised courses, training and seminars in the field of ICT and consulting, so the combination of this knowledge with my experience provides for relatively positive and relevant qualification.

Q: When do you usually recommend IT job-profiles during counselling (in classes; in fairs or personal consulting)?

V.C: There are different levels of communication with the clients. I carry out seminars and training, as well as personal consulting. Both have their advantages and drawbacks and the combination is the best decision, in my opinion.

But, to put it frankly, the individual conversation is more expedient. It allows to choose the concrete approach with respect to the specifics of the client /not only information concerning education, experience, but also psychological adjustment, etc/.

Q: Which kind of assessment-material do you use in perceiving the competence level of your client regarding IT-and IT related competencies /jobs? Do you use different gender-sensitive material?

V.C: Well I try to implement the innovative means of assessment. There are pretty different ways – specialized or general tests, assessing the technical skills of the client, on-line tests.
Q: What kind of support do you need for this? (IT communication tools; information).

V.C: These tools in general are – maintaining permanent Internet connection, have at my disposal technical support by computer, multimedia projectors, multimedia products that are both easy to present and at the same ensure a thoroughness of the information provided.
It would be perfect if there is developed smart intelligent Content Management System /CMS /, within the framework of which highly sophisticated database including:
Statistics with the results of the other applicants /not only their points, but also practical overview of a sample career development path /for example, on the basis of the points, the client will be offered the most relevant position, as well as a scheme of how would she develop within a certain numbers of years.
Maintain records with true stories of my former applicants. These girls describe how they managed to overcome the difficulties with respect to their sex. Thus the female students in the ICT sector will obtain additional support and will be encouraged, having the best practices.

Q: Addressing male and female clients during the counselling session: what differences do you make?

V.C: My first obligation and mission is to provide the best assistance to the client without making differences with respect to the sex. However, having in mind the additional obstacle females confront, I do my best to help them. In fact, there is tendency that girls are less orientated. A substantial percentage of them apply for ICT subjects without having a clear vision of what exactly they would like to work in the field of this sector. They lack the impetus and perhaps the motivation…
That's why, they need to be encouraged by all means and supported in finding their real interests and making them ambitious.

Q: What would you recommend to your female/male colleagues?

V.C: Not to underestimate the necessity of different approach towards female clients. They definitely need much more support. I shall be extremely satisfied if there is a kind of guidebook for consultants working with female students in the ICT sector. Thus all my colleagues, including myself, will be given a very useful tool.

Q: Where do you get your information about current job-profiles in the ICT industries (newspaper, personal contacts with representatives, vocational counsellors...)?

V.C: Well, it is mainly by means of personal contacts with the companies in the ICT sector, specialised newspapers, on-line database, and human resource agencies. Also, vacancies are published on the www sites of the official institutions and companies.

Q: What kind of additional information would be useful for you in transferring labour market demands to your female students?

V.C: I should be provided with detailed and regularly updated information on the state of the labour market in the field of communication technologies and computer sciences. At present, there is a lack of structured and classified information source. That is quite a big problem, which could be overcome.

Q: How do you follow the changes in the job-profiles (regularly/partial; basis?)

V.C: By updating the vacancies on regular basis. This means, I try to do it two or three times per week.

Q: Name an ICT company, you personally would like to work for? Why? (Describe your "dream-career" and the working environment).

V.C: Let me think a little… Well, I cannot name a concrete company, I mean, it is important this company to give me the chance to develop my skills, stimulate my professional perfection and provide me with the appropriate working environment – relevant equipment and motivating working conditions.

Q: If you were asked to develop a new material raising the awareness and competence for ICT of female students for your clients, which one would you recommend and in what form?

V.C: I strongly believe that developing only a concrete material will not be satisfactory with respect to the seriousness of this topic. What comes to my mind as a possible proposal is organising annually an event, a meeting of female and male students in the ICT sector with representatives of companies conducting their business in the same branch, where these young women will have the opportunity to present their capacities. They could make presentations of products or other materials they have developed. This would give the possible employers the chance to get acquainted with what these ICT specialists are capable of regardless of their sex, on equal basis.

Q: How do you assess the quality of your computer equipment (hardware/software-e learning environment) in your daily consulting practise?

V.C: Well, e-learning is the method that still needs to be introduced and developed in order to fulfil its role as important and efficient means in the process of consulting the client. It is a positive sign that there are such organisations as Student Computer Art Society /SCAS/, which develop and implement e-learning and e-consulting aiming at making them accessible for the society.

Q: What kind of information do you need to support your clients about recruiting strategies for IT companies?

V.C: To be very well informed about the tendencies in the ICT sector, have at my disposal regularly updated statistics of what are the most preferred job-profiles within it, which professions are most demanded by the companies. Only then will I be capable of providing my client with the relevant support and advice.

Q: What kind of support do you need to improve your gender-sensitivity towards your male and female clients?

V.C: Classified information and resources on the topic.

Annex II: Interview with a male vocational counsellor

Q: Which professional background are you coming from?

V.C: I graduated the Technical University in Sofia. I have Master degree in Computer Sciences.

Q: Did you personally ever think about taking up an ICT career path? Name arguments for and against.

V.C: I have been tempted not once to devote to the ICT branch and find a personal realisation within it. However, I find it very important to provide as many people as possible with the necessary support and advice in the process of making their steps in the field of professional and career development.

In spite of the temptation to start my own career as ICT specialist, I am strongly convinced that in the present situation my work is much more useful and challenging.

Moreover, I have already gained the experience and confidence that give me personal satisfaction with the job choice I have made.

Q: What experiences do you have in motivating your female clients s to choose a technical courses or carrier (next job).

V.C: In fact, I have had the opportunity to meet and talk to a lot of female students, who have made up their mind to work in the field of ICT. My observations are that most of these women feel uncertainty and are kind of afraid of following this career path. It is due to the fact that such negative agents as stereotypes and prejudice influence them.

Q: When do you usually recommend IT job-profiles during counselling (in classes; in fairs or personal consulting)?

V.C: I strongly believe and in fact my practice has proved that it is very important to build a complete strategy on recommending IT job –profiles. This means that none of the alternatives should be excluded. For example, even if the advantages of the personal counselling are obvious, one should not underestimate the importance of the other forms.
My experience leads me to the conclusion that the general presentation could be successfully presented in class, but the individual questions and specifics are to be clarified and discussed during personal meeting with the client.

Q: Which kind of assessment-material do you use in perceiving the competence level of your client regarding IT-and IT related competencies /jobs? Do you use different gender-sensitive material?

V.C: Yes, I use gender sensitive materials, but you know, in fact there is much to be done in this direction. I mean, it is quite difficult to find such materials.

Concerning the assessment materials, I prefer to combine theoretic examination / by means of ready tests / with engagement of the client in practical exercises.

Q: What kind of support do you need for this? (IT communication tools; information).

V.C: My experience has proven that when you work as counsellor you need to select the best combination of tools. While carrying out the assessment tests, it is important to present them in the most relevant, attractive and impressive way. It can be attained by means of multimedia materials that interactively engage the client. It will be useful, if there are short videos of women, telling their stories of professional success in the ICT branch.

Q: Addressing male and female clients during the counselling session: what differences do you make?

V.C: Well, in my opinion it is of substantial importance to have equal treatment towards both male and female clients. However, females will certainly need some kind of additional support, especially with respect to the difficulties they could meet. It is a common fact that, on purpose or not, women are not capable of meeting the challenges of such professions as these in the ICT sector. It is the task of the consultant to confide them in the opposite statement.

Q: What would you recommend to your female/male colleagues?

V.C: Do their best to provide their clients with the best assistance and advice they need. They could follow the following steps:

predispose these young people to feel comfortable and talk openly about their preoccupations, fears, doubts;

present the current situation on the job market / it requires being well-informed, have at your disposal updated information, etc/;

Do not omit the barriers and difficulties they not only "could", but also " will" inevitably meet. Prepare them for all these obstacles by enumerating them and proposing possible strategies for overcoming them;

give examples about female applicants who managed to find job as ICT specialists and feel satisfied with their current occupation; give concrete examples – it always provides for better results in mobilising and increasing the self-esteem of the client;

use innovative approaches while conducting the tests with the client – computer-based tests, multimedia exercises;

Encourage her all the time, etc.

Q: Where do you get your information about current job-profiles in the ICT industries (newspaper, personal contacts with representatives, vocational counsellors...)?

V.C: Well, my main resources are the following:

specialised internet-based database;

employment agencies;

student resource centres;

newspapers;

Q: What kind of additional information would be useful for you in transferring labour market demands to your female students?

V.C: Well, I just thought of the need for making easier and relevant the connection between employers and employees.

Let me tell you about partners of ours from Ireland, who have developed a good practice model in this field. So, they gather together representatives from ICT companies, which deliberate upon the main

aptitudes one could have in order to be regarded as possible employee. Then they agree on a common list of such capacities and it is regarded as basis for carrying out concrete training in order to ensure the required preparation for the applicants.

Q: How do you follow the changes in the job-profiles (regularly/partial basis?)

V.C: It is an important question. In fact, I do my best to get updated information regularly. However, it is quite difficult. There is much to be done in this field. As you can suppose, I should have at my disposal the most relevant and updated job-profiles, in order to provide the client with the best alternative. Otherwise, there is a viable risk of losing the confidence of the client.

Q: Name an ICT company, you personally would like to work for? Why? (Describe your "dream-career" and the working environment).

V.C: First of all, such company should meet two very important requirements: apply and develop innovative technologies and approaches and provide for the personal perfection of the employees.

V.C: To put it frankly, a company based in the Silicon Valley would be the best choice. I am talking about companies from the rank of Oracle, IBM. These organisations always share a big deal of innovative solutions in today's market and keep high level standards.

Q: If you were asked to develop a new material raising the awareness and competence for ICT of female students for your clients, which one would you recommend and in what form?

V.C: Well, what comes to my mind at the moment is a kind of public campaign. There could be leaflets distributed, carrying out happenings in support of increasing the chances for realisation of female students in the ICT sector.

The aim should be to challenge the prejudice and stereotypes that men are the only to work in the field of modern media, computer science and the related realms.

Q: How do you assess the quality of your computer equipment (hardware/software-e learning environment) in your daily consulting practice?

V.C: At the present moment the technical equipment plays a substantial role for ensuring me with the necessary technical and material support in my work with female clients. I use the assistance of Internet-based products and the resource base of on-line career centers. For instance, I turn to the Virtual Career Centre, developed within the Developing Youth Career services Project.
Also, recently I got acquainted with the multimedia CD " On the job market", developed by Student Computer Art Society – Bulgaria. I strongly recommend this product.

As refers to e-learning environment, there is much to be done in this direction. It is a very useful method but unfortunately has not got the necessary popularity and only a limited sector of the civil society.

Q: What kind of information do you need to support your clients about recruiting strategies for IT companies?

V.C: Systematized information and best practices from other countries, which could be very efficient for increasing the willingness and self-esteem on the side of the female clients.

Q: What kind of support do you need to improve your gender-sensitivity towards your male and female clients?

V.C: Well, as I have already mentioned, there are not many materials in the field of the gender equality in general, particularly in our country.
So, I definitely need support in getting access to such products, as well as undergo training in the field.

3.4 Barriers and needs for supporting women – Perspectives on Human Resource Management in ICT companies

Maria Schwarz-Wölzl, ZSI,

3.4.1 Summary

Unquestionable, the educational factors play an important role in the gender gap featuring the ICT professions, however, the gender gap also finds ist roots in recruitment strategies, in the work organisations and the working conditions.

Generally speaking, the organisational factors are more significant than the technological factors explaining women related friction in the ICT labour market. An Australian survey on women in ICT professions found out, that "the women think that their difficulties rest more on the adaptation to a male organisational culture than women's technological aptitudes" (Pringer R. &al., 2000, quoted in: Vendramin 2003: 60).

The barriers can be gathered in the following main categories:

- **Men oriented working conditions and lack of work-life-balance**
- **Low career prospects**
- **Masculine culture and hostile working environment**
- **Women's low self esteem**
- **Unequal remuneration**
- **Social competencies undervalued**

The following chapter is divided into two approaches:

Explanatory factors to the gender imbalances related to ICT recruitment, employment and occupation and provision of possible solution, both drawn from **secondary literature.**

Identification of challenging issues of Human Resource Managers/HRM or employers in ICT companies, when they try to overcome the gender disparities in recruitment, employment and occupation. Four **interviews** amongst ICT employers or HRM were investigated to view their current gender inclusion strategies and how and where they see the need of support into more tangible initiatives.

3.4.2 Explanatory factors – analysis of secondary literature

3.4.2.1 Introduction – characteristics of the ICT labour market

Data from 1999 shows, only 21% of ICT occupations were located in the ICT-sector, whilst the majority of ICT-workers were employed in other industry-sectors throughout Europe. (Millar J. 2001:10ff) . According to Webster & Valenduc (2003:28) the majority of firms in the ICT sector are specialist firms, which are dominated by computing services for client companies. 93% of those computer services enterprises are employing less than ten employees. Whilst larger companies tend to have structured human resource policies, many small companies tend to be far away from any "women friendly" policy.

Anecdotal evidence suggests that the ICT sector have specific characteristics that impact the HR models. Reasons to why particular HR models tended to dominate in the sector might are (see MacKeaogh July 2003):

- Pace of change and the individualised nature of work,
- Meritocracy and corresponding to that performance based - including profit share element -payment structures,
- Predominance of non-union organisations and others.

As a consequence of the fast change processes in the field of ICT, like reorganisations, downsizing, closure and business process re-engineering, ICT workers must manage by themselves their employability and career; required both vertical and horizontal flexibility have brought in the expressions of "nomadic career" or "boundaryless career", which illustrate insecurity in these professional trajectories (see Vendramin 2003).

The ICT labour market provides limited opportunities for non-standard employment both within the ICT sector and in ICT occupations; in 1999, 94% of the ICT-jobs in Europe was on full-time basis, whereas only 13% of the full time ICT workforce is female (Millar J. 2001:17).

A common argument of the under-representation of female ICT-workers is, that the labour market provides only a low number of female job applicants. But the following chapter shows, that the gender gap also finds ist roots in the recruitment policies, in the work organisation and the working environment. In fact, once successful on the ICT labour market, the level of turn over is very high for women ICT professionals. No less than 41% of the women ICT professionals interviewed by Gewirtz & Lindsey's (2000, quoted in: Moreau 2003:124) would intend to leave their job.

3.4.2.2 Men oriented Working conditions and lack of work-life-balance

The ICT sector is likely characterised by long working times, irregular and little predictable schedules, "blurring boundaries" between the professional sphere and the private sphere, between professional time and private time (see Vendramin 2003:57) – that make difficulties to women balancing work and family load. After the background of the wide-spread rules in the ICT sector "being always the fastest and the first" the according work rhythms leaves little space to private related constraints.

Numbers of studies show evidence of poor access by women to flexible and family friendly working arrangements within the sector:

- Gewirtz & Lindsey (2000, quoted in Moreau 2003:126) showed in their study among women ICT professionals, that "68% say(ing) that they're worried about the stress of the around-the-clock lifestyle and the lack of work/life balance...".
- A survey, carried out among 250 ICT companies leaders in Baden-Württemberg (Germany), highlights low reflections on that issue: 60% of the respondents think that there are no particular obstacles to women's professional careers. Consequently, a lack of attention of the managers for the possible promotion of women, as well as the lack of advice for career orientation was found. (Menez R., 2001; Munder I., 2001; in: Vendramin 2003:61)

- The research by MacKeogh (July 2003) indicates, that HRM in the ICT-sector have fundamental difficulties in terms of responding to the need for greater work-life-balance. "... we have a high performance culture like a lot of other companies in the business and by its nature conflicts with the work life balance so it's a big struggle to get that right." (quotation in: MacKeogh 2003:16) According to MacKeogh, the functions that rely on the greatest training input are the most difficult to operate on a flexible basis; the less skilled the job the greater the chance that it could be operated flexibly.

Work life balance becomes first of all translated into flexible working arrangements, part time arrangements and tele-work arrangements. The debate on the later one is highly controversial; to examine here the pro and cons would explode of the present analysis.

Flexible working arrangements

MacKeogh (July 2003) notes,

- that flexible or part time working is closely related to promotion,
- are seen by HR as particularly difficult in the fast-moving ICT sector,
- do not appear to be in management's interests,
- is an issue of negotiation on an individual basis with the line management,
- the interpretation of "flexible" working hours varies from company to company, from very ad hoc arrangements to "flexi" time.

Flexible working arrangements were seen (among the respondents) as a major initiative that could impact positively on work life conflicts. But they have to also been seen as a double-edged sword, as it is also potentially an instrument that reinforce segregation.

Part time arrangements

MacKeogh (July 2003) further notes, negotiating a part time role can be very difficult: "They're working with their managers- understanding within the scope of the job is there scope to have a part time or a job share – for two people to work at the same time and the amount of work is equal or is there an opportunity for an individual to tailor their current work load to facilitate a part time position".
However, part-time work does not match with such rhythms of work organisation and the concept of "presentisms".

With Vendramin (2003:59) we conclude, "as long as there is so few women with children in these services, there will be no pressure to change the organisation of work."

3.4.2.3 Low career prospect

The same level of qualification than men and comparable skills doesn't necessarily quarantee women the equal career path. A body of studies, focusing on the ICT labour market, show the "class ceiling" of women on the level of their positions; the majority of women can be found in middle-level jobs.

As said, the ICT sector operates on performance-based systems, including not only merit but "presentism" in terms of not simply doing the job but being seen to do the job. "Presentism" entails working life styles like "meetings in the evening and pints after wards ... it's a 12 hour day scenario." (MacKeaogh July 2003:14) which tap women into a "strong sense of frustration... Women felt capable and confident in performing their work in the sector but felt that doing a job well was not enough and that they hat to be "seen to do the job".
As a result, this concept of "presentism" presents diverse forms of discrimination go through female careers (Vendramin 2003:60):

- *"Women miss contextual and cultural information that is necessary to understand how communication runs in the company.*
- *Women are underestimated as regards the social and cultural aspects, including as for their own vision of informatics culture.*
- *Women do not have as many possibilities as men to give their personal definition of professional situations or to present their personal analyses; they are often kept away from strategic decisions."*

As a consequence women have difficulties to reach manager positions. The (male) concept of "total availability" exclude women systematically from vertical career progressions.
Once at the managerial level, Laufer (2000, quoted in: Moreau 2003:129), underlines the need of alternative working time arrangements to reach women's participation in managerial levels: "women managers experiencing much more difficulties with such a model (of total availability). While some of them considered part-time as being a solution (usually one day a week off), others emphasised the difficulties associated with such form of employment. (...) ... they expressed aspirations for a more flexible working organisation, part-time being not, for most of them, a true solution given the negative image of part-time for many male managers."

3.4.2.4 Masculine culture and hostile working environment

The still dominating culture of ICT is usually associated with a male image and hand down the idea of an ICT related professional world where "the young, dynamic and connected men are kings".

- As an example, the image of programmers – "passionately engaged in the development and the test of their algorithms, working night and day to find the least bug, talking in a jargon and ignoring all that is not technical" – is still alive. (Vendramin 2003:61)
- The CREW report (2001, quoted in: Wagner & al., 2003:84) characterises the cultural milieu of engineering enterprises – which might be unfamiliar for women - as "reactive rather than creative, technical decision making disconnected from the people using the technology, lack of effective communication skills, lack of recognition of whole person with range of roles in and out of workplace, lack of recognition of different professional development needs of men and women, gender harassment (exacerbated by racism), lack of recognition of preferred working styles".

It can be assumed that recruiters may share this picture "young, dynamic and male" and thus may induce some discrimination during the recruitment process. Recruitment campaigns themselves still picture the traditional associations with ICT, as been shown by a Dutch analysis (Van den Brekel & al., 1999:8):

- *"The emphasis often lies on the technical aspects of the job, not so much on social and communicative aspects,*
- *Strict and formal training requirements,*
- *Demand for affinity with ICT,*
- *Practically no information is given about the job that is being recruited for,*
- *Way of applying is unappealing for women,*
- *Few possibilities for "learning on the job".*

Referring to the work environment in ICT related occupations, the CREW report describes following strategies, which lead to friction of women during their ICT career path (quoted in: Wagner & al., 2003:85f)

- *"Men use social closure strategies, through defining professional competence and expertise and selecting candidates for promotion. Women rarely receive promotional credits, in particular when there is no clear public statement of the criteria for promotion.*
- *Informal networks work to the disadvantage of women and they often lack the political skills to succeed within an organisational culture where being "concerned above all with informal ties, manoeuvring towards toward the crucial gate-keepers, avoiding the organisational contingencies that trap the unwary" counts.*
- *Paternalistic and protective attitudes often prevent women from making the kind of practical work experiences men enjoy (if these are considered harsh or tough). Being treated "like you're their little daughter" seems to be a quite common experience.*
- *A large issue is women feeling invisible or wanting to blend in, because they are in a token position and/or feel ambivalent about men's gendered expectations.*
- *Finally, sexual harassment or more frequently gender harassment is at the core of women feeling uncomfortable. (...) These behaviours are often subtle and unintentional and can be aggravated by having higher qualifications then men, coming from another culture, and being considerably younger than male colleagues."*

How unincisvely the individual feeling of having the power to reconstruct the male dominated work culture towards more "women friendliness", show the study of Hellens & al. (quoted in: Wagner & al., 2003:86): "Women tend to leave a company if they find the male dominated culture dissatisfying..."

3.4.2.5 Women's low self esteem

Lack of confidence among women is a recurring theme in explanations of gender gap in ICT.

Wagner & al. (2003) in their analysis of several studies, turn to the phenomena of decreasing processes of the women's self-efficacy during the ICT educational carrier. "...women tend to enter computer programs with fascination and excitement and leave them without a sense of competency and extreme low levels of self esteem" (p. 74).

A large number of anecdotal evidence refer also to the law self esteem of women applying for an ICT job.

The low self-esteem together with a hostile working environments - as shown above – along with lack of encouragement might be an additional explaining factor of the high turn over among women in ICT occupations.

That confidence doesn't correlate with competence per se has been noted by Henwood (2000, quoted in: Millar & Jagger 2001:31), moreover she states a "contradiction between women's competence, as measured by assessments and the judgements of an outside observer, and their own subjective experience of technical competence."

3.4.2.6 Unequal remuneration

Although women ICT workers gain higher wages compared to other women in the labour market, they benefit on average from lower wages compared to their male colleagues.

- We know about the American situation, women are both over-represented in the under-sector of the ICT with the lowest wages and receive for the same work a lower remuneration compared to men. (Council of Economic Advisers 2000, quoted in: Moreau 2003:133)
- Also the study conducted by Millar & Jagger (Nov. 2001:16) shows for the UK in the two ITEC[9] occupational categories – computer system managers and computer analyst/programmers – where women are relatively well represented, the median gross hourly salaries of women are between 86 and 79 per cent of those of the men.
- According to a German based survey among 170 female ICT-workers, 52,9% are unsatisfied with their income. 16,5% of all respondents experience discriminations compared to their male counterparts with comparable qualifications. (Möller & al., 2002:121)
- At the level of the highest 10% of salaries are exclusively men represented (ibid).

The example on system analysts, given by the study of Donato (1990, quoted in: Wagner & al., 2003:84f), illustrate the mechanisms of mind setting, which undervalue the social skills of women and provide frictions in their career path. "low paid female analysts who specialised in interacting with users, and high male analysts who specialised in interacting with other IT professionals and with managers."

3.4.2.7 social competencies are required but undervalued

A range of research has indicated that the definition of the key skills and abilities that are required for ICT-related work has changed over time. According to Millar & Jagger (2001:28f) *"pressure for change have demanded a different genus of ITEC specialist who are, alongside their technical skills*

- *Possess strong communications skills*
- *Are able to share their knowledge with specialists and non-specialists through participation in teamwork*
- *Are flexible and adaptive and are able to build and maintain productive relationships with users of the technological systems that they create."*

On the one hand, social aptitudes are required, but on the other hand, these non-technical qualifications are neither recognised nor remunerated.

- The quotation above referring to female analysts, highlights furthermore, that women are automatically placed in supportive activities and be far away of acknowledgement of their social competencies.

[9] ITEC stands for Information Technology, Electronics and Communication

- This is echoed by Robertson's study (1997, quoted in: Wagner & al., 2003:87) who found out "Skill and style in communication, and responsibility for ist vitality, are practices that are highly gendered, culturally differentiated, and usually unrecognised and unacknowledged."

3.4.3 Summary and suggestions to overcome the obstacles

A variety of structural and sociocultural factors that shape women's careers in ICT has been shown, based on the intention, to view these factors rather as a vicious circle than as isolated from one another. The gender gap has various roots and may also have various solutions. Lessons from the secondary literature review should serve the development of practical interventions that would contribute towards improving the situation for women in the ICT labour market.

Barriers (bold) and suggestions are:

ICT occupations are typically full-time, with long working hours and mostly based on clients premises, which intends difficulties to balance work-private life demands.

Generally speaking, the organisation of the ICT sector should favour "the implementation of better working conditions, in particular as regards the management of working time and availability." (Webster & Valenduc 2003:64).

Initiatives of firms to retain women in occupations can be (Millar & Jagger 2001:31):

- The provision of crèches and other facilities on site in order to reduce the negative impact of parenthood on employment and career prospects.
- Opportunities for flexible home-based working that may include a budget allocation to establish the home as an operational base.

MacKeogh (July 2003) suggests, when developing a mechanism to attempt work-life-balance issues, it is important that those that are most affected by the initiative should be involved in monitoring ist development, whilst there would be the danger the development process and it's outcome would loos ist clout if it were comprised only of females. "to get male managers involved it may be necessary for HR to develop business rationales which would spell out the guidelines and goals needed to move work life balance issues from a level of aspiration to one where it becomes embedded in the organisational culture." (quotation in: MacKeogh 2003:18)

The rather masculine working culture consisting of language/jargon, images, working methods, informal networks of men, tend to exclude women.

These images of the ICT culture should be seriously re-considered because they contribute to exclude people who do not belong to these restricted profiles. A more balanced image of ICT and ICT professions must be developed.

Refreshing these images both in ICT-related product- and job advertisements is a core challenge to encouraging greater numbers of women towards participation in ICT employment.

- It is essential, that recruitment campaigns address explicitly both men and women, when it comes to overcome the low rate of women ICT job applicants, as noted by Laufer (2000, quoted in: Moreau 2003: 136).

An practical suggestion to refresh the public image of the ICT sector in order to assist women in their effort to identify pathways to ICT occupations comes from an interview, carried out by Millar & Jagger ((2001:25):
"From a Microsoft perspective, within our marketing ... we have actively taken steps to use female models, and non-gender imagery. This is tricky, as the market we are selling in is heavily male dominated, so we tend to have to include both male and female to avoid alienating people. Where we have had people in recent campaigns, the ratio has been 50:50 and with a female lead. For example, an image of two surgeons, a female one in front of a male, promoting the concept of only using qualified people to work on your critical IT systems."

Information needs to be provided to girls and women about the routes into ICT careers and the job requirements other than just having an ICT-related qualification. Practical initiatives to make women better informed (and these supposed to have a positive influence on women selecting an ICT career) can include:

- the establishment of closer relationships between education and industry
- efforts to integrate women and girls into the community of professional/education practice in ICT. (Millar J. & Jagger N. (Nov. 2001:iiff)

Because of the tendency for young male ICT managers to recruit in their own image, age also sits alongside gender in discriminating against women. Firms need to review their recruitment practices and selection criteria, their language and the image portrayed to ensure they do not discriminate against women directly or indirectly.

More women's mentoring programmes enabling to networks with women at the recruitment- and career development stages are required.

Regardless of their technical expertise, women are assigned to low status functions.

Though women do have the skills necessary to progress in ICT employment, yet few women achieve high status positions in ICT occupations. The promotion of gender mainstreaming and/or diversity management to encourage gender inclusions and career progress, is linked to the achievement of those targets.

Also regardless of their technical qualifications, women experience lower financial remuneration.

The concept of "Equal pay audits", developed by the British "Equal pay task force" as an example to overcome the gender gap in remuneration, should be mentioned here. http://www.bt.com/equalpaytaskforce/

Women tend to have lower self-esteem than men.

According to Millar & Jagger (2001) women have a responsibility to make sure that they are not overlooked in employment. However, their confidence and perceptions of their abilities are typically low and do not adequately reflect their competence.
Thus, in the context of HRM, more initiatives referring to empowerment of women are required. The provision of formal women networks within firms (also linked concept of "diversity management) might be one of possible solutions.

Jobs on managerial levels are not usually family-friendly and women are often forced to drop-out the job.
No practical approach towards solution has been found so far.

(Female) Social competencies are required and rhetorically valued but undervalued in the working day-life.
No practical approach towards solution has been found so far.

SMEs, as the majority of ICT employers tend not to have women friendly HR policies.
No practical approach towards solution has been found so far.

3.4.4 An additional remark - Gender inclusion must relate on business reasons

At the end of the day, gender inclusive strategies provide a win-win-situation both for ICT companies and female ICT workers. HR personnel, interviewed by MacKeogh (2003:19) points out that the key arguments for implementing gender inclusive initiatives must relate on business sense and states following arguments:

- A larger pool of in-take candidates: "Obviously we don't want our candidate pool to be just all male..."
- Attracting employees back into the sector particularly if there has already been an investment into their training and development.
- Importance of being seen to be a company that has a mix of employees and treats them well. "...we want to make sure we have the best skills in the company and that means a mix of people – male, female, different cultures and it also means mirroring the market base – the customer base."
- Greater diversity in the work force may result in a better product: "... we won't have – new ideas we won't be able to reflect reality out there if we don't have a mix of employees."

3.4.5 Perspectives from Human Resource Managers in ICT companies - Analyses of Interviews

The following chapter identifies issues of challenges for Human Resource Managers/HRM or employers in ICT companies, when they try to overcome the gender disparities in recruitment, employment and occupation.
While some information on gender specific barriers and obstacles in the ICT sector drawn from secondary literature has been shown in the chapter (...), there is still very little information on how ICT-companies view both structural, organisational frictions on recruitment, employment and retention of female ICT-workers and how to overcome these frictions in gender inclusions. Doubtless HR-functions have the core management position in women inclusion strategies; tapping into their expertise it may be possible to explore actions that are encouraging equality.

Thus, the interviews investigate how HRM/employers view their current gender inclusion strategies and how and where they see the need of support into more tangible initiatives.

The results of the present analysis report target to employers and HRMs who may become "change agents" in the European policy to overcome the gender disparities in ICT employment and occupation. They are key players in creating gendered work pattern.

3.4.5.1 Sampling and Methodology

It was expected, that firms, being either already engaged in one of a "Women in ICT"- related project or having already implemented elaborated strategies of women inclusion, that these HRM can provide useful information due to their already existing labour-sensitive knowledge based on past awareness building processes and to provide more specific in depth insights in their immediate areas.
Their expertise will be used to discover aspects of learning objectives that might impact on training modules development.
Both a semi-structured and explorative approach in interviewing HR managers or employers was adopted; they were asked to discuss the practices and discourses they see in their company. Interviewing HR managers or employers it would be expected to identify both if there are successful inclusion strategies in operation and/or issues of required support in doing so.

The core questions aimed to explore:

- Existing gender inclusive strategies and current experiences in recruitment and occupation of female ICT workers
- Identification of required material supporting the ongoing gender inclusion strategies
- Identification of ICT job-profiles, which are favoured by women

During the period December 2003 and February 2004, ZSI carried out interviews in four companies from different organisational categories in order to reach a broad spectrum of answers: two in MNCs and two in SMEs, all in Austria. The interviewees are themselves either in the function of HRM or in the employer (company 3).

Table 1: Description of ICT companies investigated

	Company 1	Company 2	Company 3	Company 4
Sex of the interviewee	Female	Female	Male	Female
Category	MNC	MNC	SME	SME
Location of the headquarter	US	Germany	Austria/Linz	Austria/Tirol
Company's area of operation	International	International	National	International
No. of employees (relating to the gender inclusion strategies, not of the whole company in case of the MNCs)	Approx. 2000	3300	96	140
No. of female ICT workers	No specified	10%	1	8

3.4.5.2 Reasons forselecting these ICT companies – existing innovative gender inclusion strategies

Company 1

The company is one of the forerunners in terms of gender mainstreaming; e.g. it has an well elaborated, written equal opportunity policy and Diversity Management implemented; for 2003 the company is listed under the Top 10 companies of the (US) "National Association for Female Executives".

- The Austrian company web-site provides information of some carrier paths inside the company of female employees.
- Further, for the Austrian region of the company exist a Women Mentorship Programme and
- an "Austrian Women Leadership Forum"; (definition: voluntary, internal forum of women in leadership positions, dealing with different actions in order to advance women, e.g. to increase the share of women in top-management positions, in international positions, etc.)
- Winner of the Austrian reward "Gläserner Schuh" for women friendly policy (place no. 2 in 2002 and 2003)

Company 2

The company has a strong commitment to Corporate Social Responsibility (the annual "Corporate Citizenship Report" gives evidence). The headquarter is investigating remarkable efforts to increase the share of women in the ICT workforce.

- The Austrian "Program Systems Development" Unit has recently undertaken an in-depth analysis of women related issues within the unit, in order to increase the female share in top management positions. (The results of the analysis are partly reflected in the present report.)
- Participation in "Girls Day"
- Participation in the project "Frauen in die Technik"[10].
- Participation in the project www.ict.org

Company 3

Within the Austrian project "Frauen und neue Technologien"[11] (Women & New Technologies), company 3 is one of the three partner companies.

The company's expectations on the project were:

- Models of best practices in terms of maternity/paternity leaves
- Development and implementation of measures increasing the female share within the workforce
- Examples of good practices of companies "with high social competencies"
- Support in identification of important topics

Current gender inclusive strategies implemented are:

- Participation in"Girls Day"

[10] see http://www.bmbwk.gv.at/nurtext.asp?isIlink=1&bereich=1&l1=&l2=&l3=&OID=4840#

[11] The objective is to increasingly recruit women for technical professions. http://www.frauen-technologie.at/dynapage.php supported by the Austrian Federal Ministry of Social Affairs and Generations and Ministry of Traffic, Innovation and Technology; end of the project: December 2003

- Participation in the Austrian project "Frauen in die Technik".
- Contact with polytechnics
- In case of similar qualification of job applicants -> agreement to prefer the women
- Mentoring programme for internship trainees

Company 4

Also company 4 was a partner company in the project "Frauen und neue Technologien".

Current gender inclusive strategies implemented are:

- "<company name> software aware": an annual aware for innovative ICT-performances for women; accompanying to the award the company developed a flyer and a poster promoting the award and encouraging women to apply.
- Participation in the "Mentoring-Plattform/MAP" program[12]
- Interview series with female ICT workers of the company, so-called "Success Stories" (= role models)
- Development of a flyer – "Women@<company name>
- Gender sensitive job announcements
- Job satisfaction survey within the female staff of the company

3.4.5.3 Interview Results

3.4.5.3.1 Strategies in recruitment

How to formulate job announcements

Company 1 made positive experiences in:

- Emphasising the provision of flexible work schedules including the possibility of teleworking
- Informing about the broad range of internal training opportunities
- Presentation of the company as "women-friendly employer"

Company 2 made good experiences in:

- Presentation of the company as "women-friendly employer", e.g. hint to the company's own kindergarten
- The job requirements should be very precisely formulated, which "give women security". The result of the internal analysis (s. a.) give evidence, as more the announcement inform precisely about the required skills, as more women feel confident in applying for the job. In opposite, vague formulations discourage women.

Company 3 is planning to develop a concept of gender sensitive formulation in job announcements; in contrast to company 2 the interviewee underlines, that precise/"hard" formulations in terms of the required skills might have negative impact on women, as women under-estimate their competencies and feel discouraged. On the one hand, as a SME the skill requirements are very concrete and precise and there is no place of alternatives left, on

[12] see: http://www.girlstuesday.at/MAP

the other hand the profile must be formulated in a way, that women don't feel discouraged of the concrete requirements. Form his point of view this is a "challenging feat", thus he is looking for support.

Where to announce effectively?

Company 1, 2, and 4 announce via press media, newspaper, company's web-site and educational fairs.
Company 3 made the experiences, that announcements in general press media and at universities are meaningless. He follows now the strategy of announcements in ICT-related journals, which are favoured by women. A list of journals, which are preferred by women would be supportive.

How to keep contact with schools, polytechnics and universities

Company 1, 2 and 4 have regular:

- Presentations on educational fairs.
- In-house presentation to inform pupils and students about the company; **company 3** recommends, that the female staff of the company should take care of the presentations in order to provide a genuine illustration of the "women friendly" company. Also the opportunity should be used to inform about the psycho-social situation of the female staff in the company.

Beside these strategies company 3 put also efforts in development and enhancement of a mentoring program for internship trainees. In the time before company's involvement in the project "Frauen und neue Technologien", the proportion of male and female internship trainees were 15:1. During the project period the female share could be trebled, because:

- Well defined workpackages were provided
- The mentoring strategies focused not primary on technical issues but more on "women related" concerns
- An evaluation conversation were held in the mid term of the internship
- Reflexive conversation at the end of the internship.

The interviewee made the experience, that female internship trainees need support in articulating unsatisfied feelings. For himself, guidelines for conducting evaluation conversations would be helpful.

Which job-profiles are favoured by women?

All four interview partners experienced that all job-profiles are equally chosen by women. While in relation to carrier development company 2 provides following figures, based on their analysis:

- Relatively high proportion of women in the function "process owner" (16-28%); the job profile "process owner" can be translated into quality management and to take care of the motivation of the team members.
- Relatively high proportion of women in the function "project manager" (7-11%)
- In contrast, in positions "manager" and "expert" the female proportion is significant lower (4-8%)

Echoing the literature results, the interviewee concludes, that men favour typical programmer jobs, whilst managerial job tasks are more attractive to women.

How to assess gender sensitively the competencies in the applicant/interview session?

All four companies use no gender-sensitive materials. **Company 2** hint to the importance, that in the hearing team are women included, as women have a sense for the requested soft skills (like team orientation, communication competencies,...)

3.4.5.3.2 Strategies in occupation

How to manage work-life-balance?

Company 1 and 2 provide:

- Teleworking
- Part time arrangements
- An additional year of maternity/paternity leave (company 1)
- Company own kindergarten (company 2)

Company 3 provides (and is in a ongoing process of development of):

- Individual working time models – the objective for the future to develop more individual models
- Maternity leaves models: the company is generally willing to find suitable models for each individual, but are specially interested in models during and after the maternity leave.
- The company made already good experiences with teleworking – five male workers are currently teleworking; the interviewee considers how to assess the time for paternity leave for the job grading; from his point of view their is a structural discrimination, when the time for maternity leave is not regarded as time of job experiences. “there should be investigated further considerations”.

How to deal with work-life-balance issues of women in managerial positions?

Company 1 knows from the HRM in the US-located headquarter about existing models for part time arrangements and job-sharing concepts in top-management positions. But these models are not implemented in Austria or Europe.

Company 2 see difficulties of part-time and/or telework arrangements in managerial positions, as the employees need a permanent contact person. According the results of the literature analysis, the concept of “presentisms” is also here the key argument.

Company 4 found a creative solution for a women in managerial position after her maternity leave: she shares the job with a male manager, who was being already retired, but coming back into the job for that purpose.

How to overcome the masculine culture?

According to **Company 1**, permanent awareness raising is key of a successful gender inclusion strategy. As long as the majority of the top-manager are male, the argumentation of the add value of a diverse workforce is needed.

The strategies are:

- To bring in the gender topic in every meeting and actions planed
- Portraits of successful women and their carrier concept in the company via series of interviews, presented on the intranet-communication platform (= "role models"). As "success" has an individual different meaning, the strategy includes women in different situations and positions, like young women at the beginning of their carrier or planing to found a family, women with three children, women in top-management positions, women from the Arabic world, etc., with the aim to encourage women finding their personal carrier path. (The interviewee underlines this strategy as the key factor in the successful gender mainstreaming concept.)
- Workshops on mindset awareness: training modules based on group discussions, self-assessment, including action plans for the personal attitude.

Company 2: there exist still some discriminating prejudices in the male workforce, but which are unconsciously, e.g. manager might have well-meaning, because protective attitudes, when saying "this women already has a lot to do and she is only part-time employed, we can't give her a responsible position". The crucial challenge for change agents is to find a way in the top-manager communication, that this men don't get the feeling, they are addressed as men than as managers. The company found (by coincidence) a successful strategy:

- Awareness raising workshop for men, aiming to discover the female aspects in men. The results of these workshops are quite satisfying so far – men are more able to listen and show more appreciation for women now.

Company 3: the interviewee took over the role as change agent in term of gender mainstreaming in his company; he aimed to bring in women in the 100% male workforce (with success, at the end of the day). At the beginning of the still ongoing process, he experienced remarkable resistance on the part of his co-workers. The lack of possibilities to argue with economic add value of gender mainstreaming, he was depended on his own power of persuasion. A held workshop about the meaning and relevance of gender mainstreaming for the executives of the company was a useful support in the change process.

Thus from his point of view, a list of models of good practices would be of great help (suggested medium: video)

On the other hand, the women in his company experienced no difficulties in interacting with their male colleagues so far, as these women are "already calibrated and robust through experiences made during the studies at the university".

3.4.5.4 Analysis

General, all companies are convinced, that a heterogeneous workforce offers add value in terms of business success.

- "The time before the gender inclusion strategy, the social climate was impersonal and raw. The social climate is significant better now ".
- "Heterogeneous teams bring up better solutions of problems and are more creative; the solving competencies of complex problems are optimised."
- "Men and women have the same objectives, but they choose different approaches."
- "It is in our interest to heighten the number of female applicants in order to form heterogeneous teams."

Further common characteristics are:

- All companies have strategies to increase the share of female ICT workers.
- Within the workforce prejudices and resistance against gender mainstreaming still resist
- The gender inclusion strategies are ongoing processes and open a wide range of further considerations, this means, independent of being forerunner (like in case of the MNCs in that present sample) or more or less being at the beginning of implementing a gender inclusion strategy (in case of the SMEs) all companies are in learning situations and need (external) support for that purpose.
- Independent of the structural size, gender mainstreaming needs people, who push the strategie forward. All interviewees are in the role of a change agent and need empowerment for themselves. "I am quite often seen as a suffragette." ...

Comparing the MNCs with the SMEs following pictures turned out:

- MNCs have more resources for learning through trail and error, whilst SMEs are looking for external support/external expertise in order to avoid wasting of resources, with other words – SMEs are probably the key-target group (within the HRM) of the PROMICT learning platform.
- Gender mainstreaming concepts in MNCs follow the ratio of solution for a wider range of persons (more sustainable), whilst SMEs have the tendency to look for solution suiting individual purposes (more flexible).

3.4.5.5 Lessons learned

The following collection are either recommendations for successful gender inclusion strategies of the interview partners or explicit mentioned support material of need.

MODULE – CONTENT	PURPOSE	MEDIUM
Role Models; different (!) portraits and concepts of carriers of successful ICT women Didactic method: structured Interview series	Mindset; awareness raising (men) and empowerment/motivation (women)	Intranet platform, internal newsletter, with photos and
Workshops on Gender Mainstreaming Didactic method: Group discussions, video analysis, self assessment,...	Mindset; awareness raising (men) and empowerment/motivation (women)	Workshop / guidelines for workshop conceptions
Scientific studies, circumstantiating the economic related add value of gender mainstreaming	Mindset; to convince and achieve the commitment of the top-managment	Documents
Models of best practice of gender mainstreaming	Mindset; supporting the change agent in the daily work of convincing	Videos (books or brochure are not recommendable) Networking in order to learn from the best
List of "Tips and Tricks" for the dialogue with the internal stakeholders	Mindset; supporting the change agent in the daily work of convincing	Guidelines
Analysis of the company/unit in terms of gender issues	Match; facts and figures of the work environment of the target group: argumentation for the need of gender strategies starting point of a gender strategy	Guidelines
"Bring the female staff into the boat" Didactic method: e.g. face-to-face interviews, discussion plattform	Match; network building, empowerment,..	Guidelines
"Discovering the female aspects in men"	Mindset; improve the socio-cultural atmosphere	Workshop / guidelines for workshop conceptions
Part-time and/or flexible work arrangements women/men in executive positions	Market; work-life-balance	List of models Best practices both in MNCs and SMEs
Models of maternity leaves; for, during and after the maternity leave	Match; employability	List of models Best practices both in MNCs and SMEs
List of ICT-related journals, which are favoured by women	Match; direct and unerringly placement of job announcements -> protection of resources (special important for SMEs)	
"Where to get external support" – list of national organisations/agencies providing material/financial support in terms of GM implementation	Market; special important for SMEs	Documents, link list
Gender-sensitive job announcements	Match;	Guidelines
Discourse with mentees	Match;	Guidelines

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3.4.7 Tools

Questionnaire - HRM in ICT enterprise

- Describe the employees of your company in terms of male/female? How many are IT workers of your female staff?
- What type of IT job-profile and career-possibilities s do you generally offer? (consulting, programming, web design ...)
  - Which of these job-profiles are more often chosen by women than men?
- Do you consider to motive female applicants to apply for your company at all? If yes, what kind of strategies are you following?
  - What experiences do you have in motivating female applicants to apply for your company?
- Do you have any gender mainstreaming (GM) strategies? Specially concerning female IT-workers, in terms of recruiting, retention and employability?
  - Do you have a written policy/code of conduct?
  - What are your current GM strategies concerning female IT-workers?
  - Do you benchmark your strategy with other IT companies? If yes, what are your experiences about well going strategies or not working strategies?
  - Have you ever applied for or won a female related reward? If yes, which one? What is your story of success?
- What kind of support do you need to achieve your GM-aims regarding female IT-workers recruitment, employment and retention?
- Addressing male and female clients during the applicant/interview session: what differences do you make?
- Which kind of assessment-material do you use in perceiving the competence level of your client regarding IT-and IT related competences/jobs? Do you use different gender-sensitive material?
- What kind of information do you need to support your clients about recruiting strategies for IT companies?
- How do you release information about current job-profiles in the ICT industries (newspaper, personal contacts with representatives, vocational counsellors...)?
  - What kind of additional information would be useful for you transferring labour market demands to your female applicants?
- How do you keep in contact/inform schools and universities about changes in the job-profiles (regularly/partial; basis?)
- Do you undertake any work-satisfaction surveys? If yes, what are the results regarding female IT-workers? (work environment, work-life-balance, career planning, payments, ...)
- Do you make equal pay audits?
- If not, why not? (E.g. BT makes regular equal pay audits)
- Are you currently involved in any project regarding “women and IT”? If yes, what are your aims, problems, experiences?
- If you were asked to develop a new material raising the awareness and competence for ICT of female students for your clients, which one would you recommend and in what form?
- What kind of support do you need to improve your gender-sensitivity towards your male and female clients?

4 Conclusions: Change needs a chance- Need for more professional gender-sensitive training and consultancy

4.1 Recommendations for change agents in the transition phases

This chapter summarises our recommendations drawn from the research findings in the chapters before and use it as indicator for gender-sensitive training- a rather new approach in educational science and career consultancy, especially in the field of computing education. This section bases on the role of the change agents in the three phases of considering an ICT career, the career planning and findings about the agents` needs to improve their support or consultancy process along the ICT career path in the computing industry. The recommendations are described in the mode of learning objectives to give a concrete idea of the directions to follow.

4.1.1 PHASE 1: DEVELOP THE IDEA OF A TECHNICAL ICT CAREER PATH

During the pre-adolescence period around the age of 13 to 19 young girls think about their future in terms of what career path they might choose. Right at that point the first choices for specialisation in educational programmes are due (transition from lower secondary to higher secondary and then tertiary education, taking special higher advanced courses, make a decision for another type of school, etc). Peers have a high impact of forming the future role model and influence personal decisions. In this orientation phase the training objective with students, their parents and peers is to develop the idea that a professional career in the ICT world is a real option for their future. Female students should become aware of their options to gain leadership positions in the ICT world by careful planning. They should be informed that they do not have to fight alone, assistance is provided in this process by change agents. Society and public opinion as a whole fail to combat the prejudice and stereotypes, imposed and developed throughout the years that women are not capable of attaining high goals and professional realisation in the ICT field. Female students experience difficulties in their professional orientation in the ICT branch because they have built up psychological barriers. They underestimate their capacities and usually lack self-confidence, even when their achievement are equal to those of their male colleagues. Change agents can be trained in sensitising girls, parents and peers in dissolving misconceptions about ICT careers/job profiles and opting for an unconventional career. The following table summarises the recommendations in respect to the change agents and the needs of the young female students, using the 3M approach again:

Table 1: Recommendations for change agents: Transition phase 1 (13-19 years); In this table the term students refers to female students;

PHASE 1	Needs of students (13-19 years)	Change agent to support this need	Learning Objectives/Recommendations
MINDSET	**Self concept Low self-esteem**	**Secondary teacher Career advisors**	Develop self assessment tools for the students to test their personality and computing skills.
			Students discover their skills and reflect on their possibilities with reference to computer skills (digital port folio).
		Secondary teacher Youth workers	Learned helplessness: create situations where students change their view of this approach: I really can help myself!
			Students find another attitude toward failures: to work on problems and take mistakes as a chance to learn (encourage students to take the challenge).
			Students learn how a computer system works (and experience that they can "tell the machine how to work").
	Role models Case Studies – Success Stories	**Secondary teacher Career advisors**	Students learn about modifying their role and career choice.
			Students meet role models, with whom they should to keep in further contact.
			Students meet older students who support them as tutors.
		Secondary teacher	Students learn to know about career paths of women who could be role models.
			Students learn how to manage family and job affairs, as they listen to "female success stories".
			Teachers learn to organise a project on meeting successful women in ICT companies for their students.
MATCH	**Gender-sensitive education environment / Innovation of curricula**	**Secondary teacher Vocational counsellors**	Students experience current developments in the labour market.
			Students learn about another image of ICT workers: it requires a portfolio of skills, not only IT skills.
			Students learn that ICT also can be a tool, related to very different jobs.
			Students learn about the variety of aptitudes necessary for ICT careers.
			Students detect skills they already have, that are helpful to go for an ICT career.
			Students have to gain IT competences in a fun-orientated way at an early age.
		Secondary teacher	Role models: How good are they in mathematics?
			Students experience ICT in combination with other disciplines (ICT and economics; ICT and arts) e.g..
			Teachers are sensitised to arrange an atmosphere in the classroom that is free of anxiety (to make mistakes, to get no pejorative comments etc.)
			Teachers are to be sensitised to promote individual processes of learning.

PHASE 1	Needs of students (13-19 years)	Change agent to support this need	Learning Objectives/Recommendations
MATCH	Gender-sensitive education environment/ Innovation of curricula	Secondary teacher	Students learn about the ICT career path.
			Students are confronted with a Web design learning tool.
			Students and teachers work on criteria for possibly mentoring persons
		Secondary teacher Youth workers	Teachers learn to find criteria how to deal with the role model approach working with their students.
		Youth workers Parents	Students shall get a chance to test games boys usually play!
		Secondary teacher Youth workers Peers	Students discover ways to build peer groups (alumni, tutoring), supporting each other working on computers.
		Vocational counsellors	Vocational counsellors become aware of methods of gender sensitive teaching.
	Sufficient equipment/ access	Secondary teacher Youth workers Parents	Students get assured access to use the equipment (e.g. girls´ hours).
		Secondary teacher School management	Students at an early age shall get the opportunities for computing and tinkering at school.
			Schools should provide sufficient equipment for all students to use.
	Communication aspects	Secondary teacher	Students gain experience in using communications tools.
		Secondary teacher Youth workers	Students experience internet community, building their own platform.
	Image of ICT company culture	Secondary teacher	Students experience that ICT is highly creative working field.
			Students learn about the stereotype of the image they have of IT companies.
MARKET	Information about the ICT Labour Market (Occupation & Skills)	Secondary teacher Vocational counsellors	Students learn about ICT companies that exist in their neighbourhood.
	Inaccurate perception of computer careers	Secondary teacher	Students become aware of their images of people working in ICT companies.
			Students work on clarifying the different images they are confronted with.
	Job profiles	Secondary teacher Vocational counsellors	Match personal traits to various job profiles on an ICT base.
			Students learn about the different wording used in describing job profiles.
		Secondary teacher Youth workers	Students will learn about women working in ICT companies by producing a video.

4.1.2 PRO::ICT database – Enrol and study at computing courses and higher academic institutions

In the adolescence period around the age of 18 to 19 years students have to make the choice concerning further education and/or entrance into vocational training. They have to enrol on computing courses and higher academic institutions at the transition phase from tertiary to university education. Parents, career advisors and the image of potential universities or potential employers essentially influence the decision process. There is a substantial lack of cohesion between the education offered and the requirements of the labour market in some EU countries with respect to the capacities of the candidates, but not all. Universities often do not provide for development and acquisition of relevant

capacities. As a result, female students meet with the disappointment of failure to get certain jobs, because of improper preparation. In this phase support should be given in selecting the relevant ICT courses and academic education needed for matching the expectations of the IT market/job profile with the skills and competence of the student. How should the best type of education be selected and how should future job options be anticipated? What can academic staff do to assist girls in better managing the enrolment phase? Training objectives for teacher and academic staff may be, how can a change of curricula influence the likelihood to attract more female students, how can the way of teaching support women in class?

Table 2: Recommendations for change agents: Transition phase 2 (19-25 years); In this table the term students refers to female students

PHASE 2	Needs of students (19-25 years)	Change agent to support this need	Learning Objectives/Recommendations
MINDSET	**Self-confidence**	**Vocational counsellors**	Vocational counsellors are trained to support female students in taking up unconventional careers.
			Female clients are ensured that they are capable of making unconventional career choices.
			Female clients overcome the negative notion that they are unable to compete with men in the field of ICT.
	Role models Case Studies – Success Stories	**School management**	Female teachers in ICT courses, especially in rural or remote areas, should be employed.
		Academic staff	To provide role models females are to be asked to return to the university to talk about their working experiences.
			Students are provided with meaningful perceptions of computing careers.
MATCH	Gender-mainstreaming in the consultancy process	Vocational counsellors	Vocational counsellors learn how to conduct consulting processes which take account of the gender-mainstreaming issues.
			Vocational counsellors are made aware of gender-mainstreaming issues.
			The counsellors take into account the ICT biography and history of their female clients.
	VCs competences are not enough known to target groups.	Vocational counsellors	The services need to be promoted in schools and universities.
	Improving the career service	Vocational counsellors	More ICT skills are be provided to vocational counsellors.

PHASE 2	Needs of students (19-25 years)	Change agent to support this need	Learning Objectives/Recommendations
MATCH	**Strategies to keep computing courses interesting for female students**	**Academic staff**	The benefits of good salaries, job security, flexible working hours, opportunities to work from home and job satisfaction should be highlighted.
			Students should be told about initiatives in the workplace.
			Offer different types of software (user friendly, communicative).
			Students are engaged in interesting and challenging projects.
			Provide more practical classes associated with the theory.
			Re-entry students are encouraged.
			Provide bridging opportunities to re-entry (conversion) graduate students.
			Develop strategies to inform undergraduate students about rewards and study opportunities.
			Develop strategies to make recruitment contacts in a positive way.
			Provide undergraduate females with exposure to computing research.
			Review department's publications for text/images containing messages that may discourage applicants.
			Raise staff awareness where academics discuss their research with students (cooperation with industry).
MARKET	**Job-profiling**	**Vocational counsellors**	The vocational counsellor learns to perceive the market changes as quickly as possible.
			Mentoring between companies and students shall be organised by professional VCs; professional courses via email dialogues.
			Network opportunities with local and national job agencies and employers are provided.
			Provide more appropriate ICT specific career guidance to highlight the breadth of careers available that require intensive and less intensive use of computers.
		Vocational counsellors Academic staff	Equip females with contacts to ensure positions in the professions.
			Create awareness and knowledge about the existence of IST companies. Students learn about global, national and global companies and their purpose.
	Job application	**Vocational counsellors Academic staff**	Provide workshops to improve graduates interview and job seeking skills, to help females overcome problems with self-promotion, undervaluing their skills, undervaluing their abilities.
MARKET	**Statistics and market information**	**Vocational counsellors**	Vocational counsellors learn how to search for and interpret information and statistical figures
			Local and national government authorities shall be encouraged to provide regularly updated statistics on women in ICT.
			Vocational counsellors learn methods to gain and provide detailed information on the ICT labour market.

4.1.3 PHASE 3: GRADUATE FROM UNIVERSITY AND ENTER THE ICT WORLD

Taking the first steps into what is generally perceived to be a male dominated working culture finally taken at age 25-27 or when graduating from university, or moving from tertiary education to employment and vocational training (transition to work). It is therefore important to postulate on how to dissolve misconceptions of the working culture and support activities for women. How should graduates be prepared for this step e.g. apprenticeship, alumni network? How should a company be marketed as "women friendly employer"? How should mentoring schemes, equal payment schemes be introduced and how can companies be regarded as equal opportunity employer? Where to get empowerment for introducing gender mainstreaming in the company?

Table 2: Recommendations for change agents: Transition phase 3 (23/25 +years); In this table the term students refers to female students; GM stands for Gender-mainstreaming; HR stands for Human Resource

PHASE 3	Needs of students (23/25+ years)	Change agent to support this need	Learning Objectives/Recommendations
MINDSET	Role model	HR Manager	HR managers learn how to promote the change of role models of female ICT career paths.
			HR managers learn about the importance of presenting women successful in ICT professions.
	Awareness raising	HR Manager	HR managers learn how to raise awareness of society in respect to gender equality especially in the ICT sector.
MATCH	Implementation of gender issues	HR Manager	HR managers need to learn how to implement gender-mainstreaming (GM)
	Where to get empowerment for introducing gender mainstreaming in the company?	HR Manager	How to be a change agent as a HR manager (supervision)?

PHASE 3	Needs of students (23/25+ years)	Change agent to support this need	Learning Objectives/Recommendations
MATCH	Developing a better Working culture and environment	HR Manager	HR managers need to learn how to change the working culture and improve the quality of the working place to recruit and to keep female ICT staff, restructuring the work.
		Company management	Part-time and/or flexible working arrangements for women/men in executive positions.
			Models of maternity leaves that are attractive for women in executive positions. External support providing material/financial support in terms of GM implementation for the company.
	Economic value	HR manager Company manager	HR managers need to learn about the economic value of GM: Where and how do I learn about funding public initiatives to implement GM.
			HR managers learn about the additional values when they 'bring the female staff into the boat'.
	Working Culture in ICT Skills	HR Manager	HR managers learn that provision of IT skills is important.
			HR managers work on a list of "tips and tricks" for the dialogue with the internal stakeholders.
MARKET	Raising the rate of female applications	HR Manager	The HR managers need to learn how to formulate job announcements, which ar e read by female students (e.g. list of ICT-related journals, which are favoured by women i.e.)
	How to attract high profile female candidates	HR Manager	HR managers need to learn where to advertise for new jobs?
			HR managers need to gain detailed information on the ICT labour market.
	Increasing the quality of the application and the assessment process	HR Manager	HR managers and the company need to know about gender-sensitive issues in job announcements, tests, assessments, etc. and learn to develop a different application design.
	Diversity	HR Manager	HR managers need to be made aware that male/female work teams improve the innovation/market chances of products.
			HR managers shall learn about analysis of the company/unit in terms of gender issues.
	Support women employees in the networking activities	HR Manager	HR managers need to know about existing women networks and need to provide support to women to find the networks – internal and external.
	Optimising the entrance into a company	HR Manager	HR managers learn how to design first steps.
	Marketing gender main-streaming activities	HR Manager	HR managers can learn how to market their GM activities.

4.2 CONCLUSIONS: A collection of gender-sensitive training material

We now take a look back at our initial hypothesis that given the three transition phases,

- profound and current information about the ICT labour market (anticipation of future development),
- a good match of female skills and ICT courses and studies and
- well-focused training in the empowerment of girls

will contribute to meet the challenge of moving more women into highly skilled, high paid IT jobs. Change needs a chance! The findings of the study strengthened the idea of providing support for the change agents in all transition phases in the first place. Those who may be able to induce a change, need more support in how to design and provide interventions! Thus, keeping the recommendations in mind, we propose to professionalize the training and consulting activities in the relevant phases of a girls` career planning. One important step towards this aim is to provide relevant inputs and resources for change agents. Thus, one of the project result is a collection of innovative, gender-sensitive training material which should be used in practice by the various change agents in their daily working environment.

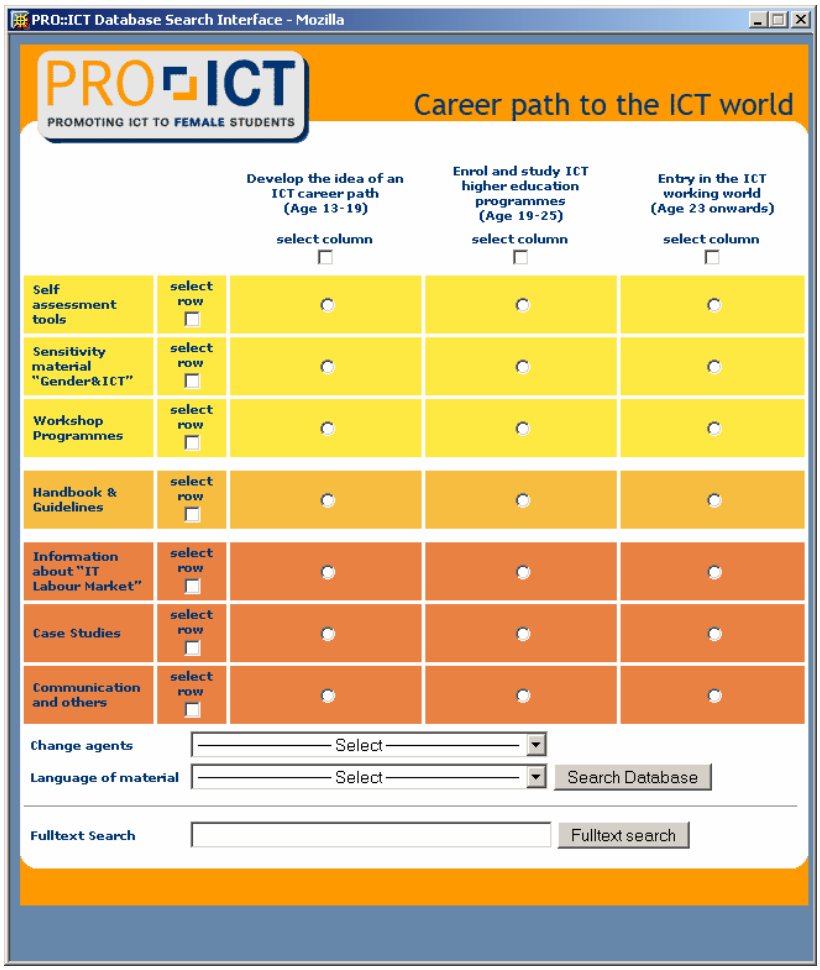
This collection of gender-sensitive training material includes approximately 50 descriptions of sensitivity material, workshop designs (including e-learning courses), information material about the ICT market and occupations, handbook and guidelines for organisational interventions and case studies of successful gender-sensitive training activities. The change agents can either use pre-defined workshop programmes customised to specific learning objectives. However, it is also possible to select single training items and create a tailor made training programme as to the specific needs of the learner group.

Besides the training material description, the PRO::ICT database offers also the material for download and with this service we hope to encourage usage on an European-wide scale. The gender-sensitive workshop programmes and e-learning courses will be publicly available on a Web-based learning environment at: www.pro-ict.net.

4.3 Navigation system and services of the PRO::ICT database

Potential users can navigate through the database by a practical search mask. Main search criteria are:

- Type of transition phase in which the students find themselves and/or
- Type of training material a change agent might find useful to meet the learning objective and/or
- Type of change agent involved
- Type of language of the material description
- Users have the options to use one or more of these criteria to retrieve material.



Step one: Select the phase of life in which your female students are. Think of their learning objective!

Classification of phases:

1. Develop the idea of an ICT career path (age 13-19)

In this orientation phase the training objective with students, their parents and peers is to develop the idea that a professional career in the ICT world is a real option in their future. Students become aware of their options to gain leadership positions in the ICT world by careful planning. They are informed that they do not have to fight alone, assistance is provided to them in this process by change agents.

Change agents can be trained in sensitising girls, parents and peers in dissolving misconceptions about ICT careers/job profiles and opting for an unconventional career.

2. Enrol on and study ICT higher education programmes (age 19-25)

In this orientation phase the training objective with students, their parents and peers is to develop the idea that a professional career in the ICT world is a real option in their future. Students become aware of their options to gain leadership positions in the ICT world by careful planning. They are informed that they do not have to fight alone, assistance is provided to them in this process by change agents. Change agents can be trained in sensitising girls, parents and peers in dissolving misconceptions about ICT careers/job profiles and opting for an unconventional career.

3. Entry in the ICT working world (23/25 onwards)

Once graduated women need to manage the first steps into the ICT job world. How can school managers, human resource managers and staff help to dissolve misconceptions of the working culture and support activities for women? How can graduates be prepared for this step e.g. apprenticeship, alumni network? How should a company be marketed as "women friendly employer"? How should mentoring schemes, equal payment schemes be introduced and how can companies be regarded as equal opportunity employer?

Step two:

Customise your individual training activity. You will find various types of training material applicable for the selected phase and learning objective(s).

Classification of training material	Description
1. Self assessment tools (personality/skills/course/job profile)	Tools for assessing personal preferences, skills and choice for ICT courses.
2. Sensitivity material for issue "Gender & ICT"	Gender-sensitive games, videos, songs, books which can be used in any sort of training setting; a collection of success stories of women "who made it" and different links where to find further examples.
3.Workshop Programmes (including online learning)	Here you can find different training designs that you can use in practice. This may involve interactions with you and girls and students directly and range from one hour presence workshop to two weeks online training. You will also find programmes that train change agents in improving their career advisory process.
4.Handbook&Guidelines	Guidelines for introducing new organisational schemes supporting women to follow an ICT career path, e.g. mentoring, gender sensitive trainings, alumni programmes, change of curricula.
5. Information about the IT Labour Market (Occupation & Skills)	This section provides information about the future ICT market, change of job profiles, needed skills, and links where and how to find information per country; research results about the special roles of woman in IT; career portals.
6. Case Studies	In this section you will find case studies that describe experiences with gender-sensitive interventions and activities conducted in enterprises, schools and universities.
7. Communication and other sources	This section provides a collection of magazines and news addressing the issue of working in an IT company and useful for placing advertisements , related Web links, discussion forums and network information.

Step three:

Select the type of change agent (s) who is (are) involved in the interaction with the students. You will be provided with input material for your training or consulting process.

Classification of change agents					
Parents/ Peers	Educator (Teacher in schools and universities)	Career Advisor/ Vocational Counsellors	Youth Trainer/ Gender consultant	School and University management	Human Resource Manager

4.4 PRO::ICT training material applicable in an online learning environment

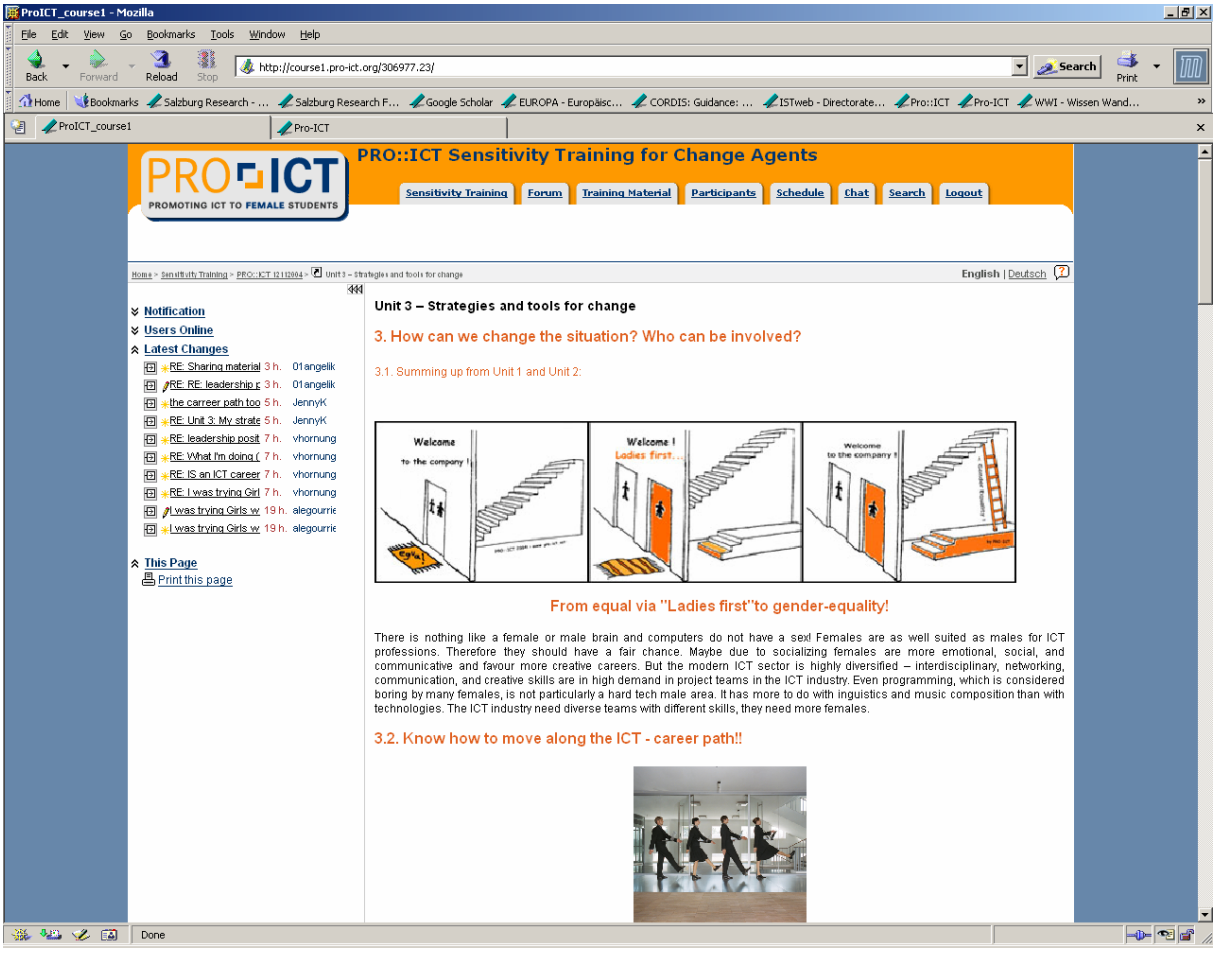
- Each material includes the following metadata and can be used to plan an individual training
- activity. Find below an example of detailed material description:

- **PRO::ICT Learning environment and eLearning Course:**

Use the online material in an e-learning course about “Gender-sensitive training for change agents! See our model e-learning course at: http://course1.pro-ict.org

The recommendations and the development of the Web-based platform collecting training modules for all change agents shall assist all persons involved to manage with the barriers and needs of female students and women deciding for and following an ICT career path. Even though the conducted PRO::ICT interviews reflected slight changes in women’s attitudes it keeps a challenge for the future!!!

Finally, we would like to put our acknowledgments to all participants of the study who gave us insights in their concepts of life and their desires for the future. Warm regards also to all those persons in the institutions of the PRO::ICT project partners who helped to realise the final outcome of the PRO::ICT project.



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FULL REPORT for download at: www.pro-ict.net