BARRIERS INHIBITING GIRLS TO APPLY TO TECHNOLOGY ACADEMIC PROGRAMMES – RESULTS FROM A HUNGARIAN FOCUS GROUP STUDY

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Abstract. The shortage of electronic, mechanical engineering and IT professionals existing within some segments of the Hungarian labour market could be solved by having more students graduate from technology programmes at universities. One possible way to increase the number of students would be to foster the increase of female applicants to such programmes. We conducted a focus group study in 2011 with Hungarian female students at several secondary schools to study what possible barriers stand in the way of getting more female students to apply to technology academic programmes and what means could be utilized to potentially get more girls to apply. Our results showed that the female students – who were at the last year of their secondary studies - knew extremely little about technology academic programmes and about what technicians actually do. Barriers standing in their way of choosing technology studies included existing stereotypes, bad experiences with certain science subjects at secondary schools, not getting support from family members to pursue technological academic programmes, and for some low self-esteem. Our findings also suggest the possible importance of getting personal impressions about an academic programme/profession in the decision-making process. The students in the sample rated more favourably those options of promoting more girls to apply to technology studies where obtaining personal impression was possible (such as taking part for example in Girls' Day programmes where they can try out a profession for a day), while they dismissed non-personal ways (such as poster adverts of academic programmes placed at secondary schools).

In October and November of 2011 we conducted qualitative research[1] on what barriers stand in the way of more girls choosing technology related tertiary studies in Hungary, and we also investigated the possible means that could be used to get more girls to apply. In this paper we first discuss the Hungarian context related to the investigated issues: the problems and situation of technology academic programmes in Hungary, the labour market demand for technology professionals, and the situation of women in tertiary education. Afterwards we discuss our research questions, our sample and methods. Finally, we present our results.

Recruitment Problems

There has been lot of attention devoted in Hungary in the recent decade to the recruitment problems of technology and science education. Hungarian education policy – in accordance with the aims of Lisbon (EC, 2000) and the strategic goals of the Europe 2020 programme (EC, 2010) wants to lay emphasis on building a knowledge-based society. The unpopularity of technology and science careers poses a serious setback to reaching these aims. This unpopularity is also a problem for serving the demands of the labour market: there is currently a shortage of electronic, mechanical engineering and IT professionals within some segments of the Hungarian labour market.

In Hungary, since 2007 there have been several policy makers and scholars who have emphasized the problem of the lack of adequate supply of technology and science professionals (Fábri, 2008a). Educational policy-making has reacted to the problem by increasing the number of places in the relevant fields within tertiary education, which were funded by the state[2].

However, this approach has not solved the quality problems; rather it has contributed to a further decline of quality: students could get into some of these segments of tertiary education in Hungary without proper selection, with very low entrance points and with limited knowledge (Fábri, 2008a, Kurkó 2008). It is also a recurrent problem that the proportion of students choosing these fields of study is too low compared to the total number of students applying for tertiary education studies. Fewer students choose these fields as their first choice when marking their preferences for their tertiary education than the number finally accepted (Kiss 2008).

[1] The research project was part of the gender sub-project of TÁMOP 4.2.2/B-10/1-2010-0020 and the writing of the current paper was supported also by the project. The Hungarian acronym TÁMOP refers to the Social mobility programme of the European Union. The conference participation of Lilla Vicsek was also enabled by funding from the TÁMOP 4.2.2/B-10/1-2010-0023 project.

[2] The recent law on tertiary education, which came into effect in the beginning of 2012 followed a similar strategy – while the number of state sponsored places was radically lowered in most of the fields, science and technology academic programs were favoured and received a relatively high number of places.

The decline of the standard of science and technology students and the low amount of interest to study in these fields has been linked by some experts to the media not conveying positive images of scientific innovation (Fábri 2008a, Fábri 2008b), low understanding of the public of the positive benefits of science (Kurkó 2008), as well to the problems with science education in secondary schools (Kurkó 2008, OKNT 2008, Réti 2011). A 2008 national report states that there are great problems with the way science subjects are taught at Hungarian schools. The teachers and the textbooks often do not have a modern methodological culture. Emphasis is often placed on lexical knowledge, instead of placing greater emphasis on practice: on having tasks that relate closer to practical problems and on the development of competences (OKNT 2008).

It has been defined as an important strategic aim in Hungary to increase the number of students applying to technology and science fields to intensify their competition in order to ensure that those who get accepted are good enough. One of the possible means for achieving this aim can be to enable more women to choose these fields.

Women in Tertiary Education

In Hungary (Róbert, 2000; Székelyi et al. 1998), as well as in developed countries (Freeman, 2004) there are more women in tertiary education than men. Many of the boys do not make it to tertiary education in Hungary, as they study in vocational secondary schools which do not enable them to choose universities in lack of a higher level final examination and also as many of them turn to getting qualifications which can be acquired faster than a BSc or MSc degree (Fényes, 2006, 2009).

In Hungary girls tend to choose going to universities immediately after finishing their secondary school as compared to boys. If they are not accepted, then they persist more: a greater proportion of them choose to apply again. Girls are also more persistent within their university studies: smaller proportion of them drops out of tertiary education, than what is the case with boys (Liskó, 2003).

Girls also have better secondary school results, which is a factor that makes their getting into tertiary education easier. The better results of girls in elementary and secondary schools are explained by the literature with their different study methods and strategies, their greater self-discipline as well as a greater inclination to fulfil expectations which can be lead back to differences in gender socialization (Rostás-Fodorné, 2003; Horváth - Környei, 2003).

According to Fényes (2009) nowadays even girls mathematics grades are better than those of boys (Fényes, 2009). There is no difference in the results of the PISA-surveys with respect to many aspects of science knowledge between the girls and the boys in within Hungary however, there is a slight difference for mathematics, with boys having a slight advantage (PISA, 2009).

There is horizontal segregation within tertiary education in Hungary: with some fields dominated by female students, others by male students. Within mathematics, science and technology academic programmes in Hungary the rate of men is more than 3,5 times as high as that of women (excluding the life sciences and environmental protection fields). Female students are more successful in getting a degree even in these fields: a lower proportion of them drop out of universities and a higher proportion of them obtain a degree than the proportion within male students (NEFMI, 2006).

Thus, in spite of the higher number of women in tertiary education, they are a minority in engineering and IT academic programmes. The small proportion of female students in these fields has also been defined as a problem in several other societies. The causes of the problem were linked to gender stereotypes among teachers, students and members of society and shattered self-esteem of girls (OECD PISA, 2006; Spencer et al, 1999). Combating gender stereotypes and promoting equal opportunity in education has been set as one of the aims of the European Union (European Parliament 2006). To get more girls to study in technology related fields initiatives such as Girls' Day initiatives were started in Germany and in other countries, where girls could visit companies with technical departments, laboratories, where they could get personal experience and talk to the employees of the organization. Some universities have started new interdisciplinary academic programmes with the aim of reaching more female students. German experiences show that in these interdisciplinary academic programmes, such as media-informatics,

etc. there is a greater proportion of female students than in more traditional technology programme fields such as mechanical engineering (Csekei, 2008).

Research Questions, Methods and Data

The aim of our explorative research was investigating the following research questions within our sample:

RQ1: What possible barriers stand in the way of getting more female students to apply to technology academic programmes?

RQ2: What means could be used to potentially get more girls to apply?

There were 3 focus groups conducted in October and November of 2011 as part of the research project with female secondary school students.

We applied focus groups, which is a type of group interview (Vicsek 2010). Focus groups can be a good method to choose when as in our case the research is explorative in nature and we want to get a rich, deep and nuanced description of the phenomena under investigation. One important constraint of focus group research is limits of generalization (Vicsek 2010). This has to be taken into account here especially as we only conducted a very small number of focus groups. Thus, we can state that the results are true for this group of girls and can only make assumptions that potentially what we had found here might apply to other female secondary students as well in Hungary – but we don't know this with high confidence.

The girls in the sample all wanted to study in tertiary education and basically all were in the last year of their secondary school studies and had to decide which university to apply to within months from our research. Group A was composed of 11 girls from of a medium strength high school in Budapest. All the participants had good grades in math. Group B was composed of 9 students of a secondary school in Budapest where it was also possible to specialize in technology. In spite of our request however, the principal recruited girls from language specialization from that school. Group C contained 12 girl students who specialized in math who studied at a strong secondary school in the countryside. Only few of the girls in the sample wanted to study at academic technology programs at universities – even in case of these girls who specialized in Math.

All group sessions took place at the schools, in one of the classrooms. They lasted approximately one hour. The semi-structured discussion was based on a guide containing questions first on where they intend to study and how they decide, then focusing later on technology academic programs and gender issues, as well as questions on what tools they thought would help in getting them or girls in general to choose technology academic programmes. The focus groups were moderated by one of the authors (Erzsébet Takács). All focus group sessions were voice recorded and then transcribed. Where it was possible, based on the voice, the person who was talking was identified. There was no video recording as some of the questions involved sensitive issues with respect to giving opinion on teachers and we felt that the students would talk more freely if there is no visual recording – where identification would have been even more obvious.

Results and Discussion

Barriers

Throughout the focus group sessions our impression was that the students know very little about the world of tertiary education. Much of their knowledge on the topic stems from the Internet, however, - according to our research subjects - universities have only a small amount of information on their web-sites which are easily interpreted by secondary students. An additional information source was their friends who studied at universities. They not only knew little about tertiary academic programmes, but also knew very little about what professions existed and what members of different professions did (except from a few obvious professions):

Natália[3]: I think it is also a problem that we do not even know what professions there are nowadays. Okay, I know that there is lawyer and doctor...

Zsóki:But they are very general.

[3] The names of the students were changed to protect anonimity.

Natália:Yes, like fireman, policeman, ...but I do not even know what my father is doing exactly. All I know that it has to do with computers...
(Group B)

The students knew extremely little as well about technology academic programmes; and about what technicians actually do, however the tasks related to these jobs were labelled as "boring".

Moderator: What does a mechanical engineer do?
Mazsi: I have no idea.. Maybe, he[4] *thinks out how things are put together, or tests them once they have been put together, I don't know.*
Panna: He makes plans.
Someone: Plans?
Anna: I don't know.
Mazsi: He plans the heating of the buildings, the piping....
Eszti: But that's the architect's job, isn't it?
(Group A)

In many cases the students had a misconception regarding the tasks of IT professionals, such as conceiving of them as only doing programming (while typically only one third of the tasks of an IT professional involve programming (Collet, 2006)):

Moderator: What image do you have of what an IT professional or a mechanical engineer does?
Anna: He sits at a machine.
Someone: He does programming.
Someone else: He puts in the program and there are numbers running across the screen ... (laughter) and he snaps...
(Group A)

The girls' own stereotypical views of the investigated professions created a barrier to some of the girls to choose IT academic studies – it was a barrier even for those who were quite good at informatics at secondary school. Mainly only those students had greater knowledge of the tasks connected to these professions, who had family members who were engineers or IT professionals. These students also expressed stereotypical views to a lesser extent.

As students had scant knowledge of the technology academic programs and the related professions, some of their expectations were based on the content and quality of science subjects at the secondary schools. A barrier standing in their way of choosing technology academic programs or science programs was their negative experiences with the science subjects at their schools:

Mazsi: Already at elementary school many are shrink back from math, physics and chemistry...
(Group A)

Most of them had problems with the way physics and chemistry was taught, mathematics was found to be less problematic – some of the girls liked the mathematics classes at their school. The negative experiences with physics were related to lack of modern content and methods, and the very high demands of the teachers. Many complained of having bad teachers. As a result of these problems many of the girls began to dislike these subjects. As for many of them it was hard to get a 5 (the best grade) in physics, they also often concluded from that that they would not be able to perform well enough at technology academic programmes – and this was a factor in choosing another programme to study instead of technology:

Moderator: And for some of you is studying to be a mechanical or electronic engineer a real possibility?
Timi: It could be a possibility for me, but I will not apply to such places, because I know how important physics is for that, and if because of that I would be thrown out after the third day, then that would not be so good.
(Group B)

Our results with respect to the negative experiences of our research subjects with science technology education are in consonance with the results of the national report that we had discussed earlier, which had found that there are great problems with science education in secondary schools (OKNT 2008).

In case of having only very limited knowledge of academic programmes and professions, one potential influential factor can also be what beliefs existed among girls on who were interested in certain kinds of studies and jobs. In all groups it was the dominant opinion that boys were more interested in technology and careers related to it and that it was mainly men who did this kind of jobs. This view can also potentially operate as a self-fulfilling

[4] In the Hungarian language the singular third person has no gender, as „he" does in English. When participants talked about the singular third person we translated it as „he" as this is the most common usage in English.

prophecy – as girls who might be otherwise interested in technology studies might feel that they are not like typical girls and this might pose a problem for their gender identity, which in turn might reinforce their other kinds of interests.

Gabi: It is rather the boys, who are interested in how things work, the machines...(laughter)
(Group C)
Évi: The boys' thinking is different… Girls engage themselves with other things, we are interested in people, in ourselves – because of this we mature earlier, as we know more about ourselves. While boys do math and physics problems…
(Group A)

Many of the research subjects in Groups A and C claimed that their choice for tertiary education was not influenced by gender expectations related to those fields: that they did not choose technology academic programmes mainly because they were simply not interested in it and not for any other reason. That this disinterest in itself could be a result of gender socialization was not mentioned – rather boys and girls were viewed as inherently having different spheres of interest (although it was mentioned that there are exceptions). The focus of the current paper is the results of our student focus groups: however, we also conducted interviews with secondary school teachers. We note here, that although many of these girls argued that the fact that these professions are held to be "masculine" professions did not influence their choices for study, many teachers expressed the strong belief during their interviews that this *was* an important factor in both the eyes of the girls and their parents.

For some of the girls who would have been interested in studying technology, low self-esteem set up a barrier: they were afraid of not being good enough, of dropping out of the university. Many of the girls in Group B had low self-esteem:

Erzsébet: I am interested in math, physics, but I am a little bit afraid as I am not good enough at them, but I would be interested in studying them (at the university).
(Group B).

The girls in Group B also emphasized the accounts of how some students that they knew who had technology related studies faced great difficulties.

The problem of low self-esteem fits with results of previous international research, which has concluded that girls often underestimate their own capabilities – with respect to their being able to perform at technology studies as well (OECD PISA, 2006.).

Meeting with gender stereotypes was mentioned as a barrier by some of the girls – especially the girls in Group B. Stereotypes set up a barrier for them to apply to technology studies as it seemed to reinforce their low self-esteem. In some cases they met with negative attitudes even within their own families:

Betti: For me the major thing that sets me back is that I feel that men treat women negatively in this respect, they are of the opinion that I would not be able to learn as fast as them how machines work, as I have less experience... My brother, he is always occupying himself with these things (machines), and if I do not know something, then he instantly says, that I am stupid, and that this is because I am a girl... They discourage us.
Some girls: Yes.
Betti: Yes, you feel that you are stupid and you should not follow that road just because you are a girl.
Moderator: Who discourages you?
Alexa: The men (laughter).
Natália: Those, who know these things better, and then if you try to do something for the first time, such as writing a programme or something like that -
Zsóki: Then they do not even give you a chance...
Ágnes: Yes..
Natália: Yes, you are a woman, you don't know this... On the other hand, you can cook...
(Group B)

A potential barrier can be expectations for facing discrimination in the labour market, as often it is expected that men have greater experience in technology related fields. Some of the girls themselves interiorized the belief that men have greater experience in that field and it was a factor towards choosing a different profession.

Vivi: I have heard that in the case of mechanical engineers they do not take on women anywhere...
Moderator: Why?
Vivi: As men have greater experience…
Panni: Or they think it is greater.. (laughter)

Rozi: Most of the time they think it is greater…
(Group C)

Many of the girls claimed that the boys got more attention from the teachers at their schools, they were the ones who were most often called to answer teachers' questions, they were more loud and confident, and asked more questions during class. This kind of difference between the behaviour of the girls and boys in secondary school has been observed in other countries as well (Catsambis, 1994). Some of the attention from the teachers could possibly be led back to the fact that the girls obeyed the school rules to a greater extent, whereas some of the boys had to be „disciplined". However, this greater attention from the teachers can also convey a hidden message that the success of boys is more important than that of the girls. In those cases when they asked help from teachers, most girls claimed that teachers were usually very helpful with them and in two groups they stated that they had no experiences with teachers treating negatively based on gender stereotypes. In Group A, however, one of the participants mentioned that all the girls were automatically put into the lower level math group. One of the participants also mentioned that they had a teacher who had a negative attitude towards the girl students:

Évi: What I saw in physics class was, that I think the teacher has the attitude that this is something the boys love and know well.

This kind of attitude from some of the teachers can work as a self-fulfilling prophecy: the girls can feel that they are perceived to be less good, and can be less confident, while boys on the same level of knowledge might consider themselves more talented.

Parents seemed to play an influential role in the study choices of some of the students. There were cases where parents pushed their children into different directions according to sex:

Évi: My parents influenced me in this respect. My father is very maths oriented, and because of this my brother was told that he should be an engineer, and …. he tried real hard until he realized that he didn't want to do it… In my case, I was told that I was like my Mom, and my mother told me, I did not necessarily have to know it (math).

(Group A)

The lack of female role models and examples can also contribute to girls not preferring technology related studies or professions. The girls are in a difficult situation as in many cases from the books, advertisements, television programmes, movie films they meet with stereotypical portrayal of women and their professions. This has the result that in the majority of cases the girls do not meet with female figures who work in these fields and who could serve as role models. The majority of the girls in our sample knew no female engineers or IT professionals.

Options of Promoting More Female Secondary Students to Apply to Technology Academic Programmes

Our findings suggest the possible importance of female secondary students acquiring greater knowledge of the possibilities in technology tertiary education and in technology professions – as they hardly had any knowledge. The girls were enthusiastic about possibilities that would somehow allow them to get direct personal experience or get into personal contact with representatives of the profession or technology students. Such options included, taking part in Girls' Day programmes (where they can get to see what members of a profession do by visiting a company and where they can even try out a profession for a day), or hearing lectures from successful female engineers or IT professionals, or hearing the experiences of alumni students of their secondary school who studied in tertiary technology education, or taking part at the open days programs at universities. Non-personal ways of gaining information – such as poster adverts of academic programmes being put up in secondary schools – were rated less positively. The influence of personal experiences was emphasized recurrently by the research subjects.

Lilla: It would be good to meet with such a woman: then you could see that there is a woman in the profession if they came to our school to tell us that this is really not bad for girls either…. An open day is I think an important possibility,… so that girls can go to a workplace and look around. If there could be workers there designated, each of them to students and they show the girls around, they try to work together. I think it is really important for the girls to see what these people actually do, how this and that works...

(Group C)

Those girls who had low self-esteem would have found it a good solution, if they had a mentor from the university to help them – in that case some of them would have been more likely to choose to study the investigated fields.

According to the opinion of our research subjects girls in general (and they themselves as well) would be more interested in technological academic programmes if they were paired with other non-technology fields. We have discussed earlier how starting interdisciplinary academic programmes can be a useful strategy to get more girls to apply (Csekei 2008).

Conclusions

We have shown that there are diverse barriers that can stand in the way of girls choosing technology academic programmes. The roots of some of these barriers go back to earlier stages of socialization. It is difficult to get the girls to have a more critical attitude to gender stereotypes. Many girls and boys try to behave in accordance with small group and wider societal expectations regarding gender and this can also put up a barrier for some girls to study technology related fields. However, if universities are open to the application of certain promotion methods which we have discussed in the paper, it is a possibility that at least some more girls might choose technology related studies. There are indications that there might be openness in that respect at least at some universities: as our research was commissioned by one of the universities precisely with the aim of finding out what they should do to attract more female students.

Our interviews with secondary school teachers have also made us aware that stereotypical beliefs of teachers and their differential treatment of girls and boys is a problem that has to be dealt with. Equal opportunity trainings for secondary school teachers might be one useful way to combat this problem.

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