Female students - a challenge for technical universities

A. Porębska, A.M. Dąbrowski, S.A. Mitkowski & E. Kurgan

AGH University of Science and Technology
Kraków, Poland

ABSTRACT: Technical studies are assumed to be difficult for both male and female students. Such studies are not popular, especially among girls, and this tendency is observed all over the world. The authors of this paper discuss female students' participation rate in studies at technical universities, and its broader implication for academic institutions and society. The example chosen to illustrate this issue is the results of a competition for young would-be students who apply to the AGH University of Science and Technology in Kraków, Poland. In the second part of this paper, an initiative is described that was taken by a group of leading technical universities in Poland, to stimulate women's interest in technical studies. Its motto: *Girls as Engineers!* The purpose of the campaign is to acquaint women with educational opportunities and to show that female students are able to achieve good results in technical sciences. The idea of educational initiatives such as these is worth backing, especially in the context of the general struggle against gender discrimination, including discrimination in the educational and labour markets.

INTRODUCTION

This paper is an attempt to confront the issue of participation rates of female students at technical universities. Technical studies are perceived as difficult by people making decisions about their further education. Only 7% of all university students in Poland study at technical universities. Among them, female students are a decided minority. Girls generally neither believe in their ability to cope with the requirements of such studies nor perceive themselves as future engineers. The same attitudes are common all over the world. In the European Union there are 49% girls and 51% boys among young people aged between 20 and 24. The ratio of male to female higher education students is 55% (girls) to 45% (boys), and among mathematics, sciences, technology (MST) students it is 31% (girls) to 69% (boys) [1].

Thus, women are better represented in higher education in Europe generally, but they obviously prefer fields other than engineering. In Poland, this tendency is clearly visible. It is reflected by the competition *AGH Diamond index* (see below), which is for young people who apply to the AGH University of Science and Technology in Kraków, Poland.

Also, to change the trend toward a low presence of women at technical universities, an initiative was taken by a group of leading Polish technical universities. Its motto: *Girls as Engineers!* This initiative is aimed at arousing women's interest in technical studies. Its role is to acquaint women with educational opportunities and to show that female students can achieve good results in technical sciences. An important element of the campaign is to create an opportunity for female scientists and female students to meet. During the meeting the students can ask the scientists questions about the problems faced in both studies and professional career.

As this campaign began only recently, it is difficult to evaluate its impact on the real choices made by girls planning their university careers. However, some preliminary data about the number of male and female students starting studies at universities after taking part in this campaign do allow the drawing of inferences on the direction of tendencies [2]. It is a good idea to make girls more familiar with technical universities and the subject matter of technical sciences. Society today needs both male and female engineers.

THE *AGH DIAMOND INDEX* COMPETITION

The competition, *AGH Diamond index*, by the AGH University of Science and Technology in Kraków, Poland, is for young people who apply to study at this university [3]. The competition is presented across four subjects: Mathematics, Physics, Chemistry and Geography. There are three levels to the competition and participants are qualified for the upper level after reaching 70% of possible points in the previous stage. Winners with the highest score in each field can study at the AGH University. The number of female and male participants in the competition is presented in Figure 1 - the

first level - and Figure 2 - after the third (final) level, respectively. Data refer to the 2009/2010 academic year. In Figure 3, the percentage of women participants in the first and after the third (final) level is shown.

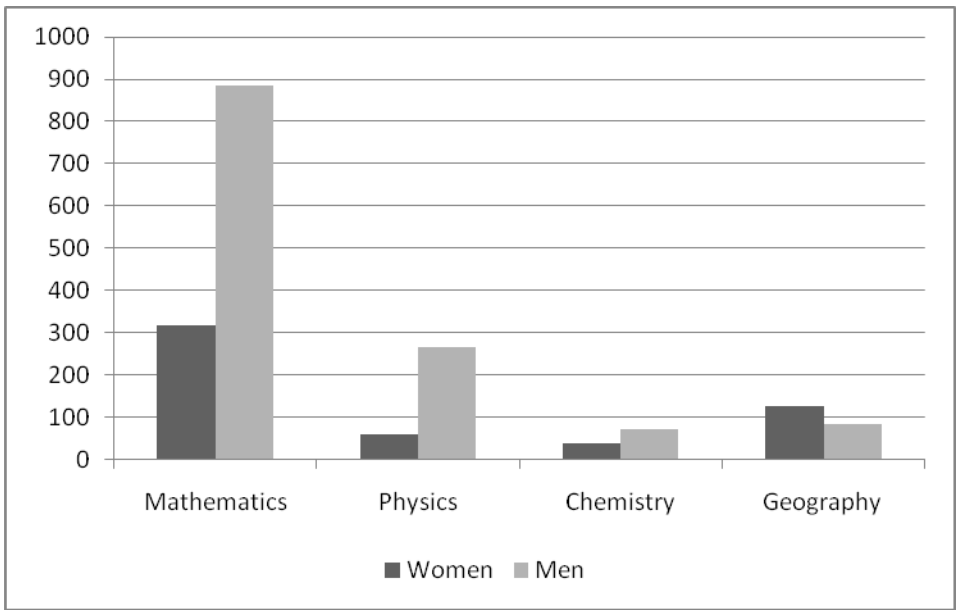

Figure1: The number of female and male participants in the *AGH Diamond index* at Level I.

As Figure 1 shows, Mathematics and Chemistry, respectively, are the most and the least popular subject in the competition. Girls are in the majority only in Geography. The disproportion between girls and boys is largest in Physics. Female participants represent just 18% of all competitors in this field.

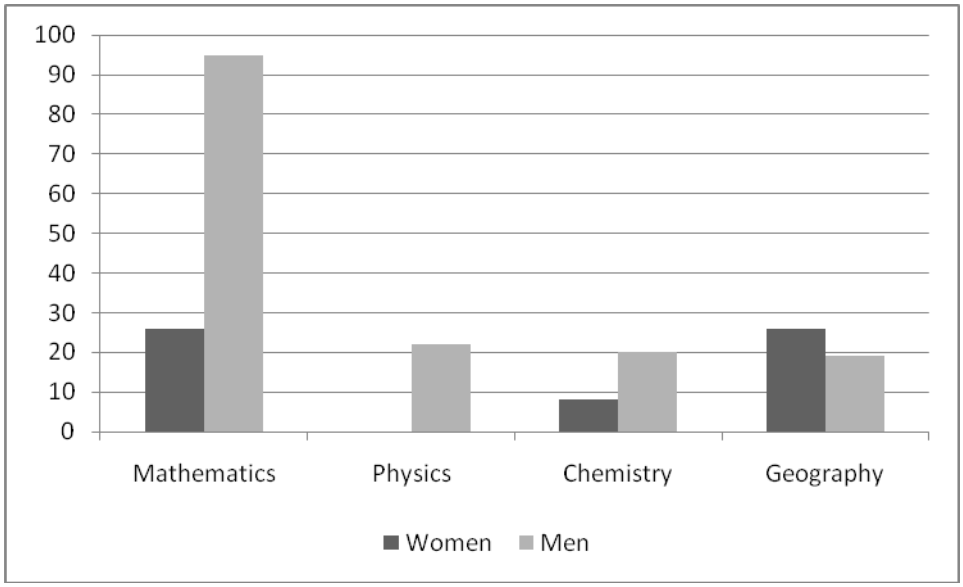

Figure2: The number of female and male participants in the *AGH Diamond index* at Level III.

In comparing the competition's Level III winners (see Figure 2), a similar result to Figure 1 is shown. But in Physics there are no females among the winners. It is worth stressing that the highest score was achieved by more than 20% of participants in Chemistry and Geography; 10% of participants in Mathematics; and only about 7% of participants in Physics. This last subject (it is most important for engineers) seems to be more difficult than Mathematics for young people - and especially for girls taking part in the competition.

Figure 3 shows the decreasing share of women among competition participants, between the first and last levels. This difference is not remarkable; but Physics again is the exception. The average participation of girls in Level I of the competition was 29% and among the winners it was 28%. The ratio of *participants - winners* is almost the same as the one achieved by boys. The value is also 29%, which is close to the percentage of women studying MST in the European Union.

In Geography, which was the only field more popular among women then men, girls achieved much better results than boys. However, in the case above of Physics, girls did not manage to pass the highest threshold. The results of the AGH

University competition seem to reflect the global tendency of women's poor interest in technical studies. On the other hand, the results prove that it is not a lack of abilities that is the major obstacle for women in their careers at the technical university; it is low motivation that is the issue. If girls are familiar with technical subjects and they decide to compete with boys, their results are similar.

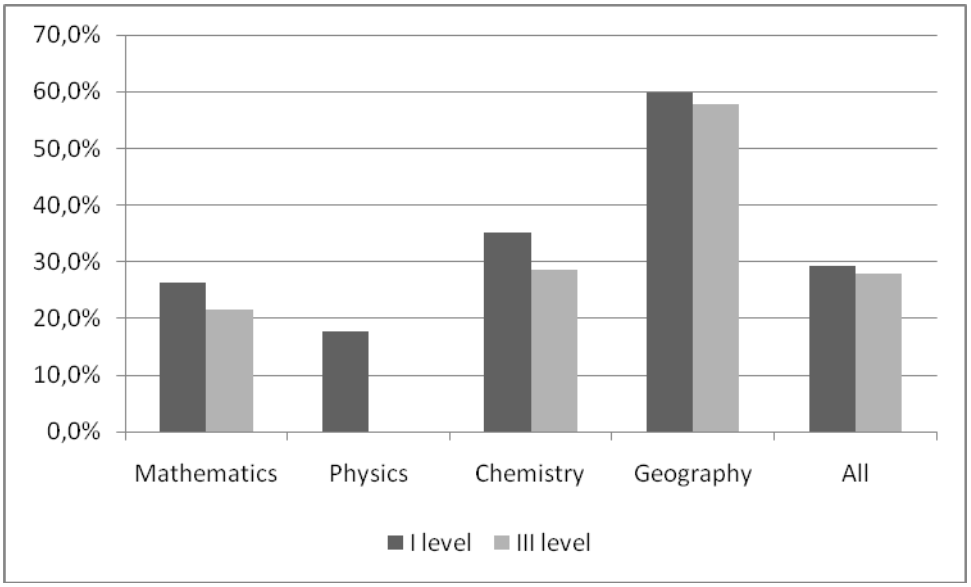

Figure 3: Percentage of women in the *AGH Diamond index* at Level I; and after Level III in the 2009/2010 academic year.

THE CAMPAIGN, *GIRLS AS ENGINEERS!*

Girls as Engineers! (*Dziewczyny na politechniki!*) is a campaign initiated by *Perspektywy* Educational Foundation (*Fundacja Edukacyjna Perspektywy*) and the Conference of Rectors of Polish Technical Universities (KRPUT). Biankia Siwinska from *Perspektywy* Educational Foundation, the author and coordinator of this campaign, said: *It* [the campaign] *plays a big role in breaking stereotypes about division between* feminine *and* masculine *faculties* [2].

This educational move began in 2007. It is based on a similar German initiative - *Girls' Day*. That is, technical enterprises, enterprises with technical departments and technical training facilities, universities and research centres are invited to organise an open day for girls [4]. Similar campaigns are carried out in several other countries. They are e.g. Women into Science, Engineering and Construction (WISE) in the United Kingdom [5] or Women in Engineering in the USA. The latter program is so popular in the USA that every university has its own version and appropriate information about it is placed on the Internet.

A good example of the university engagement in campaigns encouraging girls to study technical sciences in the USA is the Women's Technology Program at the Massachusetts Institute of Technology [6]. Experiences in all countries show that promotion of technical studies among women has a positive impact on their educational choice. The importance of stimulating women's presence at technical universities in modern societies is underlined by Lucia Sali in Special Insight Report [7]. In the Report she presents the main recommendations outlined in the European Schoolnet (EUN) White Paper, published in June 2009.

In Poland, 12 public technical universities and two faculties of physics participated in the third edition of the *Girls as Engineers!* campaign, in 2010. They were:

- AGH University of Science and Technology in Kraków
- Białystok University of Technology
- Częstochowa University of Technology
- Gdansk University of Technology
- Kielce University of Technology
- Koszalin University of Technology
- Opole University of Technology
- Poznań University of Technology
- Technical University of Łódź
- Warsaw University of Technology
- Wrocław University of Technology
- Polish-Japanese Institute of Information Technology

Three institutions that participated in the campaign in previous years resigned this year (2010). They were: Rzeszów University of Technology, Silesian University of Technology and Szczecin University of Technology. The only institution to inaugurate its participation in 2010 was the Polish-Japanese Institute of Information Technology.

In 2010 the new module of the campaign, *Girls to exact sciences*, was started. In this module two physics faculties participated:

- Faculty of Physics from Warsaw University;
- Faculty of Physics, Astronomy and Informatics, from Nicolaus Copernicus University of Torun.

Universities participating in the campaign invited all interested girls to take part in an *Open Day for Girls only*, which took place on 22 April 2010. This particular *day* in Poland was held on the same one as *Girls' Day* in Germany. During the day women participated in laboratory experiments, workshops and lectures, as well as in meetings with women professors and students. Female scientists presented particular examples aimed at proving that technical studies can be interesting and inspiring for girls as well. The open day is a most important element of the campaigns but not the only one. Girls can search for useful information and be in contact with female engineers and students *via* the Internet.

Information (in Polish) on the *Girls as Engineers!* campaign is at www.dziewczynynapolitechniki.pl.

As the *Perspektywy* Educational Foundation reports [2], in the academic year 2007/2008, when the campaign *Girls as Engineers!* began, 98,293 girls studied at technical universities. One year later, this number had increased to 101,437. In the academic year 2009/2010, the girls at technical universities numbered 107,657. In two years the number of female students had grown by 9,364. But in 2009, women made up just 32.5% of students at technical universities in Poland. It is still worse at the more technical faculties, where there are no more than a few percent of female students. Such faculties are electrical engineering, electronics, robotics and machine construction. The lowest percentage of girl students is at:

- Electrical Faculty of Silesian University of Technology - 2.4%;
- Mechanical Faculty of Technical University of Radom - 2.6%.

The percentage of women studying at technical universities in the academic year 2009/2010 is shown in Figure 4. Universities participating in the *Girls as Engineers!* campaign in 2009 are marked with a star. The share of female students is smaller at the universities possessing more engineering faculties than science faculties. With the majority of the technical universities taking part in the second session of the campaign (2009/2010), the distribution of female students among all of them is shown in Figure 5.

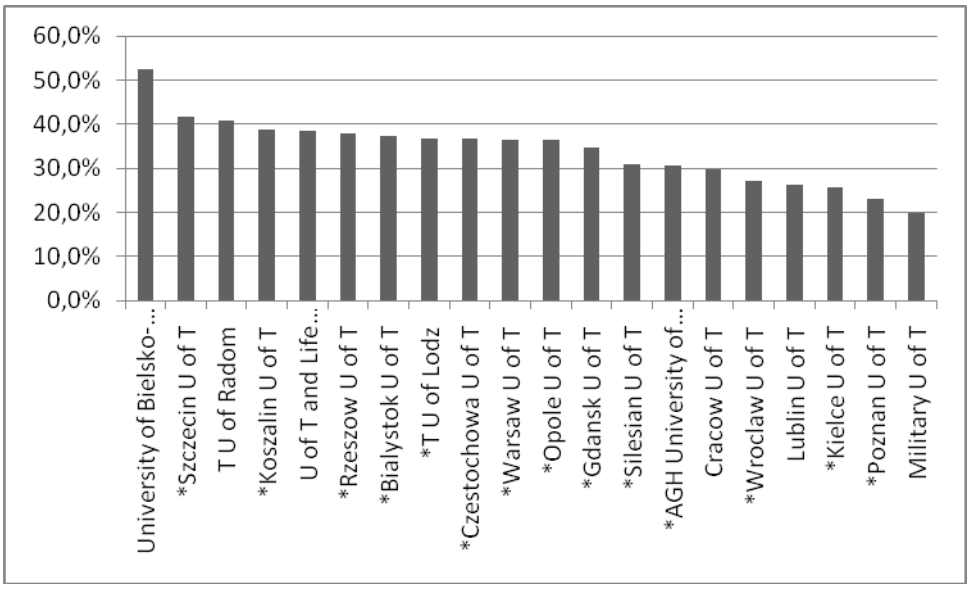

Figure 4: Percentage of women as students of Polish technical universities in 2009/2010. (Source: *Perspektywy* Educational Foundation 2009).

The average value of this increase is 1.4%. It is higher at some universities, such as Poznań University of Technology (3.7%), Rzeszow University of Technology (3.8%), Częstochowa University of Technology (4.7%), and Kielce University of Technology (5.6%). The growth of female students at technical universities that did not take part in the campaign is just 0.6%.

An unusual situation was observed regarding Szczecin University of Technology. It was established in 2008 by combining two separate universities. Therefore, data for 2009 are completely different from that of previous years. With Gdansk University of Technology, the number of girls starting studies in 2008 was greater than that of one year earlier. However, the total number of new students was so great, the percentage of women decreased.

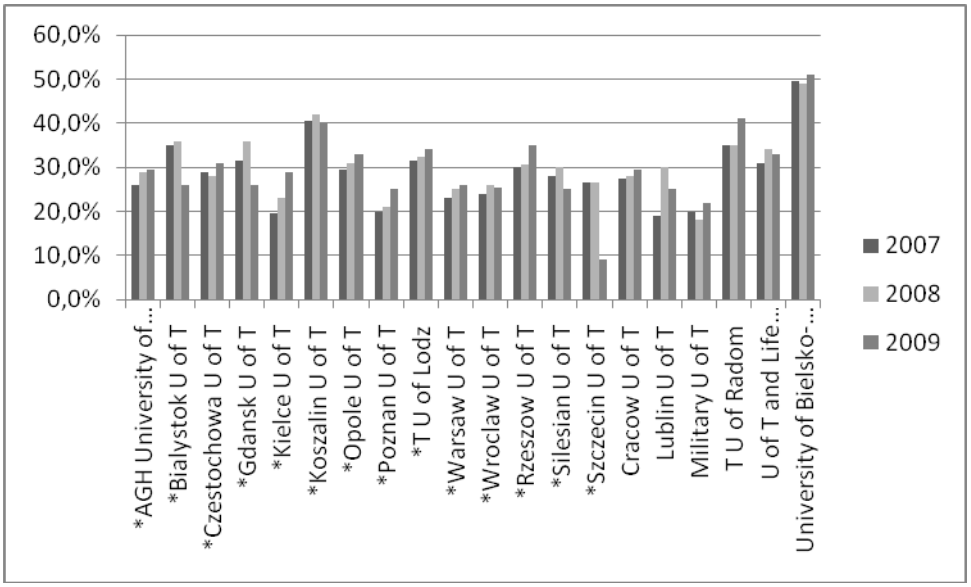

Figure 5: Percentage of women in the first year of studies at technical universities in different years. (Source: *Perspektywy* Educational Foundation 2009).

Figure 6 shows the proportions of female students at technical and humanities faculties at specific universities. In each case, the number of girls at technical faculties is meaningfully different. For Opole University of Technology, Lublin University of Technology and the Technology University of Radom the under-representation of female students at technical faculties is particularly striking.

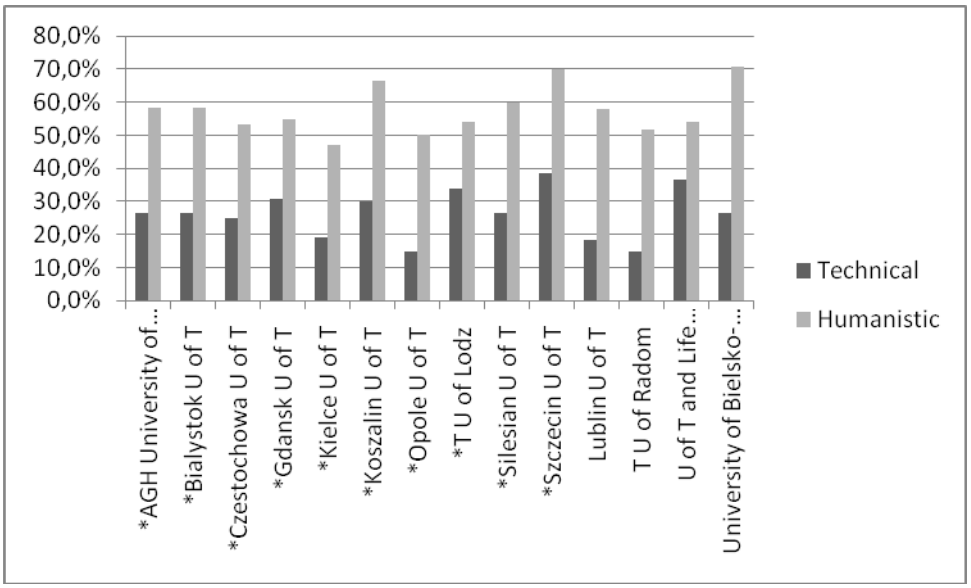

Figure 6: Percentage of women as students of technical and humanities faculties in 2009/2010. (Source: *Perspektywy* Educational Foundation 2009).

CONCLUSIONS

Technical studies are considered *difficult* by both male and female students. Specifically, this field of studies is not popular among girls and this tendency is global. A good example of this is the rate of female participation in a competition for young applicants to the AGH University of Science and Technology. Therefore, initiatives were launched to stimulate women's interest in technical studies.

Polish technical universities participate in an international campaign that introduces girls and young women to an exciting career in engineering, science and technology. This campaign competes with stereotypic views that engineering

studies are better suited to men. Such a struggle is important because modern society, still undergoing technological progress, needs a growing number of engineers within various fields - both women and men.

REFERENCES

1. Durando, M., Wastiau, P. and Joyce, A., Women in IT. The European situation and the role of public-private partnerships in promoting greater participation of young women in technology, *European Schoolnet*, 28 June 2010, http// resources.eun.org/insight/Science girls5.pdf
2. Girls as Engineers! 2010, (Dziewczyny na politechniki 2010), in Polish, 11 May 2010, www.dziewczynynapolitechniki.pl
3. Competitions *AGH Diamond index* (Ogólnopolska Olimpiada *O Diamentowy Indeks AGH*) (in Polish), 11 May 2010, http://moodle.cel.agh.edu.pl/diament/
4. Girls' Day - Future Prospects for Girls, 28 July 2010, www.girls-day.de
5. WISE Women into Science, Engineering and Construction, 28 July 2010, www.wisecampaign.org.uk
6. Women's Technology Program, 28 July 2010, http//engineering.mit.edu/education/special_programs/wtp.php
7. Sali, L., EUN White Paper: Why girls are still not attracted to ICT studies and careers, Special Insight Reports, 28 July 2010, www.xplora.org/ww/en/pub/insight/misc/specialreports/eun_white_paper_women_it.htm