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Natural Science in Belarus: Part 2 – Gender Balance and Culture

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Abstract. In Belarus, women’s representation in the field of natural science, as well as gender imbalance in physics and mathematics, have been investigated using the latest available statistical data, accessed in July 2017. Statistics on daily time use by gender and marital status, with a focus on work and family responsibilities, are provided to aid in pointing out the most challenging issues that are linked to gender-defined roles and affect female career achievements in society. Beneficial strategies to advance women in science are discussed.

For a number of years, national and local agencies of EU member states, Asian and African countries, and countries in North and South America have been working together to develop gender equality programs and initiatives to encourage and retain women in the fields of science and engineering. In the twenty-first century, gender balance in society and among early-stage researchers has been considered a strategic priority around the world because evidence shows that utilizing the skills and talents of both women and men is favorable for science itself and for society as a whole. Despite positive changes toward gender balance in science recently reported in many developed and developing countries [1], progress has been slow in quite a number of the science fields [2–4], including natural science, even though the latter is considered a major driver of innovation, which is important at all stages of economic development. Social scientists still point out “leaks in the pipeline” for women in both academic and research organizations, where women lag behind men and face challenges regarding promotion during their career paths in physics, mathematics, and chemistry in most countries around the world. Importantly, cultural differences may have a significant impact on how well women do in science [5]. In particular, social and cultural factors tend to be distinct between northern European nations and post-Communist countries of Central and Eastern Europe regarding the situation of women in science and engineering. Therefore, the collection and analysis of information for national and international policy on access, participation, and career development for women in physics and related fields, compared between developed and developing countries, will produce key ideas and approaches that could be applied by decision-makers and development agencies to other fields of science, engineering, and technology where women are still under-represented.

This work presents a survey of women’s representation in natural science and reviews new statistical data on gender imbalance in physics and mathematics in Belarus. The case of Belarus attracts attention because this former Soviet Republic in Eastern Europe is building a socially oriented market economy (National Strategy for Sustainable Socio-Economic Development of Belarus for the period until 2030), with the state playing an active role in securing social protection for the population. With regard to gender equality in society, Belarus ranked 30th out of 144 countries in the 2016 World Economic Forum’s Global Gender Gap Report; Belarus earned a Global Gender Gap Index (GGGI) value of 0.737, between Spain (0.738) and Portugal (0.737) [6]. The report indicates that GGGI has a maximum value of 1.0; it reflects gender-based gaps in access to resources and opportunities with respect to key areas such as economics, education, health, and politics. For comparison, GGGI puts Belarus behind Germany (13th place) and the United Kingdom (20th), but ahead of many others, such as the United States (45th), Russia (75th), and Japan (111th).

Current national action plans for gender equality in Belarus focus mainly on strengthening the institutions of the family and marital relationships, to advocate for the values of marriage and family and to achieve gender equality in family relationships, including involvement of men in care work and child rearing. For instance, the length of paid

maternity leave in Belarus is 3 years. However, gender bias across the Belarusian scientific community [7, 8] shows the presence of “glass walls” in career paths for women compared to male scientists, particularly in physics, and raises questions about the sources of leaks in the academic pipeline for women. Therefore, this study aims to provide insights into critical issues important for future generations of female scientists in Belarus and to advance the international agenda for women in science in terms of exchanging knowledge and identifying priorities for future areas of focus in line with global activities promoting gender balance.

As of January 1, 2017, the population of Belarus was estimated to be 9,504,700 people [9]. More than 26,000 people in 439 organizations are involved in research and development (R&D), according to statistical data for 2015 [10], including around 17,000 researchers engaged in science. Recent data from the National Statistical Committee [10] show that women account for 47.7% of researchers in the field of natural science, as shown in Fig. 1a. In comparison, a total of 21,623 full-time and 2,666 part-time academic teaching staff were employed by higher education institutions and universities during the 2016–17 academic year [11]; Fig. 1b illustrates that 54.3% of full-time academic teaching staff in higher education are women. At the same time, a minority of women in the fields of both natural science and higher education hold a doctor of science (DSc) degree: 17.9% and 20.0%, respectively. The percentage of women who hold PhD degrees is more than twice that of women with DSc degrees (see Fig. 1a, 1b).

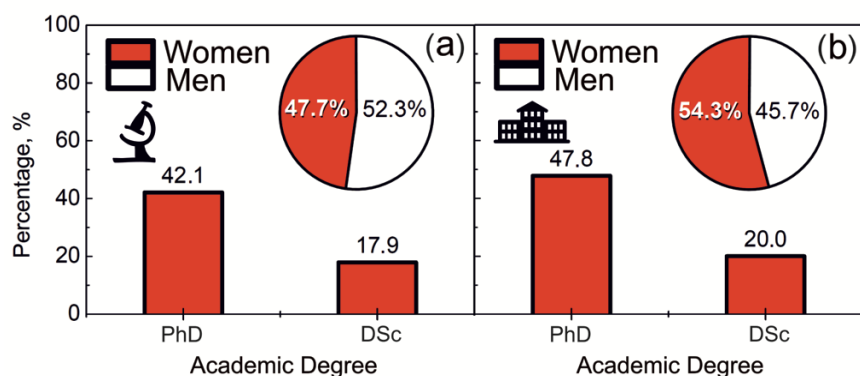


FIGURE 1. Percentage of (a) women researchers in the natural sciences and (b) women teachers in higher education with PhD and DSc degrees in Belarus. Insert (a) shows the distribution of women and men among researchers in the natural sciences. Insert (b) represents the distribution of women and men among full-time academic teaching staff in higher education.

Generally, in Belarus, undergraduate enrollment in the fields of natural science declined slightly, from 13,500 in the 2010–11 academic year to 12,100 in the 2016–17 academic year [11]. Mostly the decline is attributable to a decrease in the school-age population. Figure 2a demonstrates that half of full-time students, on average, are still women. A similar trend is reported for enrollment in 3-year PhD programs in physics and mathematics: the percentage of female PhD students was flat, and women constituted around 40% of total PhD students each year between 2010 and 2016 (see Fig. 2b). However, there is a lack of women successfully completing PhD programs in physics and mathematics because the percentage of female graduates from these PhD programs is smaller than the percentage of women enrolled for them, as shown in Fig. 2c. Therefore, it can be inferred that the proportion of women who earn PhD degrees in physics and mathematics is smaller than the proportion of women who plan to get a PhD degree. With respect to the doctoral program, which is the second stage of postgraduate education (a DSc degree is usually mandatory for one to be awarded an academic rank of professor and is considered to be an essential qualification for professors in Belarus), women accounted for less than one-seventh of doctoral students in physics and mathematics in 2014 and 2015. Compared to 5 years ago, this estimated percentage of women is down from 20% (2010) of total number of enrollments in DSc degree programs in physics and mathematics (see Fig. 2d).

As our analysis seeks to provide information on the gender gap in undergraduate education in natural science as well as in educational attainment at the level of PhD and DSc programs, we included in this study gender statistics on education and gender statistics on paid work vs. household work in Belarus. To some extent, a person’s sex, marital status, and the transition from childhood to adulthood affect achievements and career progress, especially at the doctorate level. In Belarus, young adults enter institutions and universities mostly between the ages of 17 and 21 [11]. They typically apply for PhD programs aged 24 to 28. Therefore, data in Fig. 3 are of particular interest, such as daily time use, average age of mothers at childbirth, and childcare, all of which are important for data analysis on gender balance in natural science.

Figures 3a and 3b break down the statistics on daily time use by sex and by marital status, focusing on work and housework (which is often referred to as “unpaid work”). It is obvious that if one takes into account both paid and unpaid work, then women, particularly those who are married, work longer hours at the expense of recreation and

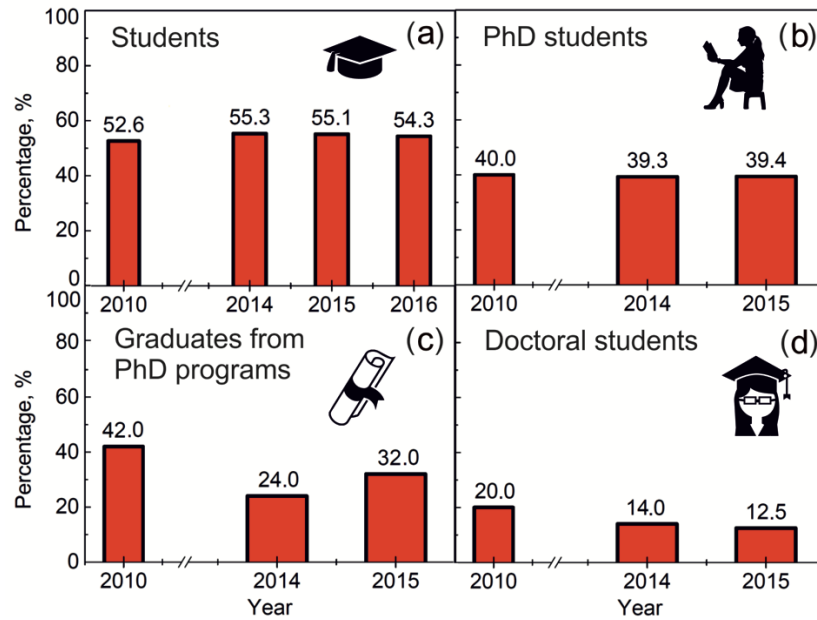


FIGURE 2. Female enrollment in higher education (a) in the natural sciences, and (b) in postgraduate programs in physics and mathematics; (c) percentage of female graduates from postgraduate programs in physics and mathematics; (d) female enrollment in doctoral programs in physics and mathematics.

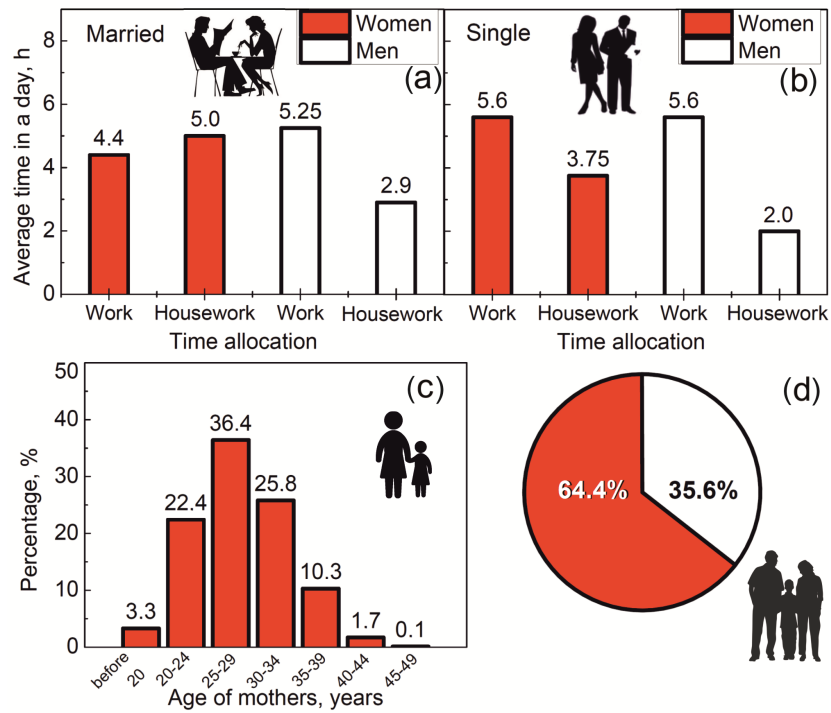


FIGURE 3. Daily time use by women and men concerning professional work and housework, (a, b) broken down by marital status; (c) birth statistics by mother’s age, and (d) childcare provided by married women and married men.

leisure time compared to men. Surprisingly, despite the fact that single women work as much per day as single men on a weekly basis, the statistics reveal that they spend almost the same time in total on both work and housework (an average of 9.35 hours a day) as do married women (an average of 9.4 hours a day). For single men, mainly as a result of less time spent on household chores, the statistics are the opposite: on an average day they spend less time on work and housework than married men (7.6 hours compared with 8.15 hours).

At the same time, it should be noted, Belarusian women tend to make the transition to adulthood a few years earlier than men: women marry at age 25.5 on average, while men marry at age 27.5 [12]. In 2015, the total fertility rate averaged 1.7 children per woman. Figure 3c illustrates that the mean age of women at the birth of a first child is 26. Note that this age matches the age of women's enrollment into PhD programs. On the other hand, Fig. 3d shows the percentage distribution of married men and women's involvement in childcare. On an average day, women spend 1.8 times more time providing childcare in comparison with men.

Today, there are ongoing debates around the world as to whether science is a gender-neutral institution. In Belarus, women and men had a fairly equal presence in the field of natural science until recently. In this survey, we have presented the latest available data on gender statistics with a focus on issues that set the stage for future gender imbalance in Belarus. While female graduates tend to outnumber male graduates in natural science at the undergraduate level, they are underrepresented in advanced degree programs. The lack of women who hold a DSc degree indicates vertical segregation in science in terms of lower status and pay of female occupations. One also needs to take into account that family responsibilities affect the career path of women scientists and often lead to a career's interruption by childbearing. In addition, women continue to bear the main responsibilities for housework and childcare because of gender-defined roles. Balancing work and family life is still a challenge for women. However, a small age gap between spouses is assumed to indicate wide educational and employment opportunities for both of them. Progress in men's involvement in childcare and household chores is beneficial for both women and children and shows positive tendencies in Belarusian society to reconcile work and family responsibilities.

In view of these data, it is obvious that to meet increasing demand for socio-economic national development and high international competitiveness, equal access for girls and boys to education in science at the general secondary education level is an issue of top priority, whether or not they are interested in scientific or engineering careers. In Belarus, family-friendly policy plays an essential role in promoting gender equality in scientific environments and networking. At all levels of society, positive male role models should be promoted in order to enable men to support and encourage women, resulting in balanced partnerships of women and men in public and private life. In conclusion, this study demonstrates the need for continuing efforts to collect information on the situation of women in natural science and calls for a closer examination of female career paths in Belarus to advance women in science and engineering at national and international levels.

NOTE

As a result of several circumstances, two papers on Belarus were submitted separately. With the consent of both authors, the editors have elected to present both papers.

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