ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ В ОБРАЗОВАНИИ

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IT EDUCATION AS A FACTOR TO INFLUENCE GENDER IMBALANCES IN COMPUTING: COMPARING RUSSIAN AND AMERICAN EXPERIENCE

E. K. Khenner

Perm State National Research University, Perm, Russia.
E-mail: ehenner@psu.ru

C. Frieze[1], O. Zane[2]

Carnegie Mellon University, Pittsburgh, USA.
E-mail: [1]cfrieze@andrew.cmu.edu, [2]ocz@andrew.cmu.edu

Abstract. *Introduction.* The problem of the relatively small number of women professionally employed in computing (computer science and information technology) is relevant throughout the world. Despite the fact that IT professionals are widely in demand, women in many countries, including the USA and Russia, make up no more than a quarter of their total number, which requires explanation. One of the major reasons for this phenomenon, according to the authors, lies in the education system.

The *aim* of this article was to analyse the factors affecting gender imbalance in IT professions, by comparing two countries in which information technology has historically played an important role, and which are very different from each other in many ways – economic, political, educational system and others.

Research methodology. The present research is based on the comparison of data on IT education in schools and universities, and the degree of involvement of girls and women in computing in the USA and Russia.

Results. Both in the USA and in Russia, gender imbalances in IT professions are formed largely in the field of education. Cultural stereotypes about computing as a male-dominated profession are produced by the media. Such stereotypes can discourage some girls and young women from studying computer science and also result in imbalance formation. The education system needs to increase the confidence of girls and young women in the possibilities of realising their abilities in the field of computer science and information

technologies. Educational institutions should help to eliminate the negative attitude towards girls' choice of IT professions.

Scientific novelty. For the first time, general factors in the field of education were identified that affect gender imbalances among IT professionals in Russia and the USA – the countries with significantly different traditions and educational systems.

Practical significance of the present work is to justify the conditions for improving school and university education to solve the problem of gender inequality in IT industry.

Keywords: IT education, women in computing, gender imbalances.

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IT-ОБРАЗОВАНИЕ КАК ФАКТОР ВЛИЯНИЯ НА ГЕНДЕРНЫЕ ДИСПРОПОРЦИИ В КОМПЬЮТИНГЕ: СРАВНЕНИЕ ОПЫТА РОССИИ И США

Е. К. Хеннер

Пермский государственный национальный исследовательский университет, Пермь, Россия.
E-mail: ehenner@psu.ru

К. Фриз[1], О. Зейн[2]

Университет Карнеги Меллон, Питсбург, США.
E-mail: [1]cfrieze@andrew.cmu.edu, [2]ocz@andrew.cmu.edu

Аннотация. *Введение.* Проблема относительно малой доли женщин, профессионально занятых в компьютинге (информатике и информационных технологиях), актуальна во всем мире. Несмотря на то, что IT-специалисты широко востребованы, женщины во многих странах, включая США и Россию, составляют не более четверти от их общего количества. Одна из причин указанного явления, по мнению авторов чрезвычайно весомая, кроется в системе образования.

Цель данного исследования – анализ факторов, приводящих к гендерной диспропорции в IT-профессиях, с помощью сравнения опыта двух стран, в которых информационные технологии исторически играют важную роль и которые сильно отличаются друг от друга по многим параметрам – экономическим, политическим, системам образования и иным.

Методология исследования – сопоставление данных о школьном и университетском IT-образовании в США и России и степени вовлеченности женщин в этих странах в область компьютерных технологий.

Результаты работы. Показано, что и в США, и в России гендерные диспропорции в IT-отрасли формируются в значительной мере в образовательной среде. Их появлению способствуют также транслируемые масс-медиа социокультурные стереотипы о программировании как исключительно мужской профессии. Системе образования необходимо повышать уверенность девушек и молодых женщин в возможности реализации их способностей в сфере информатики и информационных технологий. Образовательные учреждения должны содействовать ликвидации негативного отношения к выбору девушками IT-профессий.

Научная новизна. Впервые выявлены общие факторы в сфере образования, влияющие на гендерные диспропорции среди IT-специалистов в США и России – странах с существенно разными традициями и системами образования.

Практическая значимость работы состоит в обосновании условий совершенствования школьного и университетского образования для решения проблемы гендерного неравенства в IT-отрасли.

Ключевые слова: IT-образование, женщины в компьютинге, гендерные диспропорции.

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Introduction

In this paper, we present data and perspectives on women in informatics and computing from two seemingly different countries with two distinct cultures: Russia and the USA. Both the USA and Russia share a concern about the low levels of women's participation in computing. At the same time, women's participation levels between Russia and the USA differ. We ask: is access to computing education making the difference?

Let us clarify, for the Russian-speaking readers, that in this paper we use the term "computing" as a collective term that includes all types of education in computer science, information technology, information system, software engineering and computer engineering.

The problem of women's low participation in computing is relevant in many aspects. Computing offers some of the highest paid and fastest growing professions in the USA and Russia. In the USA it is projected that 70% of all new jobs in STEM will be in computing; but only 17% will be filled by computer science graduates [1]. In Russia IT specialists are highly sought after; appropriate vacancies are in third place among all existing in the labor market (the first and second places are occupied by workers and professions in the service sector)[1].

[1] HeadHunter Russia [Internet]. Moscow: Head Hunter Group; 2020. The labor market in Russia in the first quarter of 2015; 2015 Apr 30 [cited 2020 Jun 20]. Available from: https://hh.ru/article/16709

This makes it even more disturbing to see that American and Russian girls and women are seriously underrepresented in computing in both industry and academia. At the same time, in both Russia and the USA women earn approximately 56 percent and 57 percent respectively of the bachelor's degrees awarded by institutions of higher education. Clearly, women are as successful as men in studying in higher education programmes.

In Russia, women make up only about a quarter of workers in computing fields[1]. A similar situation exists in the USA, where women account for more than half of the professional workforce but only 26% of computing professionals [2].

In this paper, we analyse how education in general and IT education in particular affect the situation in this area. This analysis is based on both numerous publications on this topic and our own experience. The main method used by us is the comparison of various aspects directly or indirectly related to IT education in our countries.

Comparative Analysis

University professors

Regarding universities and academic positions in the USA, the representation of women in computing fields is even lower than in industry accounting for between 18% and 21% of research faculty. The proportion of women faculty members overall is also 21% and most American women faculty are untenured [3]. Women hold only 15% of full tenured professorships.

In Russia, among university teachers, there are 57% of women and 43% of men. Their positions are distributed as follows: heads of departments: women — 43%, men — 57%; full professors: women — 33%, men — 57%; assistant professors: women — 59%, men — 41%; senior lecturers: women — 70%, men — 30%; assistants (teachers responsible only for laboratory work and practical classes): women — 67%, men — 33% [4]. In both Russia and the USA women advance much more slowly than men and achieve high-level positions less often than men.

There are significant differences among university teachers in the distribution of men and women by profession: women among professors are much more in the humanities and less in technical, mathematical and natural sciences, including IT.

Below we give several specific examples taken from the websites of some of the leading Russian universities. 21 faculty members work in the System Programming department of the Faculty of Computational Mathematics and Cybernetics in the Moscow State University. Among them there are six full professors (all of them are men), and 11 assistant professors (only two of them are women). A slightly more gratifying picture can be seen at the Department of Informatics of St. Petersburg State University (22 faculty members in total, one

[1] Federal State Statistics Service (Russia). Women and Men of Russia Statistical Digest [Internet]. Moscow: Federal State Statistics Service; 2018 [cited 2020 June 20]. 241 p. Available from: https://www.gks.ru/free_doc/doc_2018/wo-man18.pdf

woman out of five full professors, three women out of seven assistant professors). In the Higher School of Economics, a university established in the post-Soviet period when it had the opportunity to form its academic staff from scratch, there are 11 females out of 44 faculty members (including one woman out of 11 full professors and one woman out of 11 assistant professors) in the Department of Software Engineering.

Approximately the same is observed in regional universities: for example, in the Perm State University, there is not a single woman in the full professor position among 50 faculty members of computing (but women occupy 40% of the assistant professor positions).

A similar situation occurs in US universities. For example, in the Department of Electrical Engineering & Computer Science in the Schwarzman College of Computing at MIT (Massachusetts Institute of Technology) among 160 faculty members, 27 are females of which eight are full professors. In the Department of Computer Science at the University of Chicago among 67 faculty members, 11 are females, and only three of them are full professors.

University students

Among undergraduate students in the USA, 19% and 21% of CS Bachelors recipients were women according to the 2018 Taulbee and NSF[1] reports respectively [4].

The data for Russian women is much higher ranging from 23% to 39% depending on the particular programme. At the Master's level, women account for 26% and 30% of degrees awarded in the USA while ranging from 21% to 46% in Russia. However, it should be noted that in Russia the least popular programmes among women are the highly technical fields such as Informatics and Computer Engineering and Software Engineering. At the Doctoral level in the USA women account for 20% and 19% according to Taulbee and NSF respectively. In Russia the situation is notably better; among doctoral students, 47% are women. NSF also reports that 21% of Associate's degrees (these are usually 2 year degrees from community colleges or online studies) are awarded to women in CS.

CS education at school

Russian schoolchildren start to study elements of informatics in primary school, where informatics can be either a separate subject or be integrated into other subjects. Boys and girls learn the foundations of logical and algorithmic thinking along with the initial elements of computer literacy [5].

In middle school, computing/informatics is always a separate subject, *compulsory for all students*. The course of informatics introduces the basics of information science and basic information technologies. Most high schools offer informatics because it is a popular subject and most students who enter university will have studied informatics in high school at a basic level; those

[1] National Center for Science and Engineering Statistics. Women, Minorities, and Persons with Disabilities in Science and Engineering: 2019 [Internet]. Alexandria, VA: National Science Foundation; 2019 [cited 2020 June 12]. 11p. Special Report NSF 19-304. Available from: https://www.nsf.gov/statistics/wmpd

students who study informatics at an advanced level, as a rule, plan to continue their education at university in the field of computing.

School education in Informatics in Russia is briefly described by Khenner and Semakin [6]. A more detailed description, including the evolution of this education from its inception, can be found in the book, *Methods of Teaching Computer Science* [7].

Most of the university programmes related to IT require students to take and pass the Unified National Exam (UNE) in Informatics after high school. It is difficult to determine exactly what part of their successful results in the UNE in Informatics applicants need to present for IT training programmes, since some engineering universities traditionally prefer physics to informatics, which sometimes looks rather strange (for example, for programmes "Computer Science and Computer Engineering", "Software Engineering" and some others). However, this does not apply to all technical universities: for example, Tomsk, Novosibirsk and many other technical universities, for admission to IT training programmes, require the UNE in informatics. Most classical universities do the same, including federal and national research universities. It is safe to say that for the majority of school graduates entering the IT training programmes UNE in Informatics is necessary.

Statistics on the gender composition of students choosing an exam in Informatics, demonstrates the interest of girls to IT professions. From the regional reports on the results of UNE for the last five years, girls made up 23-26% of the total number of applicants taking the Unified National Examination in Informatics (depending on the region). The average score for Informatics was 61 (out of 100 points), which is higher than for most other subjects. In general, girls usually show marginally better results than boys: girls on an average show 62 points and boys 60 points. It allows us to conclude that at the level of studying informatics at school, girls are no less successful than boys, but this picture is seen against the background of the fact that the number of boys who chose the Unified National Examination in Informatics are three times more than number of girls. The mere fact of choosing this or that National Examination tells a lot about the choice of subsequent professional education and professional careers.

The picture for USA students at the K-12 levels is quite different. Until recently, few American students, boys and girls, had the option to study CS or even to discover if computing fields were of interest to them. However, recent increased funding in K-12 education, and the introduction of the CS Principles course (situates programming in a broad college level introduction to computer science), has led to an upswing in students taking CS classes in High School. The number of girls taking the Advanced Placement (AP) Computer Science exam rose from 17% in 2014 to 28% in 2018[1]. This increase is especially present in states with more robust policies around K-12 CS education. In 48 states and Washington D.C. students can now count computer science courses toward high school graduation. The AP in computer science course in the USA may be comparable to the Russian Unified National Exam (UNE) in Informatics, but in the latter case girls often outperform boys.

[1] College Board. Program Summary Report 2019 [Internet]. New York City: College Board, 2019 [cited 2020 July 1]. 1p. Available from: https://research.collegeboard.org/programs/ap/data/participation/ap-2019

Overall, American K-12 schools continue to lack substantial CS education and "most high schools do not yet offer rigorous computer science". Despite nine in ten parents wanting their children to study computer science, only 40% of schools offer courses in programming[1]. These schools are disproportionately wealthy and white and skew slightly towards high schools with few elementary schools offering computer science courses.

Even with the increase in girls' engagement with high school CS in the USA the percentages are still low. There have been several explanations for why this came about. One of the leading arguments revolves around the arrival of the home computer, marketed to men and boys, and often featuring computer games thought to appeal to boys [8]. Overall, American boys and girls, parents, teachers, and the media, tend to perceive CS as a boys' field [9].

Discussion

What happened to women in computing?

The above data does not tally with the history of women's early emerging presence in computing. Women played critical roles in the USA throughout the World War Two years and onwards. According to NCWIT in 1984 37% of students who graduated with a CS bachelor's degree were women [9]. In the case of Russia women played a significant part in the pioneering stages of informatics and computing development. "In the 60's – 80's of the last century, at least half of the university students majoring in specialties related to programming were women; and after graduation, almost all of them worked in their profession" [10].

What happened to women in computing in the USA and Russia (even if to a lesser degree in Russia), to squash what seemed like a growing presence? In the USA the situation appeared to go unnoticed until 1997 when American computer scientist, Tracy Camp, brought attention to the issue with her momentous paper "The Incredible Shrinking Pipeline" [11].

By the early 2000's many American industries were starting to notice the value of diversity and attention to the low participation of women in computing prompted several business led reports. A 2007 McKinsey & Company study looked at 101 mainly large corporations from a range of industries across Europe, Asia, and the United States.

"(C)ompanies with a higher proportion of women on their management committees are also the companies that have the best performance" [12].

The European Commission's report, "The Business Case for Diversity," showed surprising benefits resulting from including good diversity practices as a business priority[2]. Benefits ranged from reduced absenteeism, reduced employee turnover, and improved corporate image. With such reports came more calls for

[1] Code.org. 2019 State of Computer Science Education [Internet]. Seattle: Code.org; 2019 [cited 2020 June 12]. Available from: https://advocacy.code.org/2019_state_of_cs.pdf

[2] Directorate-General for Employment, Social Affairs and Inclusion (EU). The Business Case for Diversity: Good Practices in the Workplace [Internet]. Luxembourg: European Commission; 2005 September [cited 2020 June 12]. 62 p. Available from: https://rownosc.info/media/uploads/biblioteka/publikacje/business_case_for_diversity.pdf

improved gender diversity in computing fields in the higher education system.

In Russia, the share of women in business has been growing in recent years, but the statistics are very heterogeneous and depend on what is meant by "business". If we talk about women entrepreneurs, according to Otkrytie FC Bank, one of the largest Russian banks, based on an analysis of loans issued, in 2019 women entrepreneurs account for about 30% among entrepreneurs of Russian small and medium-sized businesses[1]. According to government statistics the proportion of women among self-employed persons is 43%; in the same category, the share of women-employers is 32%.

In the USA, there have been several explanations for the low participation of girls and women in computing fields. One of the leading debates has focused on the lack of computer science (CS), or programming classes in the Kindergarten through high school (K-12) curriculum. At the same time there is a strong belief that student exposure to the field is critical to taking the next steps into a computing major and careers in the field [8].

The explanation that it is the lack of computer science education that holds girls back does not hold true for girls in Russia.

Stereotyping and other obstacles

While access to computing in the education systems differs greatly between Russia and the USA another obstacle appears widespread in both countries. The issue of gender stereotyping and gender norms is believed to impact the participation of girls and women in the fields of computing in both Russia and the USA. In the USA "inaccurate stereotypes depicting computer scientists and engineers as geeky, brilliant and socially awkward" abound [13]. Similar attitudes hold true for Russia. One Russian study found that girls were more likely than boys to base their future careers on their perceived ability in the field. At the same time girls were more likely than boys to have low self-esteem and negative evaluations of technology subjects. Thus, it is not surprising that they do not choose computing careers. Researchers attribute their findings to the roles of socialisation and gender norms. "Formally, the education system does not put obstacles for boys and girls in choosing professions. However, starting from children's games, through textbooks, home economics lessons for girls and plumbing / carpentry for boys, stereotypes are laid in the minds of young people that professions are divided into "male" and "female" [14]. The study confirms that this stereotype continues to play a significant role in choosing a profession" [15].

This brings us to another leading debate on the low participation of girls and women in computing fields in the USA. Throughout the 1990s and to date, gender difference thinking has become entrenched in public attitudes [8]. Gender stereotypes and beliefs that boys and girls, men and women are very different, not just biologically but also intellectually have become a common way of seeing the world [16]. Best-selling books like *Men Are from Mars, Women Are from*

[1] Bank "Otkrytie": The share of women entrepreneurs in the small and medium business of the Russian Federation is growing. Prime Business News Agency [Internet]. 2019 Jun 26 [cited 2020 Jun 20]; Finance: [about one p.]. Available from: https://1prime.ru/finance/20190626/830107377.html

Venus have perpetuated the belief that men and women are very different. This has meant that many boys and girls, encouraged by the well-meaning (but often unconscious) messages from the adults around them grow up thinking they are suited to different studies, behaviors, and careers. For example, "… anonymous, aggregate data from Google searches suggests that contemporary American parents are far more likely to want their boys smart and their girls skinny" [17]. The belief that men are innately better at coding than women, is another case in point. This mindset, fed by stereotypes, is relentlessly perpetuated in the popular media of the USA [18, 19].

Another explanation for the low participation of girls and women in computing fields in the USA revolves around the issue of "choice" [20]. American students have a huge selection of courses and areas of study to choose from. In many cultures choice is influenced by economic factors such as the need to find employment, sometimes to help support families, and sometimes for economic independence. India is a good example where women represent almost 50% of CS undergraduates and are strongly encouraged to study computer science for its career opportunities [21]. In the USA choice is often determined by what the student loves. "American girls who aim to 'study what they love' might be just as passionate about computer science and engineering as they are about teaching and nursing if they had more chances to find out whether they love these STEM fields" [22]. Choice also plays a role in the lives of Russian girls. We saw earlier that in Russia at the level of studying informatics at school, girls are no less successful than boys. But this picture is seen against the background of the fact that the number of boys, who chose the Unified National Examination in Informatics, are three times more than the number of girls. The mere fact of choosing, or not choosing, the Informatics option in the National Examination tells a lot about the choice of subsequent professional education and professional careers.

In one Russian survey study of high school students' choices for college studies, results showed that boys and girls made choices comparable to American stereotypes: the boys chose the natural and technical sciences while girls showed the opposite trend, planning to study the arts and humanities. Differences in choice were found to be statistically significant. "Only 35% of girls preferred STEM disciplines (technical and natural), while in boys this indicator was almost twice as high (65%)" [23]. The researchers tied the choices of the girls to self–esteem in STEM disciplines but also to the way in which the "hidden curriculum" of schools steered girls and boys in different directions. "This is very likely to demonstrate to girls: their life path is different from men's, which cannot but affect their professional choice".

The majority of educators in the USA are women (76%), often thought to be tied to the belief that women tend to occupy low status jobs and teaching is considered a low status job "Unlike in many other countries, in the United States, teaching has long been seen as a relatively low-status profession" [24]. Women also dominate the teaching profession in Russia where teaching is considered "women's work" [10]. But while the majority of teachers of informatics in Russia are women, in the USA men dominate the math and science classes (we have

no data specific to computing, probably because so few schools have computing on the curriculum). It can be said that school informatics in Russia stands on women's shoulders. This is confirmed by the data of modern statistics taken from statistical reports of the Ministry of Education of the Russian Federation. According to them, in Russia in 2019 the teaching of informatics was the main occupation for 29,270 teachers. Among them, 21,233 women (72.5%), and they dominate in all age groups. Russian women have the benefit of paid maternity leave (70 days before the expected date of birth and 70 days after). Afterwards, they can take unpaid leave to care for a child up to 3 years *with guaranteed work in the same position* after its completion. This policy prevents Russian women with a "gap" in their work history from being shut out of IT/CS teaching.

For girls in the USA to choose computing often means having to challenge stereotypes and go against gender norms [25, 26]. At the same time with few women established in the field there are few role models to inspire young girls. In this sense we might argue that although girls are not told they cannot do computing, subtle messages are telling them it is not what girls do.

If we put this all together for girls in the USA – little exposure and experience in computing, little encouragement to see yourself in the field, media stereotypes, many alternative gender appropriate choices – it is not really so surprising that few girls and women participate in computing fields. The education argument does not hold true for Russian girls who receive a solid foundation in computing education in their early years in school but Russian girls still have to overcome low self-esteem before they feel that informatics is a choice they can make.

Approaches and strategies to improve women's participation in computing

As awareness of the low participation rates of women in computing in the USA, along with increased understanding that careers in computing are plentiful and lucrative, have brought more attention to the issue. Industry demands for more skilled workers with computing expertise have also raised awareness of the USA falling behind in the global technology market. The past few years have brought more encouragement and options for girls to study computing. We have seen the growth of organisations like the National Center for Women in Information Technology (NCWIT), packed with resources and support for girls and women in information technology; we have seen the emergence of online opportunities like Code.org providing the means and encouragement for girls to learn coding; Google's Girls Who Code provides community-based clubs and summer immersion programmes. These represent a sampling of the many new efforts to address the gender gap in computing.

In the USA, there have been several approaches to address women's low participation in computing. In the 1990's through to early 2000's, some researchers thought the best approach was to change computing to suit women. In this approach CS course work would be more practical based and meaningful, appealing to the gender stereotype that women care more about the applications of computing than about theoretical or abstract aspects [9]. Our work at Carnegie Mellon University (CMU), where we have 50% women in the CS major, has

challenged this strategy. We know women can do the work and our curriculum has not changed to accommodate perceived gender differences. Indeed, we believe a gender difference approach that serves to accommodate perceived gender differences will ultimately perpetuate the gender gap in computing [9].

More recently, we see a move towards recognising that the low participation of women in computing is cultural and needs to be addressed at the cultural level. We see this clearly when we look at other cultures where boys and girls grow up without the same gendered steering towards studies and careers [20]. In Malaysia, for example, men and women participate equally in CS at the undergraduate level; a similar situation exists in India [27, 21]. These students do not grow up thinking math, science, CS is just for boys. Girls in the Arab sector of Israel are equally represented in CS in High School (unlike the Jewish sector), largely as a result of parental encouragement [28].

Studies at Carnegie Mellon University

At Carnegie Mellon University (CMU) we recognised that culture was indeed the primary factor for determining women's participation in computing. We recognised that women have the intellectual potential to equal their male peers but may not have had equitable exposure and experiences in computing as their male peers. For example, it has been well documented that many more boys have been programming at home or in schools and are more likely to choose a CS major in college [8]. To help alleviate this disadvantage in 1999 CMU dropped the programming requirement in their applications for the CS major. This recommendation was part of the findings from a 1990's study at CMU which concluded that students did not need a background in computing skills to study and graduate with a bachelor's in computer science [8]. From 1999 onwards admitted students are still required to have excellent high school exam scores, strong interest in math and science, computing and technology, and a demonstrated leadership contribution to their home communities. Around one third of students are admitted into CS with no CS background. This shift in the admissions criteria was a critical point of change in the undergraduate student body, a change from a homogenous student body to one with more women *and,* also, more men from a range of backgrounds.

At the same time, we recognised that women are often situated in unwelcoming environments, in very male dominated classrooms and peer groups [29]. To address this CMU developed programmes to enhance women's leadership, mentoring, socialisation, and CS skills through the organisation, Women@SCS. Further studies at CMU were carried out from 2002-2017. These studies involved interviews and surveys to assess student attitudes towards CS and their experience at CMU. These studies have shown that since the change in admissions and the implementation of Women@SCS to help level the playing field women have become central to the culture and have provided many community building events and activities that have benefited the entire community [9]. Since 2018 CMU has seen gender equity in the CS student body. Our studies concluded that cultural change (in this case at the school level with institutional support), not curriculum change, has been the key.

Conclusion

While women in Russia are still underrepresented in the field they are well ahead of the USA in terms of both CS K-12 education and the percentages of women studying computer science in higher education. One article suggests "Russian women's foothold in science and technology can in part be traced back to the Soviet era, when the advancement of science was made a national priority. Along with the growth in specialist research institutes, technical education was made available to everyone and women were encouraged to pursue careers in this field." [30]. CS educators in the USA can gain a broader perspective by looking at CS education in Russia.

There are many obstacles to improving the participation of women in computing that need addressing from both the USA and Russian perspectives. Here we present five issues of mutual importance:

In the USA, and in Russia, we need to be challenging cultural stereotypes that may discourage some girls and young women from studying computer science. Russian girls are heavily exposed to American media and we might assume that negative images of women in computing roles, or the absence of women, could be impacting their participation in the field in much the same way as American girls.

In the USA, and in Russia, we see girls and young women with low self-esteem and confidence regarding their CS/IT capabilities.

Some parents and teachers still hold negative views about girls going into computing fields.

Unconscious bias among some tech companies and high level employers (and some academics) means they fail to notice how company culture discourages some women from remaining in the field.

Company leaders need to recognise that women are often at a disadvantage in maintaining work/life balance. Susan Wojcicki, the CEO of YouTube, gave a speech at Grace Hopper in 2015 and showed how companies can change. In one example, she addressed the problem of women leaving IT after several years of work (e.g. after the birth of a child) and then having difficulty returning to their previous status. She showed how improving this situation for women could benefit both women and the company [31].

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Information about the authors:

Evgeniy K. Khenner – Dr. Sci. (Phys.-Math.), Professor, Department of Information Technology, Perm State National Research University; Corresponding Member of the Russian Academy of Education; ORCID ID 0000-0002-6397-4465; Perm, Russia. E-mail: ehenner@psu.ru

Carol Frieze – Dr. Sci. (Philosophy), Director of Professional Organisations SCS4ALL and Women@SCS, School of Computer Science, Carnegie Mellon University, Pittsburgh, USA; ORCID ID https://orcid.org/0000-0001-6797-5564. E-mail: cfrieze@andrew.cmu.edu

Olivia Zane – Administrative Assistant and Outreach Coordinator of Professional Organisations SCS4ALL and Women@SCS, School of Computer Science, Carnegie Mellon University, Pittsburgh, USA. Email: ocz@andrew.cmu.edu

Contribution of the authors: E. K. Khenner – 40%, C. Frieze – 40%, O. Zane – 20%.

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Информация об авторах:

Хеннер Евгений Карлович – член-корреспондент Российской академии образования; доктор физико-математических наук, профессор, профессор кафедры информационных технологий Пермского государственного национального исследовательского университета; ORCID ID 0000-0002-6397-4465; Пермь, Россия. E-mail: ehenner@psu.ru

Фриз Кэрол – доктор философии, директор профессиональных организаций Women@SCS и SCS4ALL, Школа компьютерных наук, университет Карнеги-Меллон; ORCID ID https://orcid.org/0000-0001-6797-5564; Питсбург, США. E-mail: cfrieze@andrew.cmu.edu

Зейн Оливия – административный ассистент и координатор по связям с общественностью профессиональных организаций SCS4ALL и Women@SCS, Школа компьютерных наук, университет Карнеги-Меллон, Питсбург, США. E-mail: ocz@andrew.cmu.edu

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