

School of Data Analysis. Its role in the development of computer science and programming in Russia is similar to that of the role of the New Economic School played in terms of economics and finance.

Credit for the fact that the country is no more lagging behind the West in many sciences, like it did in the times of the Iron Curtain, should be given to Russian physicists and mathematicians.

3. Prospects

Nowadays there are at least three other areas where demand for mathematicians is high.

First of all, Russia needs to develop new innovational disciplines that emerged earlier in the West. As mentioned before, it has managed to overcome the gap in the sphere of economics and computer science but there's a whole range of areas (e.g., in natural sciences and engineering) where the process hasn't even started yet due to lack of resource base. In some fields it is already being accumulated but it is also necessary to form an initial pool of specialists who would first get an appropriate education themselves and then start training future generations. Experience shows that in the end, such stories help create new labor market opportunities for physicists and mathematicians.

Secondly, new disciplines are emerging all the time. Their scope and professional & educational requirements often are still vague even in the most progressive countries. Such areas include mathematical methods for drug design or quantum computers and communications. This is where new international labor markets for physicists and mathematicians are developing too. If Russia timely invests sufficient funds in the development of such areas, it will likely become one of the world's innovations leaders.

Thirdly, Russia is finally able to offer internationally competitive employment opportunities to academic mathematicians. Holders of foreign PhD-diplomas in math are now coming back to Russia to take up new jobs. The introduction of postdoc-equivalent positions at some of the Russian universities and research centers gives talented young mathematicians a chance to build a successful academic career within the country.



Math in Moscow: Conveying Traditions of Russian Mathematical School

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Math in Moscow (MiM) is the name of a short-term (1-2 semesters) study abroad program offered in English jointly by the Independent University of Moscow (IUM), National Research University Higher School of Economics (HSE), and Moscow Center for Continuous Mathematical Education (MCCME). It was first launched in spring 2001 by IUM. Along with courses in mathematics and computer science, students can study Russian language, Russian literature, history of mathematics and science, and history of Russia. All MiM courses are credited to the students at their home institutions.

The main goals of the program are to:

- intensify the interaction between Western and Russian (not only mathematical) cultures;
- make Russian traditions of teaching mathematics available to international students;
- provide an international learning environment to IUM students;
- provide an international teaching experience to IUM instructors;
- broaden foreign students' understanding of contemporary Russia.

The biggest difficulty encountered by MiM in pursuing these goals is not program-specific; it rather applies to all internationalization efforts in Russia. Potential students have certain stereotypes about life in Moscow and Russian people that are hard to break. Thus, MiM's efforts to overcome these stereotypes may have cultural significance, not bounded to mathematics only.

The MiM program aims at combining the best traditions of Russian and Western systems in teaching mathematics. We have adopted the North American custom of giving significant homework assignments. Grading follows Western

traditions and takes into account the results of students' activity during the whole semester. Teaching methods follow Russian traditions: rigorous theory presentation with full proofs, solving meaningful rather than formal problems, involving students in collective problem discussions. Questions are welcome in class, if not required.

Teaching international students in the MiM program, as well as teaching Russian students at IUM, is very individual. The list of courses for each semester is formed in accordance with individual application forms. Each student has an opportunity to learn as much mathematics as he/she chooses. We've had students who took up to 7-8 courses per semester. The program provides gifted foreign students with a rare opportunity to study in a big group of talented classmates. The students, chosen from leading US and Canadian universities, form an extremely strong math-oriented group they would've never seen at undergraduate level in their home universities. This stimulates their abilities and makes teaching more efficient.

In 2008, when Higher School of Economics created the Faculty of Mathematics together with the Independent University of Moscow, MiM became a joint effort between IUM, HSE and MCCME. This gave international students even more opportunities to contact Russian students. They live in the dorms together with HSE students and may take courses offered by the Faculty of Mathematics in English. Participants of the HSE Master of Science program in Mathematics (both foreign and Russian) may take MiM courses too.

Since prerequisites for the program are rather low, we've had students of very different level. About 35% of the participants were juniors at their home universities, 35% — seniors, 15% of — sophomores, 15% had just graduated. This difference in level stimulates team work. Living in one dormitory, students often discuss math problems and lectures. Groups are extremely small in size, which allows individual approach to each student, no matter what their level is.

Besides teaching mathematics, the program offers excursions and trips, in particular, a three-day trip to St. Petersburg and a two-day trip to ancient Russian towns Vladimir and Suzdal.

Since spring 2001, more than 300 students from over 160 universities have participated in MiM. We have had, among others, participants from the following institutions: California Institute of Technology, Cornell University, Harvard University, Massachusetts Institute of Technology, McGill University, University of California at Berkeley, University of Chicago, University of British Columbia, University of Montreal, Yale University. Though the program is mostly oriented on American and Canadian students, we've had six students from Europe too.

MiM started in 2001 as a pilot program between Cornell University and IUM. The first and unique student in the first semester of the program was Alex Smith from Cornell.

Soon after that, the American Mathematical Society, led by its President Felix Broder, started to award NSF-sponsored fellowships to selected American students going to MiM. A few years later, the Canadian Mathematical Society, led by its President Christiane Rousseau, started to award similar fellowships sponsored by the CMS and NSERC to Canadian students.

In 2010 and 2013 we asked our alumni about the role of Math in Moscow in their education and its impact on their careers. It turned out that almost all our alumni had chosen to continue their studies at graduate or postgraduate level. Several alumni have already got their PhDs and work at mathematics departments of different universities.

Many alumni tell that:

- MiM has had a strong impact on their decision to pursue a degree in mathematics;
- their stay at MiM determined their current field of research;
- courses they took at IUM were not offered at their home institutions;
- MiM has shown them different ways of thinking about mathematics;
- it was a wonderful experience to share the time with other math students, to develop friendships and work relationships with math students from all over North America. Many alumni are still in touch with some of their acquaintances from Moscow, both Russian and American.

Several former MiM students joined the Master of Science program in Mathematics offered by HSE Faculty of Mathematics. In fact, MiM keeps playing a major role in recruiting the best mathematics students to HSE. For example, 2 out of 3 international MSc students who entered this year have MiM experience. We see two main reasons for such a strong recruitment effect: firstly, students like the program and want a kind of continuation; secondly, students get a general idea that living in Moscow is a rewarding experience. Unfortunately, although the MSc program at HSE is advertised widely, and 20-30 international applications for this program are received every year, highly qualified applicants are few, and their information sources are even fewer, MiM being the only stable one.

Andrei Negut, who participated in MiM in spring 2007 as a Princeton junior, wrote in 2010: "Math in Moscow was a great experience for me as an undergraduate, but also as a future mathematician. Not only were the courses very interesting and well-taught (on a par with my undergraduate institution, Princeton), but I also met there a number of great mathematicians who taught me new fields and with whom I later coauthored several papers. I would recommend MiM and IUM to all my friends."

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