(Via Google Translate from Russian - assisted by Peter Gacs)

Recently, my friend Sasha Shevkin asked me to write an autobiographical essay to be placed on his website as an appendix to the Russian translations of my articles. I wrote it and he posted it. But then I thought, "Why am I worse?" -- since the essay has already been written, why not put it on my website too. Here it is.

Andrey Toom

Autobiographical notes of a mathematician and teacher

I was born on April 12, 1942 in Tashkent, the capital of Uzbekistan, then part of the USSR, and now an independent state. The war was on the outskirts of Moscow and its entire population was evacuated to the east. From 1944 to 1989 I lived in Moscow. My father Leon Toom worked as a translator from Estonian and other languages, and also wrote poems that were not published during his lifetime. My mother Natalia Antokolskaya illustrated children's books. My parents were busy, and I spent a lot of time in my grandmother's room, who gave a huge amount of tutoring lessons in all subjects, so I had a lot of school knowledge even before school. I remember that grammar lessons were just like mathematics lessons for me and just as interesting. I still think that studying grammar in school is extremely useful not only for pragmatic purposes. I think that the extremely weak mathematical preparation of American students is due not least to the fact that they are not taught grammar.

In 1949 I went to school No. 69 in Moscow and graduated from it in 1959. My high school mathematics teacher was the famous Alexander Abramovich Shershevsky, nicknamed "The Nose", one of the best mathematics teachers in Moscow at that time. He managed to overcome my inertia and insist that I participate in mathematical competitions organized by Moscow University (in which I received one third prize and two commendable reviews) and go to mathematical circles led by university students. I chose a circle where the most active leader was Alexander Moiseevich Olevsky, whom we called Sasha. Most of the circles were mainly engaged in solving Olympiad-type problems (which is not bad at all), but Sasha was passionate about rigorous proofs of mathematical analysis (epsilon-delta reasoning) and for me this was just what I needed. I believe that it was at this circle that I became a professional mathematician.

Immediately after graduation, I participated in the first International Mathematical Olympiad in Romania and received the third prize. That same summer, I entered the Faculty of Mechanics and Mathematics of Moscow State University. Following the example of professors, I considered it my honorable duty from the very first year to lead a circle for schoolchildren and participate in the organization of mathematical Olympiads. My closest friends were the students involved in this activity. Nowhere else in the world have I seen such care of professional mathematicians for the transfer of knowledge, skills and enthusiasm to the next generations as in Russia. Like other immigrants from Russia, I carry the memory of this care with me. Forty-five years have passed since then, and there

has not been a single year when I have not made some contribution to mathematical education.

I have always liked discrete mathematics. I especially liked the lectures of Oleg Borisovich Lupanov with his clear style and in 1962 I asked him to be my supervisor. He agreed and offered me several tasks to choose from. In particular, he told me Karatsuba's result about the complexity of multiplying two multi-digit numbers and suggested improving it. On the same day I had an idea how to do it. Just then, the winter holidays began, which, as usual, I spent skiing at my grandfather's dacha. In two weeks, I practically wrote an article that was published in the Reports of the Academy of Sciences. This was my first publication in professional mathematics. (Before that, I only published a collection of preparatory problems for the Olympiad.) Now this method is known as the Toom-Cook method or Toom3. Andrei Nikolaevich Kolmogorov, who formulated this problem, became interested in my publication and invited me to participate in his projects: write articles for the Kvant magazine and teach at the summer mathematical camp and the Physics and Mathematics Boarding School organized by him.

I wanted to work at the intersection of mathematics with other sciences. This desire led me to a seminar led by Ilya Iosifovich Pyatetsky-Shapiro, I entered graduate school under his guidance and performed several papers on processes with local interaction (processes with particles, cellular automata), for which in 1972 I received the Moscow Mathematical Society Prize for young scientists, and in 1973 - a Ph.D. Processes with local interactions and their application to the natural sciences have remained my main subject of research ever since. In the seventies we thought that such processes could be useful as mathematical models of biological phenomena. Now I think that biological phenomena are too complex to be modeled in this way. However, these processes are suited very well as models of physical phenomena. In addition, such processes can help in the design of computing systems. On the Internet you can find references to "Toom's rule". Although this rule appeared in the work of Pyatetsky-Shapiro, Kolya Vasiliev and Marina Petrovskaya, I have some right to it, since I first proved its most important property - non-ergodicity at a small noise parameter. However, I continue to be interested in algorithms - in combination with random processes.

Before finishing my postgraduate studies, I went to work in an interdepartmental laboratory under the guidance of Israel Moiseevich Gelfand, and under his influence I began to help the Correspondence Mathematical School, for which I wrote several assignments and manuals. Officially, the work in this laboratory did not include teaching duties, but I voluntarily participated in many educational projects.

In addition, I was interested in the humanities. In the early seventies, at some conference, I listened to the report of Volodya Lefevre and was fascinated by his ability to reason logically in the humanities and the fruitful idea of multiple reflection. Under his influence, I published several works at the intersection of psychology, game theory and literary criticism.

In 1985, I met Styopa Pachikov at a home seminar, and as soon as he organized the Computer Club, I became his permanent teacher. Working at this club has given me a lot of food for thought about how children learn. I said above that I became a mathematician in a mathematical circle, that is, in an informal setting, where my presence was not registered in any form, and I did not receive any grades. Something similar happened to my children. During the last three years of my stay in Russia, when I taught at a computer club, my son Anton was a student there. The atmosphere was extremely informal, and it was in such an environment that Anton became essentially a programmer. When we rode the subway home, he told me: "Today I understood how goto differs from gosub " or "Today I learned how to handle strings." A few years later, when we lived in San Antonio, my daughter Nastya attended a painting club. The payment was - only for the maintenance of the premises. All the other members of the club were older than her and willingly showed her everything they could do themselves. There Nastya became an artist, although she did not receive any diploma. Then she graduated from a prestigious art college and received a diploma, but she believes that she did not learn anything there.

I was repeatedly invited to visit foreign universities, but for many years the party committee of Moscow State University did not allow me to accept any of these invitations. Only in 1989 was I unexpectedly allowed to accept an invitation from Errico Presutti to visit a university in Rome. In order not to wander back and forth and each time depend on the whims of the party committee, I went from Rome directly to Rutgers University in the USA, where I had an invitation from Joel Lebowitz. Being in America and using one invitation after another, I asked my wife and children to come, we applied for political asylum and received it right away. However, getting a permanent job was not so easy: the communist system was falling apart, and a stream of Russian and Eastern European scientists poured to the west in search of work. Employees of the consulates shied away from Soviet passports. Due to the impossibility of obtaining a visa, I could not accept invitations to other countries. In addition, shortly after my arrival in the United States, the Chinese authorities staged a massacre on Tien An Men Square, and all fifty thousand Chinese graduate students known for their diligence who were in the United States at that moment applied for political asylum and began to look for work. My colleagues did everything to provide me with at least a temporary job in my specialty. Following Lebowitz, Peter Gacs invited me to Boston University, where I spent the 1990-1991 academic year teaching algorithm theory to graduate students in the computer science department. Then I was invited for the 1991-1992 academic year to the University of Texas at Austin.

From 1992 to 1997 I taught at the Catholic College and then at the University of the Incarnate Word in San Antonio. The average level of students was extremely low, and the leaders of the university believed that they did not need knowledgeable mathematicians. Once a vacancy opened at this university and received about a hundred applications. The two strongest claims were from recent immigrants from Russia, both with a large number of published works. They were both immediately rejected, which didn't surprise me. Something else surprised me. When the commission selected the best three of the remaining candidates and submitted them to the dean for consideration, and he saw that he had to choose from three mathematicians, each of whom was more competent than

himself, the dean announced that we had, in fact, enough teachers and closed the competition. Subsequently, he hired, without any competition, people with no publications at all, barely able to read basic courses.

At another university, I messed up everything myself. I was invited to give a lecture to students with the understanding to hire me if the lecture was successful. I chose the topic "Real Numbers" and invited my listeners to vote on the question of whether the infinite decimal fraction 0.999999 ... (zero, comma, infinite sequence of nines) is less than one. The overwhelming majority voted for less, including the university's vice president, who was sitting among the students. At another university, I also messed up everything. They called me from there and offered to read the "business calculus". I replied that students who take a course with that name usually do not know school mathematics, and that's what they should be taught. Then the one who tried to get me there scolded me in broken Russian: "Andrey, you threatened their existence." He meant that the professors there only knew how to teach тчат disgusting business calculus. All these years, many of those who hired were less competent than the best they could hire, and they avoided taking on the best. Some visitors knew how to pretend to be dumber than they were. Some threw a good half off their list of publications and got a job because of it. The word "overqualified ", that is, overly qualified, was heard everywhere as the true reason for many refusals.

Over the years, I have broadened my horizons by reading books on the psychology of math education. I had read about the theories and influence of Thorndike and Dewey on American education already back in Russia, but only when I arrived in the USA did I see for myself how deep and in some respects destructive this influence was. I have participated in several discussion lists designed to discuss math education issues via email. For several years I have been especially active on a list called math-teach. This list contains a complete registration of messages, they are available on the internet, and you can search by keywords there. This is a very interesting read. Participation in these discussions gave me a lot to understand the psychology of American teachers and educators. My interlocutors expressed thoughts that seemed self-evident to them, not noticing that they, like parrots, repeated the statements of theories of a very dubious nature. For example, they demanded literal applicability to everyday life from word problems. Another example: in Russia the word "arithmetic" is perceived quite normally, but in the USA they avoid it, they are afraid to seem provincial. As a result, even university students do not know how to solve simple arithmetic problems simply, in their minds, they must make letter notation, tables. I remember how at one American university students were having difficulty solving a text problem by making a table, and suddenly a Chinese girl came up to the blackboard and solved the problem in one line. Everyone was amazed.

In Russia, the presence, even the abundance of word problems in the courses of arithmetic and algebra, is familiar to everyone. In the United States, the attitude towards word problems is painful, neither teachers nor students can solve them ,and justify themselves by saying that these tasks are not needed, since they are not encountered in everyday life. By the way, most Americans also do not know how to apply mathematics

to physics. At a lecture on calculus, I solved one mechanical problem, and then I said: the same result can be obtained from the law of conservation of energy. Silence. I asked: "Whoever heard anything about the law of conservation of energy - raise your hand." There was one foreign student in the group, and he was the only one who raised his hand. The fact is that in American education there is no distinction between important and secondary. American students must choose from a huge number of options, and no one will tell them that one subject is more important than another. However, all subjects are taught so poorly that the choice, perhaps, is indeed unimportant.

Now in the United States there is a persistent struggle for the introduction of at least some standards in education. Ten years ago, this struggle was just beginning, and the absence of a national education program seemed to most Americans a matter of course. When I expressed arguments in favor of such a program, my interlocutors explained it by the fact that I came from a non-democratic country.

In the USA, I learned to appreciate more the Russian mathematical education, which seemed banal to me when I knew no other. When I taught mathematics circles in Russia, I took for granted the basic knowledge and skills of my students. What I would do if my students were not able to perform the simplest algebraic transformations - I do not know. Most likely, the circle would have had to be closed. While teaching in America, I came face to face with the fact that people are not born with mathematical knowledge, that they need to be systematically taught and that in Russia this is done well, but in America - negligently. Based on my experience teaching mathematics at US universities, I have published several articles strongly critical of American mathematics education. Almost all these articles and their Russian translations are available on my website.

At the same time, I was very cordially invited to Brazil. Since 1998 I have been working in Brazil, first at the University of Sao Paulo and now at the Federal University of Pernambuco. I try to do here the best of what I was taught in Moscow - good science and good education in organic connection with each other. There are talented young people here who need scientific guidance, and my contribution is very noticeable. And it is true, even though I say it in a joking tone, that I am the only probability theorist in the entire northern half of Brazil - an area larger than England, Germany, Italy and France combined. My interest in mathematics education also came to fruition. I have already been invited several times to give a series of lectures on the topic "Comparison of school mathematical education in Brazil and other countries." In these lectures, I emphasize the organization and other advantages of Russian education in comparison with Brazilian and American ones.

I think I have the right to include here another aspect of my work. My grandfather was the famous poet Pavel Grigoryevich Antokolsky (1896-1978). His poem "Son" expressed the grief of millions of parents whose sons died fighting in the Patriotic War. I have been working on his literary heritage for several years. Even during the life of Antokolsky, a threat arose to his archive and professional library, and after his death it worsened. I can proudly say that thanks to me the poet's archive was preserved, which was not easy. In the anniversary year of 1986, I organized several evenings in memory of Pavel

Antokolsky. In addition, I played a very active role in the preparation of a collection of memoirs about him. The collection turned out to be interesting and was quickly sold out. One of the articles in it is mine, and it was read with interest. I am preparing a new version of these memoirs, which will appear on my website. Together with my wife Anya, we continue to publish both Pavel Antokolsky and Leon Toom (1921-1969).

In September 2004, at the invitation of the Moscow-based Independent University, I visited Russia after a fifteen-year absence. In some respects, Russia and Brazil are similar: two large unorganized countries with huge potential and a lot of problems. But there are also differences. Education in Brazil is much worse than in Russia, and science is weaker. This may be why in Brazil scientists are valued more than in Russia. The level of students at the Independent University is one of the highest in the world, in Brazil they would try to keep them with all their might, but the diplomas of the Independent University are not recognized by the Russian government, as if the authorities wanted to push everyone abroad.

On my site **http :// www . de . ufpe . br /~ toom** you can find many of my articles, including articles in Russian, as well as a complete list of my publications in English and Portuguese. I have two email addresses: **toom @de.ufpe.br** and **andretoom@yahoo .com**

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