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Teachers of the mathematically gifted: Two case studies

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This article is devoted to people who taught highly gifted schoolchildren and developed educational materials for them. Teaching the highly gifted involves changing the contents of education and, possibly more importantly, changing its form and style. Consequently, mathematics educators who are involved in such teaching face new problems, and in fact such teaching often means the appearance of a special new type of teacher at a school. In this paper, we will discuss two prominent Russian figures in the advanced course of study in mathematics. An analysis of their biographies will facilitate a better understanding of both the methodological and the pedagogical history of the advanced course of study in mathematics, as well as the social-political circumstances under which such study took place in the Soviet Union.

Keywords: Advanced course of study in mathematics, schools with an advanced course of study in mathematics, teachers of the mathematically gifted.

INTRODUCTION

Highly gifted children need highly gifted teachers. This fact was recognized quite long ago and quite widely (Stanley, 1987; Thornton and Peel, 1997), yet the study of the biographies and preparation of teachers of the highly gifted is only just beginning (see Even, Karsenty, & Friedlander, 2009; Evered & Karp, 2000; Karp, 2010; Leikin, 2011). Below, we will discuss two Russian figures in mathematics education, Vladimir Ashkinuze and Semyon Shvartsburd, who played important roles in the formation of the advanced course of study in mathematics and, first and foremost, in the formation of Russian schools with an advanced course of study in mathematics. Each of them is the author of dozens of important works. However, far less is known about their own biographies (see the obituary of S. I. Shvartsburd in the journal *Matematika*

v shkole), and these will be the main focus of what follows, since the analysis of their biographies, we would argue, is useful for understanding where teachers for the advanced course of study in mathematics come from—an understanding that this study severely needs. The present article is based first and foremost on archival materials related to these two figures, which have been discovered by Vasily Busev.

ON SCHOOLS WITH AN ADVANCED COURSE OF STUDY IN MATHEMATICS

Russian schools with an advanced course of study in mathematics began attracting international attention practically from the moment of their inception (Vogeli, 1968); nonetheless, it will be useful to review certain key moments in their development.

The first Russian classes with an advanced course of study in mathematics appeared in 1959 under the supervision of Semyon Shvartsburd in Moscow under the banner of the “polytechnization” campaign that was taking place at that time, which sought to combine school-based education with production-based education (Karp, 2011). Subsequently, a number of leading Soviet mathematicians became involved in the creation and development of a system of schools with an advanced course of study in mathematics, including A. N. Kolmogorov, I. M. Gelfand, M. A. Lavrentyev, V. I. Smirnov, D. K. Faddeev, and many others. As a result, fundamentally new educational institutions were formed, in which gifted schoolchildren were offered the opportunity not only to learn mathematics more and better than usual, but also to become involved in genuine mathematical creativity. The unfolding methodological formation of the new system was evidenced by publications in the series *Problems of Mathematics Schools*, the first of which, *Teaching in*

Mathematics Schools, was edited by S.I. Shvartsburd, V.M. Monakhov and V.G. Ashkinuze (1965).

The first mathematics schools were established during the period of the so-called thaw, after the death of Stalin, when there were hopes that the Soviet regime would become more liberal. When after the resignation of Khrushchev and especially after the invasion of Czechoslovakia by Soviet troops in 1968, these hopes had to be abandoned, the position of these schools began to change. The authorities did not dare to shut them down completely, since they saw in them a most valuable source of trained workers for the military-technological struggle with the West. However, every effort was made to restrain the spirit of freedom that inevitably sprung up in schools which awakened and nurtured the striving for independent research. Naturally, the position of teachers in these schools changed as well (Karp, 2011).

At the same time, a certain development of the mathematics schools continued, despite the rigidification of the political regime. In particular, textbooks for such schools became popular during this period, for example, *Algebra* by N. Ya. Vilenkin, R. S. Guter, S. I. Shvartsburd, B. L. Ovchinsky, & V. G. Ashkinuze (1968), and *Mathematical Analysis* by N. Ya. Vilenkin & S. I. Shvartsburd (1969).

Gorbachev's *Perestroika* made mathematics schools popular and brought them government support. Their numbers grew rapidly (which was probably not especially good for their quality—Karp, 2011). One of the textbooks that enjoyed greatest popularity at this time was written by M. L. Galitsky, M. M. Moshkovich, & S. I. Shvartsburd (1986). S. I. Shvartsburd died in 1996 in Haifa, and V. G. Ashkinuze yet in 1970s, so we will not address mathematics schools during later periods in any detail. We will merely state that, despite the difficulties that they have encountered, they continue to exist and successfully to prepare future mathematicians, physicists, and engineers.

ON THE ARCHIVAL FILES OF V. G. ASHKINUZE AND S. I. SHVARTSBURD

All three files—two relating to V. G. Ashkinuze (Ashkinuze, 1963, 1967) and one relating to S. I. Shvartsburd (Shvartsburd, 1974)—were discovered in the archives of the Russian Academy of Education (RAO). The RAO is a continuation of the Academy of

the Pedagogical Sciences (APN), which was established in 1943 in order to oversee and coordinate the work of scientific organizations of a psychological-pedagogical profile. Such organizations (scientific institutes and laboratories) were many, and they employed many famous scientists, for example, most of the Russian scholarly works on psychology that are known in the West were written by employees of the institutes of the Academy of the Pedagogical Sciences.

One can only speculate about the nature of the circumstances under which the files analyzed below began to be kept. Vladimir Ashkinuze worked for a certain time at the Academic Institute of General and Polytechnic Education (which until 1960 was called the Institute of Methods of Instruction), and therefore the existence of a file on him during this period was to be expected. And indeed this file mainly contains materials documenting his hiring and discharge from the institute, including his personal history statement, official forms (the so-called personal form for personnel records), character references, and his reports (this file was ended in 1963). When at a later date V. G. Ashkinuze, now employed elsewhere, returned to the APN system as a part-time employee, a new file on him was begun (and ended in 1967).

S. I. Shvartsburd likewise worked in the APN system from 1962 on, initially at the Institute of General and Polytechnic Education, and then at the Institute of the Contents and Methods of Instruction. By all appearances, however, the file on Shvartsburd began to be kept for a special reason, namely, because he was nominated as a candidate for full membership in the APN (he had been elected as a corresponding member in 1968). The cover of the file bears the following heading: “application for full member status in the APN.” The file contains biographical details, including Shvartsburd’s personal history statement, reviews of his work, lists of his publications, and so on (this file was ended in 1974).

TOWARD A BIOGRAPHY OF V. G. ASHKINUZE

V. G. Ashkinuze was born in Moscow in 1927, as he writes in his 1958 personal history statement, into a “family of Communist public servants.” He goes on to state that “at the present time my parents are special pensioners” (Ashkinuze, 1963, sheet 5). A “special pension” was a pension assigned by special warrant, rather than in accordance with general rules; in a later

personal history statement from 1966, he writes more clearly that his parents had been Communist Party functionaries (Ashkinuze, 1967, sheet 5), who had, however, already lost their positions by 1958, when he wrote his first personal history statement. In 1944 Ashkinuze enrolled in the Mathematics-Mechanics Department and in 1949 he graduated from it. As can be seen from the list of published works in his file (Ashkinuze, 1963, sheet 8), in 1951 he published an article in the *Ukrainian Mathematics Journal*: “Theorem on the Splitability of J-Algebras.” Taking into account the fact that publication in a journal does not happen overnight, one can assume that the article contained Ashkinuze’s scientific findings from his last years of study at the university (possibly his thesis). The promising young mathematician, however, began his professional career as a mere teacher, and the institutions at which he taught included the so-called School for Working Youth, by no means the most prestigious educational establishment. It should be borne in mind that the end of the 1940s and beginning of the 1950s were the years of the anti-Semitic, anti-cosmopolitan campaign, so it was probably difficult for Ashkinuze to find any better employment. In January 1954 (in other words, less than a year after Stalin’s death), Ashkinuze was accepted to the graduate school of the Institute of Methods of Instruction, and moreover he enrolled at once in the second year of the program. In August 1955, Ashkinuze finished his graduate education and began to work at the Shakhty Pedagogical Institute (in the city of Shakhty) as teacher and department chairman. After working there for the required three years, Ashkinuze returned to Moscow, becoming in June 1958 a junior research employee of the Institute of Methods of Instruction (later called the Institute of General and Polytechnic Education). The papers that he published after his 1951 article were devoted to methodological issues, with the exception of an article published in the anthology *Matematicheskoye prosveshcheniye* in 1957: “On the Number of Semiregular Polyhedra.” Ashkinuze himself, listing his achievements for 1958–1959 (Ashkinuze, 1963, sheet 16), noted his participation in developing programs in mathematics for eight-year and three-year courses (in other words, for the upper grades); articles discussing these programs; testing out lessons on “The Derivative and Its Application in the Investigation of Functions” in classroom conditions, a topic that had not been studied in schools previously; delivering lectures on the methodology of teaching elementary mathematical

analysis in secondary schools for teachers; working to develop a textbook for a course in algebra; and others.

Subsequently, these studies were continued, and new ones were added. A character reference from 1963 indicates that Ashkinuze was supervising two planned projects—the writing of a textbook in algebra and the writing of a study on the methodology of teaching algebra—in addition to heading a laboratory devoted to schools specializing in mathematics, which had been formed on his suggestion, and in connection with which he spent four months studying mathematical machines at another institute (Ashkinuze, 1963, sheets 48–49).

This character reference was written in connection with Ashkinuze’s transfer to a different place of employment (the Moscow State Pedagogical Institute—MGPI). It is noteworthy that the purpose of the character reference was to smear Ashkinuze, to the extent possible, by describing him as an individual who was leaving a job and thus interrupting his planned projects, which “have already cost the Soviet state over 10 thousand rubles” (Ashkinuze, 1963, sheet 49). The director of the institute felt so strongly about the need to besmirch Ashkinuze’s reputation that he did not hesitate to add a personal attack, pointing out that Ashkinuze did not exhibit sufficient moral purity, taking work-related trips with his female laboratory assistant.

Nonetheless, in 1966 Ashkinuze returned to the APN system, while continuing to conduct his main work as a docent (associate professor) of the MGPI. He was accepted as a part-time employee at the newly founded Institute of School Equipment and Technological Means of Instructions (Levitas, 2010). However, he did not work there for long—only until 1967 (Ashkinuze, 1967, sheet 7). At this point, his files end.

TOWARD A BIOGRAPHY OF S. I. SHVARTSBURD

S. I. Shvartsburd was born in 1918 in a small town in Moldavia. His father, as he states in his personal history statement from 1974 (Shvartsburd, 1974, sheet 4), worked as a grain receiver before the Revolution and was killed in 1941. After graduating from a ten-year school in 1935, Shvartsburd enrolled in the Physics-Mathematics Department of Odessa University, from which he graduated in 1940, staying on at the same university as an assistant at the Department of Theoretical Mechanics. Having contracted polio in his

childhood, he remained handicapped, and therefore was not drafted into the army. After the war began, in July 1941, together with the university, he relocated to the city of Jalalabad, where from 1941 until 1944 he worked as a mathematics teacher. In 1942, he joined the Communist Party (having become a candidate for membership already in 1939) and in 1943–44 he was bureau head and deputy head of the department of agitation and propaganda of the Jalalabad Municipal Committee of the CPSU. In August 1944, Shvartsburd returned to Moscow, where he worked as a teacher of mathematics until 1962, when he became a senior research fellow at the Institute of General and Polytechnic Education. He defended his candidate's dissertation in 1961 and his doctoral dissertation in 1973 (Russia has two advanced degrees: the degree of a candidate of sciences corresponds to a Ph.D., while the so-called doctoral degree is higher—roughly speaking, one can say that this degree corresponds to the rank of full professor). In 1968, he was elected as a corresponding member of the APN. Shvartsburd received various awards and honorary titles; he served as head of a number of influential organization: as chairman of the mathematics section of Academic Council of the State Committee on Professional Education of the USSR, as deputy head of the Academic Council on the Problem of the Advanced Study of Individual Subjects; as head of a seminar for the mathematics teachers of Moscow, etc. Shvartsburd developed numerous curricula, including—in collaboration of V. G. Ashkinuze, in 1963—curricula for secondary schools with on-the-job education for the “computer operator” track, which were important for the subsequent development of mathematics schools.

From the late 1950s on, Shvartsburd began closely collaborating with Professor Naum Vilenkin, a well-known mathematician and mathematics educator (their first joint publication, “On Certain Applications of Exponential and Logarithmic Functions,” appeared in the journal *Matematika v shkole* in 1959). This collaboration continued in the field of the advanced study of mathematics, and in the development of curricula for grades 4–5 (the general supervisor of this work was A. I. Markushevich).

Shvartsburd's file contains reviews of his work by a number of leading figures in mathematics and mathematics education. Thus, Andrey Kolmogorov wrote:

In the person of S. I. Shvartsburd, we have an outstanding representative of our mathematics education. In his field of organizing student preparation in applied mathematics in secondary schools and secondary educational institutions, he is a central figure. (Shvartsburd, 1974, sheet 24)

Elsewhere, A. N. Kolmogorov emphasizes Shvartsburd's contribution to the construction of “a system of advanced mathematical preparation with a focus on numerical analysis in the upper grades of secondary schools” (sheet 23), which he distinguishes from working with schools with an advanced course of study in mathematics (which he also credits Shvartsburd with doing, listing the textbooks that Shvartsburd wrote for such schools).

A. A. Lyapunov, a corresponding member of the USSR Academy of Sciences, mentions the fact that S. I. Shvartsburd has done a great deal

for various types of intensive, specialized secondary mathematics education. These include different forms of elective work (such as mathematics circles, Olympiads, etc.), specialized physics-mathematics schools, classes in computer programming, and also mathematical technical colleges preparing mid-ranking professional mathematicians. (Shvartsburd, 1974, sheet 25)

The file also contains a long letter signed by a number of figures in mathematics, pedagogy, and technology, supporting S. I. Shvartsburd's promotion to the rank of doctor. The signatories of this letter include such well-known mathematicians as V. A. Uspensky.

I. Shvartsburd was not elected to full membership in the APN. His file, however, contains no information about this.

DISCUSSION AND CONCLUSION

The files examined above are interesting for several reasons. First, they offer examples of Soviet clerical practices in the scientific and scientific-methodological sphere. Today, millions of people are still alive who took part in that life, but even so, although a great deal has remained unchanged since Soviet times, many details have disappeared and are becoming forgotten, for which reason it is important to record them (for example, the fact that in order for Ashkinuze to be hired

as a part-time worker, permission had to be obtained from the Deputy Minister of Higher and Secondary Education of the USSR).

Second, the files pertain to individuals whose roles in the creation of mathematics schools and of intensive, specialized education in general—to use A. A. Lyapunov's terminology—was extraordinarily important. A. N. Kolmogorov does not name Shvartsburd as the founder of the advanced study of mathematics in Russia, drawing a subtle distinction between applied advanced study, in which he clearly acknowledges Shvartsburd's preeminence, and advanced study in general, in which Shvartsburd is allotted an important, but not a leading role. In reality, the advanced study of mathematics as a whole, as has already been noted, grew out of applied advanced study, although, of course, in this process the role of, say, Kolmogorov himself was undoubtedly unparalleled. The names of the creators of a new system that exerted an influence over the entire world should not be forgotten, and consequently, the collection of details about their biographies is valuable in itself.

But perhaps even more important is the question posed at the beginning of this article: where do leaders in the education of the mathematically gifted come from? In an earlier work (Karp, 2010), we discussed teachers, famous ones, but nonetheless specifically teachers, who continued working in schools. Both Ashkinuze and Shvartsburd left schools and became involved in secondary mathematics education at a different level. Nonetheless, in this case, too, it may be said that the biographies of future leaders in the advanced study of mathematics can be very varied. It would be inaccurate, for example, based on the fact that mathematics schools were often perceived as hotbeds of liberalism (which they indeed were), to draw the conclusion that the individuals involved in organizing the advanced study of mathematics were inevitably opposed to the Soviet regime. Such individuals could well wish to serve the regime in good faith, occupying high-ranking positions if this was possible. To be sure, the regime did not always agree to offer them such positions, and could even refuse their service altogether (in the still-liberal year of 1968, S. I. Shvartsburd got elected to the APN as a corresponding member, while in 1974, as a Jew who moreover did not occupy any high administrative position, he was not elected to the same organization as a full member).

Both Ashkinuze and Shvartsburd evidently had excellent preparation in mathematics, and this is probably the only characteristic shared by all prominent figures in the advanced study of mathematics. Another characteristic that is typical of the biographies of many of them, although naturally far from all, is a relative lack of access to the usual career paths, at least at the early stages of their careers. There is little use in speculating what might have happened if V. G. Ashkinuze had been admitted to graduate school in mathematics immediately upon graduating from university. We have no information concerning the circumstances that caused S. I. Shvartsburd to break off his party-member career and to remain a school teacher for almost twenty years (even while maintaining ties with academic circles, see Sector of mathematics, 1948).

Analyzing the life of her father, Aron Maizelis, who was an outstanding teacher in mathematics schools, Yelena Platonova (2007) objects to the explanation that Maizelis went to work in schools because he had been unable to find employment elsewhere, showing that even as a student Maizelis had been passionately interested in questions of teaching and instruction (which, however, does not seem to us to rule out the possibility that, if he had been given the opportunity to teach at a higher educational institution, he would not have done so). In any case, given the absence of precise biographical information, one can only speculate. It may be argued, however, that both Ashkinuze and Shvartsburd were in situations in which, in order to achieve success, they had to turn their lives around somehow, to find something new, which had not been envisioned previously. Thornton and Peel (1999) wrote about the importance of the teacher's creativity for cultivating creativity in the students. In certain cases, life itself impelled the teachers to be creative.

In conclusion, we should say that the aforementioned shortage of information poses new problems for researchers. It would be extremely interesting to continue gathering information both about those figures in mathematics education who are the focus of this article, and about others. One would like to hope that personal and state archives still exist in which documents have survived that are capable of shedding a light on the history of mathematics schools and their creators. Such research must be continued.

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