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SCIENCE AND TECHNOLOGY IN THE SOVIET SECONDARY SCHOOLS

The Soviet system of secondary education shows features of American, European, and pre-revolutionary Russian educational patterns combined into uniquely Soviet forms and meanings. The heterogeneous elements of the Soviet school system are integrated into a powerful mechanism for the indoctrination and training of people for the state economy. Nevertheless, the system operates with many inefficiencies.

In common with the American tradition in public education, the Soviet system is designed for mass education. In theory, all youths attend school through age fourteen; those in large cities and densely populated industrial communities, through age seventeen. And by 1960, according to the plan, ten-year education (age seven through seventeen) is to be made universal.

In common with the general European practice, Soviet secondary schools have a rigidly fixed and uniform curriculum in all schools of general education; the methods of instruction are formal and authoritarian; rigorous demands are made upon the student, necessitating on his part much memorizing and learning by rote.

From pre-revolutionary Russia, the Soviet school has resurrected many superficial and other features of the tsarist state-operated schools (but not of the many private schools which were rapidly developing in Russia before the revolution). The central bureaucratic

control over the schools; the quasi-military, strict discipline; the special uniforms which students must wear in and out of school; and, more importantly, the demand of complete, unquestioning orthodoxy in the social content of instruction--these are among the features of the Soviet school which stem from the tsarist past.

The uniquely Soviet contributions to the school system derive from the philosophy, strategy, and objectives of the communist goal of world domination. The Soviet government vigorously fosters universal education--for no one must be left out of the labor pool. Its plans are predicated upon maximum technical competence from its civil and military servants at each occupational level. Therefore it provides rigorous and concentrated training in specific skills rather than a broad education to serve the needs of the individual. Above all, the Soviet regime demands unquestioning obedience--and its school system is designed to inculcate this virtue. The Soviet school system is by no means the utopian organization pictured in the official propaganda and exemplified in a number of model schools; nevertheless, its performance in terms of Soviet objectives is impressive.

The central component of the system is the Ten-Year school. It includes three progressive stages: the elementary (grades I-IV, age 7 through 11), the middle (grades V-VII, age 11 through 14), and the upper (grades VIII-X, age 15 through 17). At the end of the elementary schooling there is a more or less irrevocable syphoning off from the main educational stream into the ranks of common and

semi-skilled labor; and after the completion of the seventh grade into the ranks of skilled and sub-professional labor. Approximately 20 per cent complete the tenth grade and may then compete for the privilege of admission to an institution of higher learning. Admission is by competitive examinations in as many as five subjects (including mathematics, physics, and one foreign language) against a state fixed quota for different categories of freshmen. About 40 per cent of the applicants are admitted.

The curriculum of the Ten-Year school is fixed and uniform in all basic subjects throughout the Soviet Union. It provides for a school year of 33 six-day weeks (plus one week for field trips in grades IV-IX) and up to 33 class hours (45 minutes each) per week in the last three years of school. Homework assignments add considerably to the student's load; in mathematics, for instance, the amount of time the student is officially expected to spend on homework comes to nearly 50 per cent of the class hours!

Until a few years ago the curriculum of the Ten-Year school generally and of the last three grades in particular was oriented exclusively toward further training in schools of higher education. With the relatively large proportion of the population (children born before the sharp drop in the birthrate during the war) in the high school age group, the last few years have witnessed an over-production of Ten-Year school graduates relative to the number which the state has been willing to train at a higher level. Consequently, many measures have been introduced, particularly since 1953, to divert

a large proportion of Ten-Year school graduates directly to work in industry and agriculture or via a variety of specialized short-term training programs opened for the Ten-Year school graduates. Changes have also been introduced in the curriculum of the Ten-Year school, increasing the time allotted to "skill" subjects (including manual training and practical workshop) from 4.8 per cent of the total load in 1952-53 to 10.9 per cent in the current year at the expense of academic subjects. Although the present drive for making secondary education increasingly practical has somewhat lightened the student's formal academic load, the program is still very demanding. In ten years of schooling Soviet students are expected to master as much material--and in some subjects considerably more--than their American counterparts do in twelve years. Mathematics (including algebra, plane and solid geometry, and trigonometry) takes up more than 20 per cent of the total school time of every Ten-Year school student: in our schools, it has been estimated that only 27 per cent of the students take any algebra, and only 13 per cent study geometry. The Ten-Year school curriculum provides five years of instruction in physics and four years of chemistry for all students; in 1950 only 4 per cent of the American high school students studied physics and 7 per cent studied chemistry.

To graduate from the Ten-Year school, students must successfully pass special oral examinations in all key subjects within the scope of the entire course. The scope of the examinations is extensive; however, approximately 30 groups of specific single topics or questions

(three or four in each group), one of which a student draws in lottery fashion at the examination, is known in advance. Thus cramming in the preparation for the final examinations is the rule for all but the brightest students.

Admission to schools of higher education is competitive for all students except those who receive the mark of "excellent" in the Ten-Year school finals. The college entrance examinations, which all other applicants must take, are far more demanding than the finals in secondary school. In mathematics, for instance, the examination problems do not lend themselves to special coaching or cramming but require a thorough mastery of fundamentals and their imaginative application. Standards of examinations vary from school to school and from field to field so as to select the most talented for training in the key areas of science and technology.

There were 762 institutions of higher learning in the Soviet Union (as of January 1955) of the following types:

	<u>Resident</u>	<u>Extension</u>
Universities	33	--
Engineering schools	188	16
(a) Polytechnic 23		
(b) Specialized 165		
Medical	75	--
Economics	19	3
Agriculture	80	1
Law	5	1
Art	46	--
Physical Culture	13	--
Pedagogical	278	4
(including 52 Two-Year schools)		
Total Number	<u>737</u>	<u>25</u>

EDUCATION AND THE SOVIET AIRCRAFT INDUSTRY

The Soviet high school graduate interested in a higher education must decide at once in what field he will devote his life to the service of the State. He may apply for admission to one of the 33 universities which train high school teachers, college professors, and scientists, or to a specialized technical, medical, legal or other institute, or to a normal school. In most cases, the availability of a vacancy or other practical considerations affect his choice more strongly than his personal preference because of the great financial and social advantages which go with any college degree and because on the average only about four out of ten applicants are admitted.

If he has selected aeronautical engineering, he is one of some 20,000 students who attend seven specialized institutes closely integrated with the Air Ministry. In the first two years of his study he receives a solid grounding in the fundamentals of aeronautics and then learns increasingly special skills. His teaching is rather formal because his professors are too few and too busy to give him much personal attention. After a five and a half year course, he will be assigned by the authorities to a design or production job in industry for which his particular education has specially fitted him.

While this pattern is followed by some 97 per cent of the engineering students, the very cream of the crop do graduate work and staff the Research Institutes of the Air Ministries, where applied research and advanced development are carried on with the technical

guidance of small task forces of applied mathematicians trained mostly in the Mechanics Faculties of the Universities to fulfill the specifications laid by the military engineers from the Zhoukowski Air Academy and its sister institutions.

Thus, the business of research, development, design, and production of aircraft is carried on by a closed group of scientists, engineers, and technical representatives of the only customer. Its leadership rests in a few highly skilled scientist engineers who spend part of their time teaching, part directing research and consulting for specific factories, and part in the top administrative echelons of the Air Ministries.

This "multiple hat" system allows the effective execution of a well-integrated policy of aeronautical development and production but does nothing to encourage professional cross-breeding or to prevent the occasional duplication of effort by different ministries inevitable in the absence of sufficient technical publications or broad scientific meetings. It also puts a heavy responsibility on a few shoulders and fails to distribute the opportunity for leadership among enough younger people. It deliberately stresses problems arising in development rather than fundamental research without immediately apparent practical motivation.