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Soviet Education Programs

- **FOUNDATIONS**
- **CURRICULUMS**
- **TEACHER PREPARATION**

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CHAPTER III

Polytechnic Education in the General Schools

Introduction

THE SOVIET CONCEPT of polytechnic education for general education schools in the Soviet Union has emerged primarily from the complex factors and forces that were discussed earlier in this study (see especially chapter I).

The following pages present specifically information about (1) the philosophy and purpose of polytechnic education, (2) polytechnic courses, (3) the new curriculum reforms, (4) organization and operation of school workshops and production training, (5) organization and methods of teaching polytechnic subjects, and (6) research.

Polytechnic education, as discussed in this chapter, deals only with the elementary-secondary general schools, which enroll the largest number of students in the Soviet Union. Completion of polytechnic education takes place upon graduation from the senior grades. Although the senior grades are at present optional, a high percentage of students enter these grades; the others attend vocational and technical schools, take correspondence courses, or go to work and possibly study part-time.

We learned that all schools have not been able to introduce the earlier polytechnic curriculum that was issued in 1957, but that efforts are under way to provide schools with equipment, materials, and qualified teaching personnel to implement the new ambitious program.

TERMINOLOGY

It is helpful for the reader to grasp the concepts behind the terms *polytechnic education* and *work experience education* in order to understand fully the kind of general educational program

now developing in the Soviet Union. The first term is Russian; the second, American. Although Soviet educators do not use the term "work experience education," the ideas of work experience are nevertheless interwoven in polytechnic education to implement their educational plan of combining manual work and academic education.

Definition of polytechnic education.—The term *polytechnic* is translated from the Russian word *politekhnicheskoe*. The root words in the term "polytechnic" are *poly* and *technic*. The prefix *poly* is derived from the Greek word *polys* meaning many or much, having or consisting of many. The word *technic* stems from the Greek word *technikos* and means art, artful, or mastering. After talking with Soviet educators and observing their schools, we feel that polytechnic education in the U.S.S.R. is the kind of education which deals with understanding the various technics of industrial and agricultural production; the application of scientific principles to mass production; the organization and utilization of workers; the development of habits of work and technical abilities; and the planning of jobs involving self-discipline and initiative.

Work experience education.—The reader will encounter several different terms used to describe certain aspects of Soviet polytechnic education. Some of these terms are labor program, labor education, labor production, socially useful work, productive labor, productive practice, summer practice, industrial practice, productive work, labor training, production education, and production training.

These terms, as translated to us, are used within the context of this report to convey varying shades of Soviet meaning. Essentially, these terms reflect the Soviet belief that their general schools should provide some form of what we could call *work experience education*.

As reported by the Office of Education, in Bulletin 1957, No. 5, "The term 'work experience' when studied etymologically refers to any activity in which an individual engages resulting in the production of useful goods and services. To include the social and intellectual effects of this experience on the individual, a broader term has been proposed—'work experience education.'"[1] The bulletin further reports that "Work experience education may achieve both vocational and general education goals. Likewise,

[1] *Work Experience Education Programs in American Secondary Schools.* (Office of Education Bulletin 1957, No. 5.) Washington, U.S. Government Printing Office, p. 4.

it embraces both paid and nonpaid work done by students enrolled in the program. The most significant aspects of an educative work experience program include arranging for the work to be done on school-released time, providing supervision by the school, granting credit, and providing supplementary instruction related to problems of personality development, community relations, and job success."[2]

In Soviet general schools these "work experiences" occur in school or during school-released time. They also embrace both paid and nonpaid work done by the students; and a coordinating group made up of school and industry officials plan the educational program.

Philosophy and Purpose of Polytechnic Education

We learned in our discussion with Soviet educators that they believe quite strongly that all students need to know about the fundamentals of mass production. The aim is not only to understand production in a passive way, but also to have students participate actively in school workshops and in industry, so that they can get an intimate knowledge of how an industrialized nation produces the goods and services that it needs. U.S.S.R. educators indicate that each student should be able to take an active part as a *worker* in some phase of the economy of their vast land.

We also learned that they were concerned about the attitude some adults and youngsters display toward state-owned equipment and property. They feel that students working in workshops on worthwhile tasks can be taught to respect property and to use it as if it were their own. And, they express the wish to instill in their pupils the love of labor and respect for the laboring man—the worker. In other words, they intend that the school is to be the vehicle to implement certain fundamental concepts of Soviet morality and philosophy. The student, they believe, should also see the fruits of his labor and receive some remuneration for the work performed.

Another factor that shapes Soviet education is the theory of Soviet educators that general elementary-secondary schooling should provide a background or base upon which all professions and vocations can be built.

One of the primary purposes of polytechnic education in the

[2] *Ibid.*, p. 5.

Soviet Union is to provide fundamental technical knowledge common to all industrial fields. It is broad rather than narrow training. Their educators hold that it helps students express themselves through polytechnic experience; that students get professional orientation which enables them to choose their professions more intelligently. Polytechnic education is a better preparation for life, they say. In the process of acquiring this knowledge practical habits of measurement, drawing, and laboratory techniques develop. It also gives the student experience in labor production in school. And, in the future, Soviet industry will be using automation to an ever increasing degree, and students will need to know more polytechnic information to adjust to the new machinery and ways of production. Such are some of the purposes of polytechnic education as stressed by Soviet educators.

RELATION OF POLYTECHNIC EDUCATION TO OTHER STUDIES

It was pointed out numerous times to us that the general subjects are the first in which to emphasize polytechnic education, and that mathematics and science form the bases of polytechnic education. Even though there is a direct correlation between polytechnic courses and mathematics and science courses, Soviet educators are striving to bring about an even greater relationship between them and all areas of instruction.

For example, in botany classes fifth graders are taught about different kinds of trees, and in woodworking classes they are taught what can be done with the trees. One educational researcher explained how polytechnic education is correlated by teaching mathematics. He used the illustration of a metal box that could be made in two different shapes yet have the same volume. However, the exposed surface of the box was greater in one shape than in another. Polytechnic education would be related to this problem, he said, because if industry had to heat this metal box, more energy would be expended if it were of one shape because of its greater exposed surface. His major point was that in the teaching of mathematics, other factors are being considered and attempts made to correlate mathematics with problems close to life—in particular, industrial life.

Soviet educators told us about the changes made to improve the teaching of physics in order for students to understand better the foundations of production. In the revisions of the physics course, the fundamentals of technics were left in so as to help bring about a relation between theory and practice. During the revision of the polytechnic course in electrotechnics they found

that certain principles needed to be included in their physics courses to give the necessary theoretical understanding. As a result, information is now presented in physics classes about (1) principles of semiconductors, (2) modern automation principles, and (3) solid bodies (given more emphasis). It was emphasized to us that these changes in the curriculum brought about a closer relation of the school curriculum to life.

Since one of the main branches of production deals with chemical production, new topics were introduced in chemistry dealing with (1) chemical industries, (2) production of salts, (3) metallurgy, (4) extraction and refining of gases and fuels, and (5) chemical elements. They want to give students a better notion of molecular theory and they have discarded unnecessarily complicated problems in their old syllabus.

Formerly mathematics had a great deal of calculation, but something was lacking. The students, they felt, should get an idea that mathematics can be applied to the practical as well as the theoretical. This is of great importance, we were told. To improve their mathematics courses, the functional theory is introduced in the fifth grade, and the students will study mathematical principles which can be applied to life. The student is expected to understand the applications of the theoretical concepts also. There must be a balance between the applied and the theoretical, we were told. Nor was their main purpose of mathematics—that of developing logical thinking—overlooked in making these changes in the curriculum.

Another example showing how physics can be correlated with polytechnic education is shown on table 9, page 163. This table points out that in discussing problems of thermal action of electric current the students should be taught about schematic drawings, devices that use scientific principles, how these devices work, and their construction.

Polytechnic Courses

Although all courses in the school are being designed to contribute toward polytechnic education, certain courses, along with mathematics and science, do so more specifically. These are: labor (manual arts) as a subject in grades 1 through 4; labor training in grades 5 through 7; principles of production (industrial and agricultural) in grades 8 and 9; technical drawing in grades 7 through 10; electrotechnics and automobiles or tractors in grade 10.

Drawing in grades 1 through 6 includes art instruction and is not generally referred to as a polytechnic course. It is reported here because of the extent to which drawing is taught in the elementary grades prior to the student's taking *technical drawing*, and, because all drawing is so basic to achieving polytechnic education.

In addition to these courses, students also spend time working during the fall and spring in the school parcel of land (garden), and have industrial practice after school and for several weeks during the summer months. And students get experience in production work at an enterprise or collective farm during the ninth grade. See appendix I, table B, for further details on the 10-year curriculum that was being implemented during the 1958-59 school year.

Another way students supplement their school experience is through participation in "Pioneer Circles." These circles help provide students with an outlet for their individual interests. In one school in Moscow, we saw four boys returning to the woodworking shop to make repairs on their model airplanes which they had constructed in one of the circles.

LABOR AS A SUBJECT IN GRADES 1 THROUGH 4

Some of the specific aims of this instruction is to stimulate initiative and design creativity in pupils, to help them develop skills in drawing and in measuring precisely, and to become acquainted with the properties of materials. Soviet educators consider these activities as a form of labor.

Manual arts.—In grade 1, students work with paper, cardboard, scissors, and paste; sew with needle and thread; work with clay (oil mixed with clay); and care for plants and animals. These same activities are carried out in grades 2, 3, and 4. However, in grade 4, students also bind books and do *technical modeling*. Actually, in technical modeling, they make toys and models of machinery like tractors, cranes, gliders, and even parachutes.

We saw many of the objects made by students, such as simple figures and bowls made by pinching, rolling, and pressing clay in various shapes. Much in evidence were houses, barns, and windmills, made from paper and cardboard. Each article was painted nicely to resemble the original. Such activities are conducted in the classrooms with students working at their desks. (See fig. 1–4, page 28.) One Soviet teacher expressed the hope that they would eventually have a separate room for this kind of work.

The school system provides the necessary supplies and equipment such as rulers, knives, scissors, needles, embroidery frames, brushes, shovels, watering cans, saws, chisels, and vises. See list of equipment for study in manual labor for grades 1 through 4, page 137.

Drawing.—In grades 1 and 2 students draw with crayon and water color. They incorporate the ideas of perspective, shading, and color. The student is taught to apply the skill of observation in his drawings. In grades 3 and 4 the students are taught about the size of objects and the distribution of light and shade. Students in grade 6 receive instruction in drawing perspective views, such as in a picture with a horizon, using space in relation to picture, the role of colors in paintings, and how to use water color.[2]

Applying perspective, developing creative imagination and initiative, and understanding the relationship between objects at different distances are part of thematic drawing. Decorative drawing includes the study of geometric and national art designs. Discussion and analysis of art such as paintings and reproductions—both prerevolutionary and Soviet paintings—are also required. Table 4 shows the subjects studied in drawing, with the number of hours, in grades 1 through 6.

Table 4.—Drawing (grades 1 through 6)[1]

Subjects studied	Total hours	Hours per grade					
		1	2	3	4	5	6
1	2	3	4	5	6	7	8
Drawing from nature	116	14	17	20	21	22	22
Decorative drawing	42	11	10	7	6	4	4
Thematic drawing	30	8	6	4	4	4	4
Discussion of art	10	------	------	2	2	3	3
TOTAL	198	33	33	33	33	33	33

[1] Ministry of Education of R.S.F.S.R., *Programmy srednei shkoly. Risovanie.* (Syllabuses of Secondary School. Drawing.) Moscow, Uchpedgiz, 1958. P. 2.

Examples of some of the subjects in drawings made by students are doors; windows; cylindrical and conic objects, such as boxes, cans, and flower boxes; illustrations from fairy tales; decorative wallpaper; drawings from nature, such as the migration of birds;

[2] Ministry of Education of R.S.F.S.R. *Programmy srednei shkoly. Risovanie.* (Syllabuses for secondary school. Drawing.) Moscow, Uchpedgiz, 1958. 16 p.

sketches of benches and chairs; and pictures of posters for holidays. Students are also expected to discuss intelligently various paintings.

At the end of the 6th grade, students are expected to know how to use perspective and shade, and they should be able to draw from nature from memory. They should be able to use water colors and make posters, and be able to recognize distinguished painters, and understand the history behind each painting.

LABOR TRAINING IN GRADES 5 THROUGH 7

Soviet educators believe that these courses help students understand other subjects, develop respect for work and State property, develop good habits of measurement, drawing, and laboratory techniques, and learn the basic elements of production work.

Woodworking.—Students receive instruction about wood and its qualities, the advantages and disadvantages of various woods, the technical qualities of wood, plain and quartered sawed lumber,

Figure 3-1.—Sixth-grade boys in woodworking class (labor training).

Figure 3-2.—Sixth-grade girls in woodworking class (labor training).

drying, and the preservation of wood. They also learn how to cut wood and use the equipment and instruments (tools) of a jointer (woodworker). (See fig. 3-1.) In one woodworking shop students were cutting out handles for tools. One boy, using a hand plane made of wood (except for the metal planeiron), was planing a rake handle held in a wooden vise.

Mostly hand-operated tools are used by the students in these classes, to perform such operations as marking, cutting, planing, drilling, and chiseling. (See fig. 3-2.) Most of the useful articles were put together with screws, glue, and nails. Articles are sandpapered and finished using a sealer, with either a translucent finish, paints, or enamel. (See fig. 3-3 and fig. 3-4.)

Metalworking.—Students must know about ferrous and nonferrous metals and their alloys, and get a general understanding of their qualities. They do bench metalwork at their work station and learn about safety rules. Various hand operations are taught, such as cutting with snips, chiseling, shaping, filing, bending, drilling, cutting threads, and finishing metal objects. (See fig. 3-5 through fig. 3-8 for illustrations of the shop work.) Notice that the article in fig. 3-8 can be used in a physics laboratory.

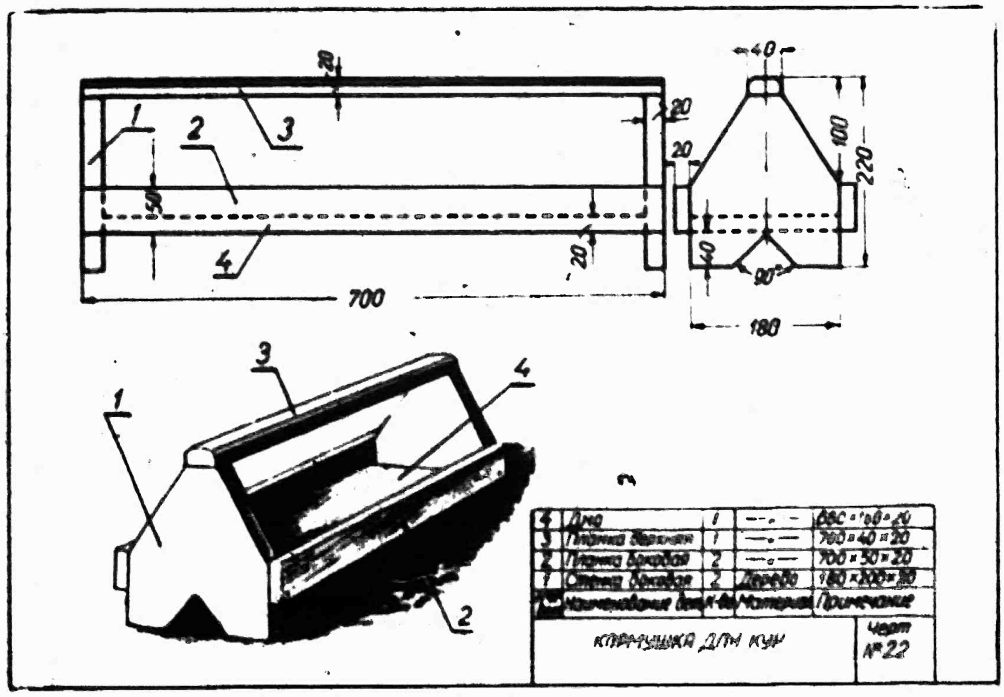


Figure 3-3.—Feedrack for chickens.

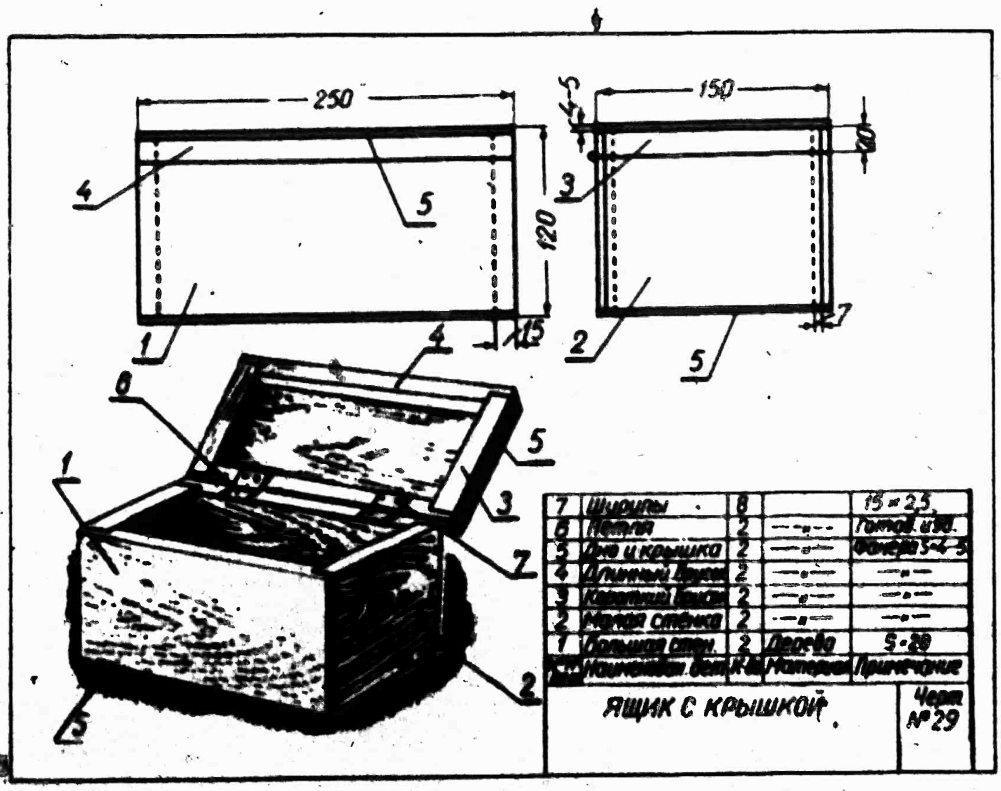


Figure 3-4.—Box with a cover.

We learned that many articles made in the workshops, such as test tube stands, chemistry racks, and apparatus for demonstration of waves, were for the science laboratories. Fig. 3-9A shows a display of some of the useful articles, such as rakes, tin cups, trowels, and small pails, students make in metalwork.

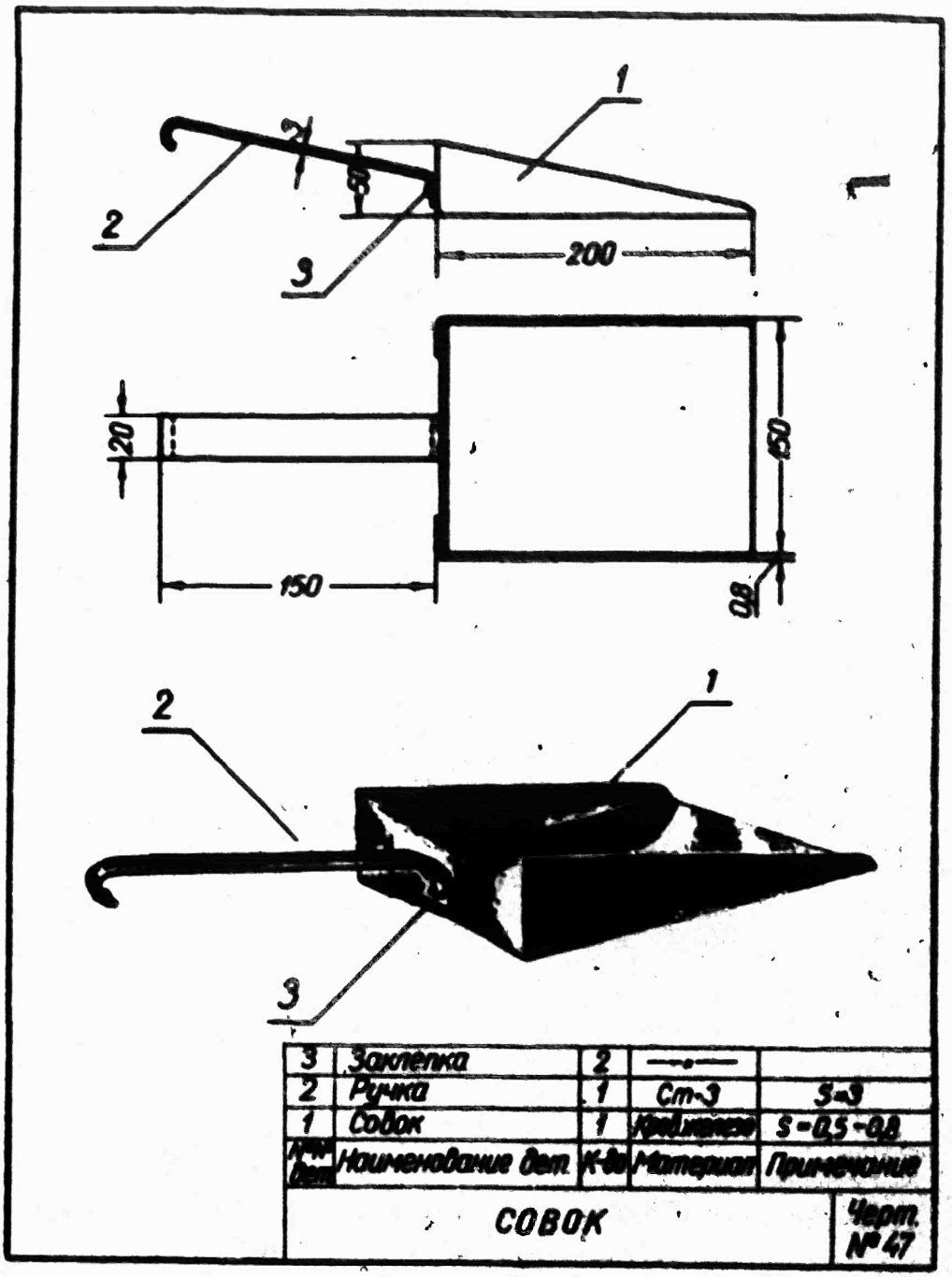


Figure 3-8.—Dustpan.

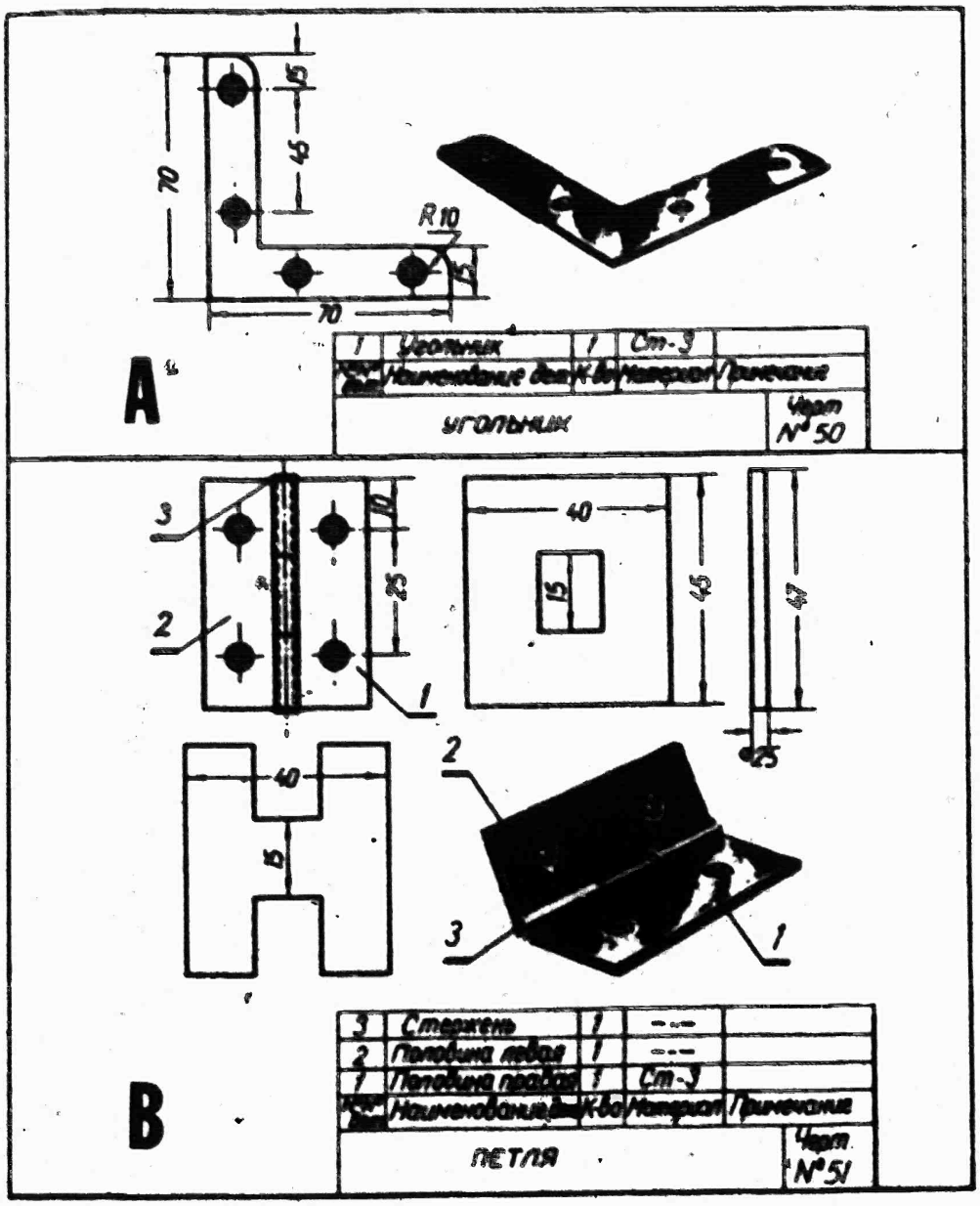
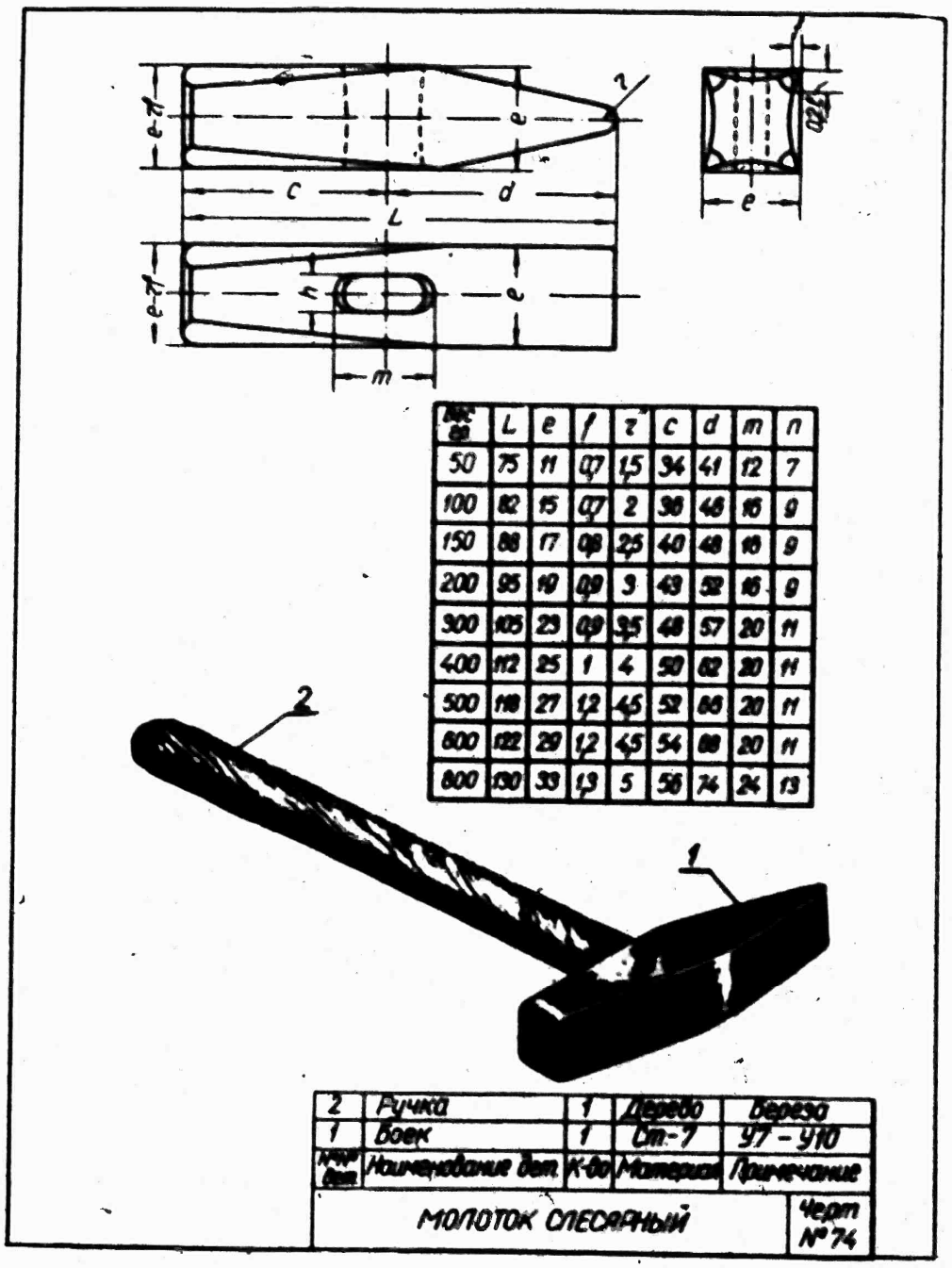


Figure 3-4.—(A) Flat corner iron and (B) hinge.

Electrical work.—In addition to working with metal, pupils in the metalworking shop are required to gain elementary understanding of electric work and lighting. They study transmission and distribution of power and insulation procedures, plan and do electric wiring, and draw schematics. Experience is acquired in using house wiring devices and doing elementary house wiring. Electrical appliances, their construction and operation, are also studied. Fig. 3-10 and fig. 3-11 A & B show two of the articles representative of this type of work.



№ оп	L	e	f	r	c	d	m	n
50	75	11	0,7	1,5	34	41	12	7
100	82	15	0,7	2	36	46	16	9
150	88	17	0,8	2,5	40	48	16	9
200	95	19	0,9	3	43	52	16	9
300	105	23	0,9	3,5	48	57	20	11
400	112	25	1	4	50	62	20	11
500	118	27	1,2	4,5	52	66	20	11
600	122	29	1,2	4,5	54	68	20	11
800	130	33	1,5	5	56	74	24	13

№ поз	Наименование дет.	К-во	Материал	Примечание
2	Ручка	1	Дерево	Береза
1	Боек	1	Ст-7	У7 - У10

Figure 3-7.—Mechanic's hammer.

From our observations, the electrical phase of instruction seemed to be the weakest in grades 5 through 7. Steps, however, are said to be under way to correct this, and in one school we visited the instructor proudly showed us a shop laboratory that he and his students had built during the year, which was fitted

for electrical work and lighting. The facilities will be used for the first time during the 1959-60 school year.

School plots.—These school plots (gardens) provide for an integral part of the labor training in these grades, as well in the other grades. The practical work on the plots serves as a supplement to science courses in botany and zoology. Experi-

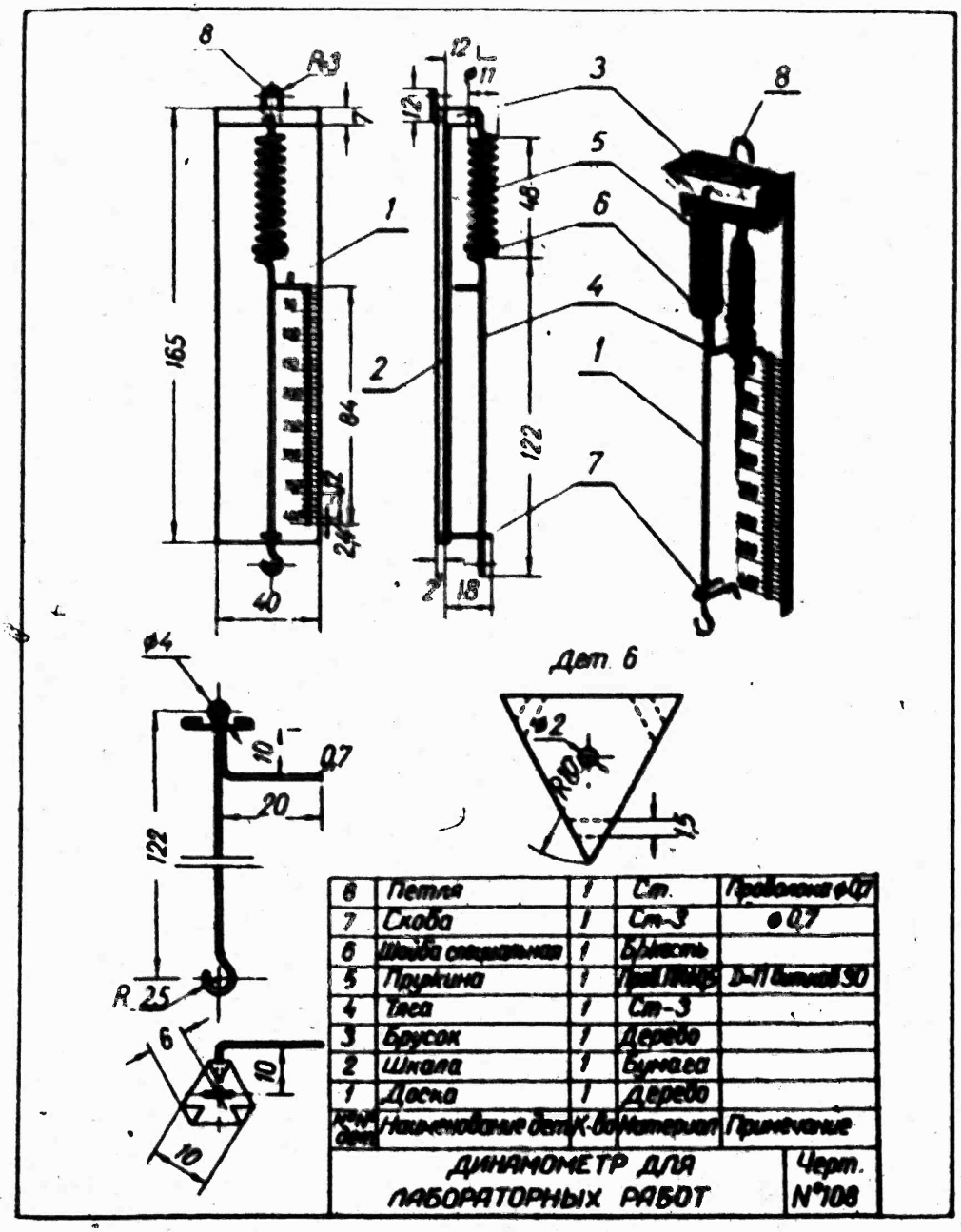
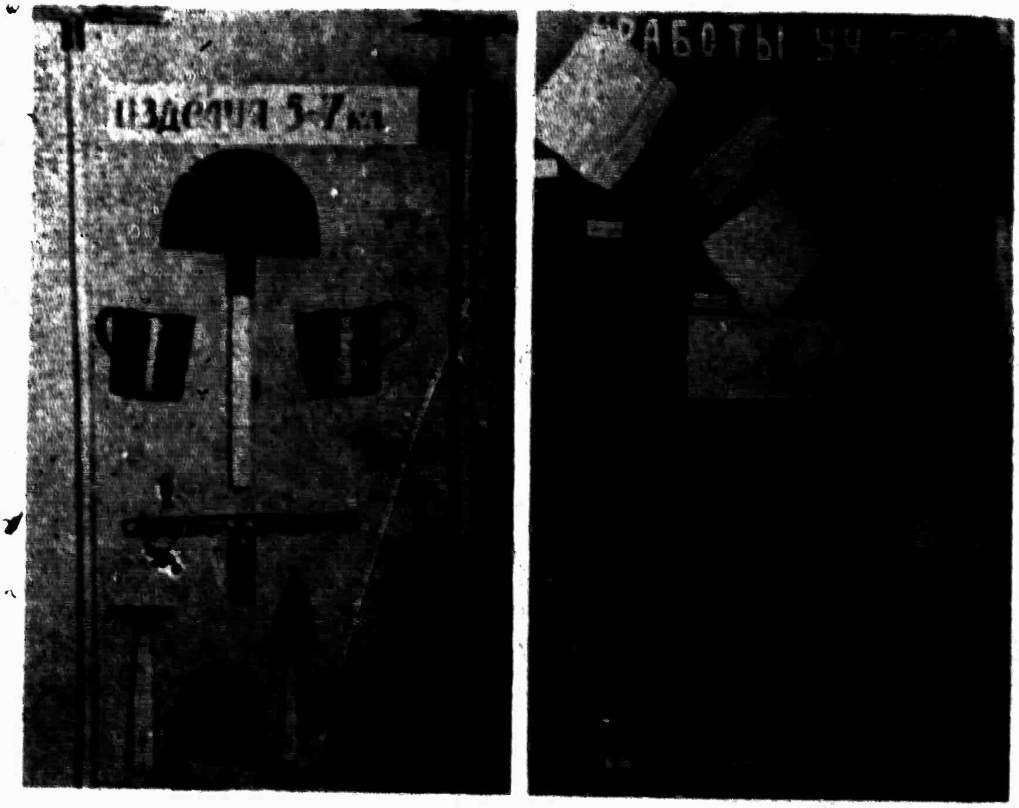


Figure 3-8.—Dynamometer for laboratory work.



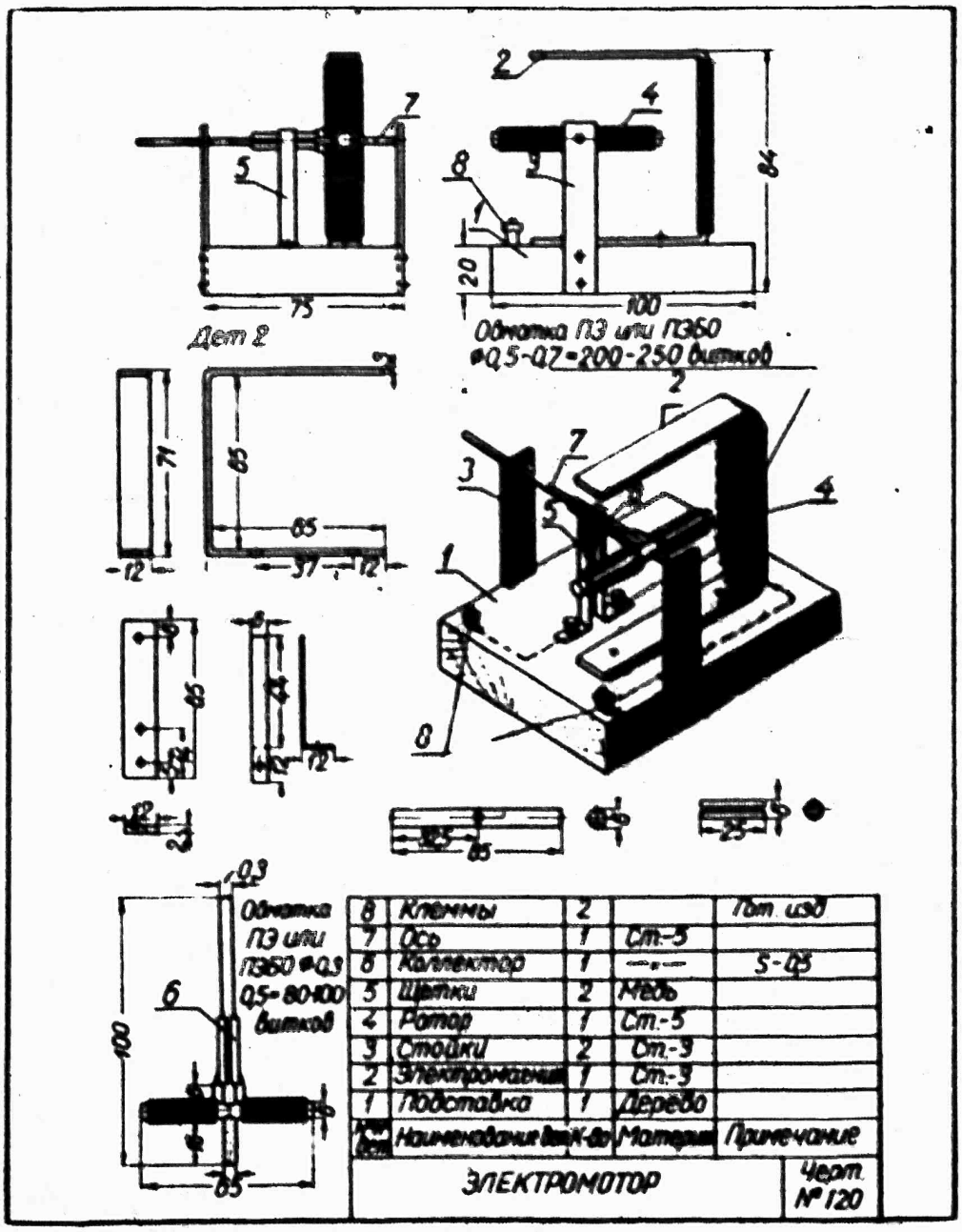
(A) (B)

Figure 3-9.—Illustrations of useful articles made by students in grade five and above. above.

ments are conducted during the year under the supervision of the teachers. Students in the fifth grade grow vegetables and soft and hard fruits. Other socially useful work entails tree planting and keeping the school grounds clean and orderly, activities which are done, however, after school. All youngsters participate in working on the plots during the autumn harvest and spring planting time.

We had the opportunity to see students working in brigades (groups) preparing the soil for planting. Sometimes twenty students would form a line and turn the soil over with their shovels. In the southern regions of the Soviet Union the plots (gardens) had already been planted and vegetables had begun growing. Students worked in brigades to weed them. They also used the necessary fertilizers and insecticides. A description of a plot is given in chapter II, p. 87.

School production work.—Students in these grade levels receive an introduction to production education and make various useful articles in large quantities. Sometimes the work is devoted to the needs of the school. Kindergarten toys, flower pots, chemistry



Поз.	Наименование	Кол.	Материал	Примечание
8	Клеммы	2		Лат. изол
7	Ось	1	Ст-5	
6	Коллектор	1	—"—	5-05
5	Щетки	2	Медь	
4	Ротор	1	Ст-5	
3	Стойки	2	Ст-3	
2	Электромагнит	1	Ст-3	
1	Подставка	1	Дерево	

Figure 3-10.—Electric motor.

tray boxes, test tube holders, and hooks, as well as other useful items, have been produced by the student.

Soviet educators emphasize that this production education is very important and that the student should see the results of his labor, both in the form of a well-made article and in remuneration. They also feel a student's attitude improves when he realizes his work has value. Schools work cooperatively with industrial plants in this phase of the instructional program. The plants provide

the materials that the students use to learn about production methods and to get a beginning concept of mass production.

In a boarding school in Moscow, one of the new type schools in the Soviet Union, we were told the labor training is carried out in two ways: (1) Through self-service and (2) through productive labor.

Self-service means that students make their own beds, clean the dormitory rooms, take turns serving and doing jobs in the cafeteria, and in general take care of themselves.

Productive labor is taught through participation in live production work. We saw sixth graders (boys and girls) making paper boxes from cardboard sent to the school from a factory. The finished boxes were used to pack toys at the factory. During the 1957–58 school year this school made 70,000 boxes. The students had work stations where certain operations were performed, and all students learned all the processes over a period of time. Fig. 3-12 shows a girl operating a stapler to fasten the box sides together.

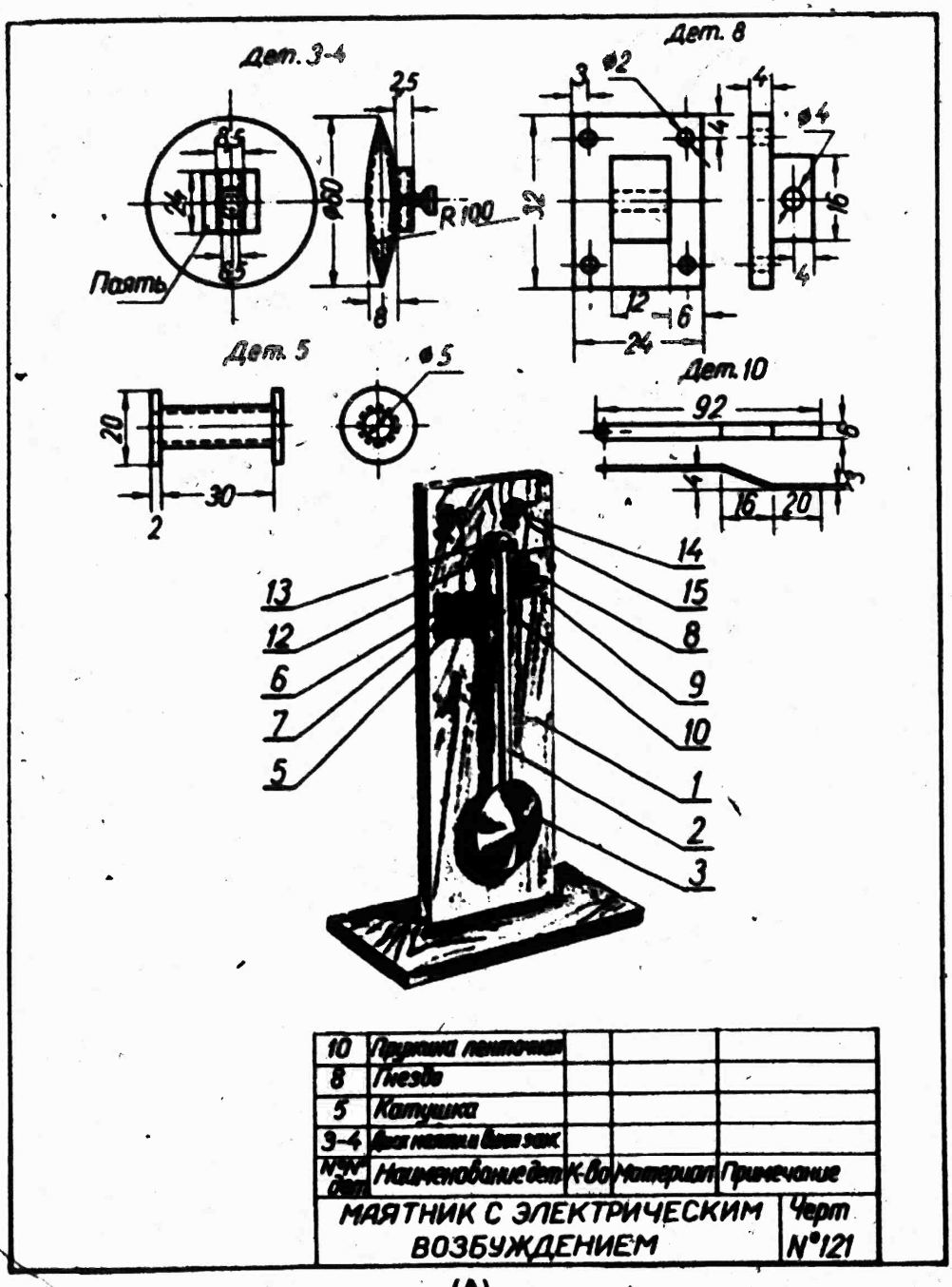
In a sewing class in this same school, girls were making small geology bags. The students receive from 5 to 9 kopeks (approximately ½ to 1 cent) for each bag. The girls had completed 6,000 of the 20,000 bags they were supposed to make. Not all the girls were working on the production job; some were working on individual projects—useful articles for themselves. Dresses, needlework, embroideries, aprons, dress patterns, skirts, and blouses are examples of articles made by students in the sewing classes. (See fig. 3-13.) Also refer to fig. 3-9B, which shows samples of student's work.

We also saw in the school workshop 6 sixth-grade boys making wood shelf brackets. They make 250 a month. On another production job each student made from 10 to 15 wooden screwdriver handles in one hour. Some of the money the pupils receive for such work is turned in to the school to purchase items needed. Last year the value of the students' work was 150,000 rubles. The students received for themselves 90,000 rubles for their part in the production labor.

In a rural school in Russia, students raised 1,000 rabbits and gave them to the State. At the time we visited the school they still had 129 rabbits in a building near the school.

FUNDAMENTALS OF PRODUCTION IN GRADES 8 THROUGH 10

The primary aim of these grades is to give students a basic understanding of modern production and its main branches. The

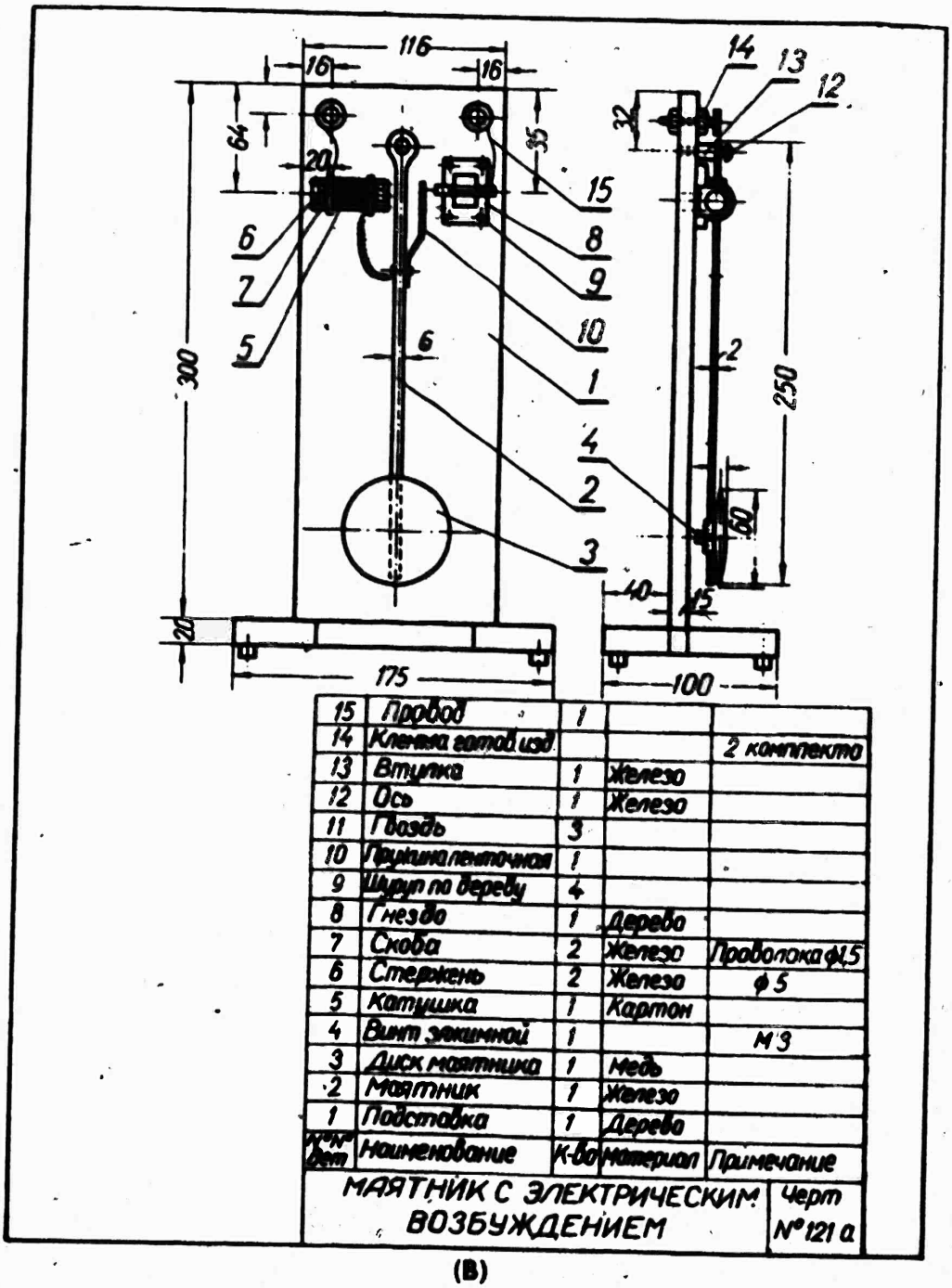


(A)

Figure 3-11.—Pendulum controlled by electrical excitation.

main branches of production, according to Soviet educators, are (1) mechanical production of different materials and products, (2) chemical production, (3) agricultural production, and (4) energy production (particularly electrical energy).

In grades 8 through 10 of the 10-year school, students in urban schools study *fundamentals of production* and do practical productive work. In the ninth grade they study machines and



Поз.	Наименование	К-во	Материал	Примечание
15	Провод	1		
14	Клемма аккумуляторная			2 комплекта
13	Втулка	1	Железо	
12	Ось	1	Железо	
11	Гвоздь	3		
10	Пружина ленточная	1		
9	Шуруп по дереву	4		
8	Гнездо	1	Дерево	
7	Скоба	2	Железо	Проволока ф1,5
6	Стержень	2	Железо	ф 5
5	Катушка	1	Картон	
4	Винт закладной	1		М 3
3	Диск маятника	1	Медь	
2	Маятник	1	Железо	
1	Подставка	1	Дерево	

МАЯТНИК С ЭЛЕКТРИЧЕСКИМ ВОЗБУЖДЕНИЕМ — Черт. № 121 а

(B)

Figure 3-11.—Pendulum controlled by electrical excitation.

industrial production in a specific enterprise. The first half of the 10th grade is devoted to electrotechnics and the last half to automobile work. On passing from grade 8 to 9, pupils spend several days during the summer months in agricultural practice on a State farm, and on passing from grade 9 to 10 they spend time in an industrial enterprise.

In rural schools, students in grades 8 through 10 study

fundamentals of agricultural production and do practical work in plant growing, animal husbandry, the use and operation of agricultural machinery, and the tractor. Between grades 8 and 9 and 9 and 10, students spend several days in the summer on State farms and in grades 9 and 10 students work during the harvest periods.

Although technical drawing actually begins in grade 7 and continues through grade 10, it is all treated here under grades 8 through 10 for convenience in reporting. Both urban and rural students (boys and girls) are required to take technical drawing.

Technical drawing (grades 7 through 10).—By the time students take technical drawing in the upper grades, they already have a background in elementary drawing. Technical drawings in the upper grades are based on a series of models made of wood in various shapes. Some models resemble geometric forms and others, parts of machines. Different grade levels have sets of

Figure 3-12.—Girl stapling a paper box in a school production job.

Figure 3-13.—Seventh graders in sewing class.

these, and in each succeeding grade level the models are more complicated. The student is expected to draw projections of the models. Auxiliary, perspective, and orthographic projections are a part of these courses. In the 10th grade, students are required to draw part of an industrial assembly drawing as one of the last requirements. We observed a 10th grade drawing class in which students were in the process of completing their assembly drawings.

The student must also know how to read technical drawings. Fig. 3-14 shows a typical drawing, and the following questions which students were expected to answer refer to this particular drawing:[4]

1. What is the name of the part which is shown in the drawing, what metal is it made from, and how many projections are shown on the drawing?
2. Give the dimensions of the parts.
3. What is the thickness of the flange?
4. How many through cylindrical holes are in the model, and what are the diameters of the cylindrical openings and the radii of the curves on the object?

[4] S. M. Kulikov, *Chtenie i vypolnenie chertezhei v proektsiiakh.* (Reading and performance of technical drawings in projections.) Moscow, Gos. ucheb. ped. izdat., 1950. P. 140.

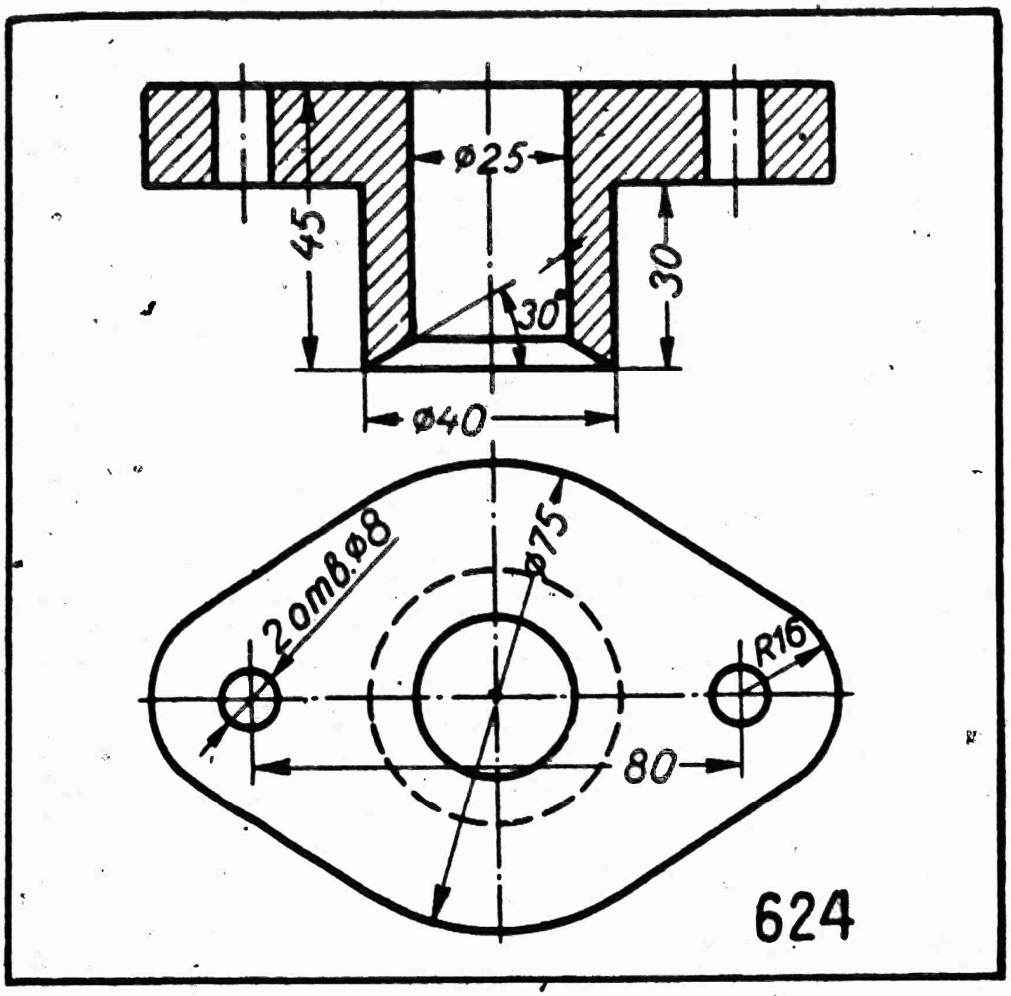


Figure 3-14.—An example of a problem in "how to read a technical drawing." (Refer to questions in text.)

5. What is the distance between the axis of side openings?
6. Determine the wall thickness of the cylindrical part,
7. Plot three projections: the main view without cross section, the side view with cross section in the plane of symmetry, and the plan view.

Another illustration of a drawing problem is given in fig. 3-15 A and B. The student is asked to study all the isometric sketches and identify which of them could be drawn by a single view in orthographic projection. Also, he must make a drawing of 2 or 3 projections and indicate the structure of the parts, in some cases, by a sectional view or extraction.[5]

Machine study (urban schools, grade 8).—This grade level is devoted to understanding machines, mechanisms, and the elements

[5] *Ibid.*, pp. 107–109.

of technology. Soviet educators consider this course basic to their overall polytechnic program in the senior grades. Students learn the application of the principles of science to machine study. Topics such as machine-building materials and the processes for cutting metals, especially on the lathe, milling machine, and shaper, are studied. (See fig. 3-16.) The parts of machines, nomenclature, gear ratios, how the machines are assembled and how they are installed are important topics for discussion and work.

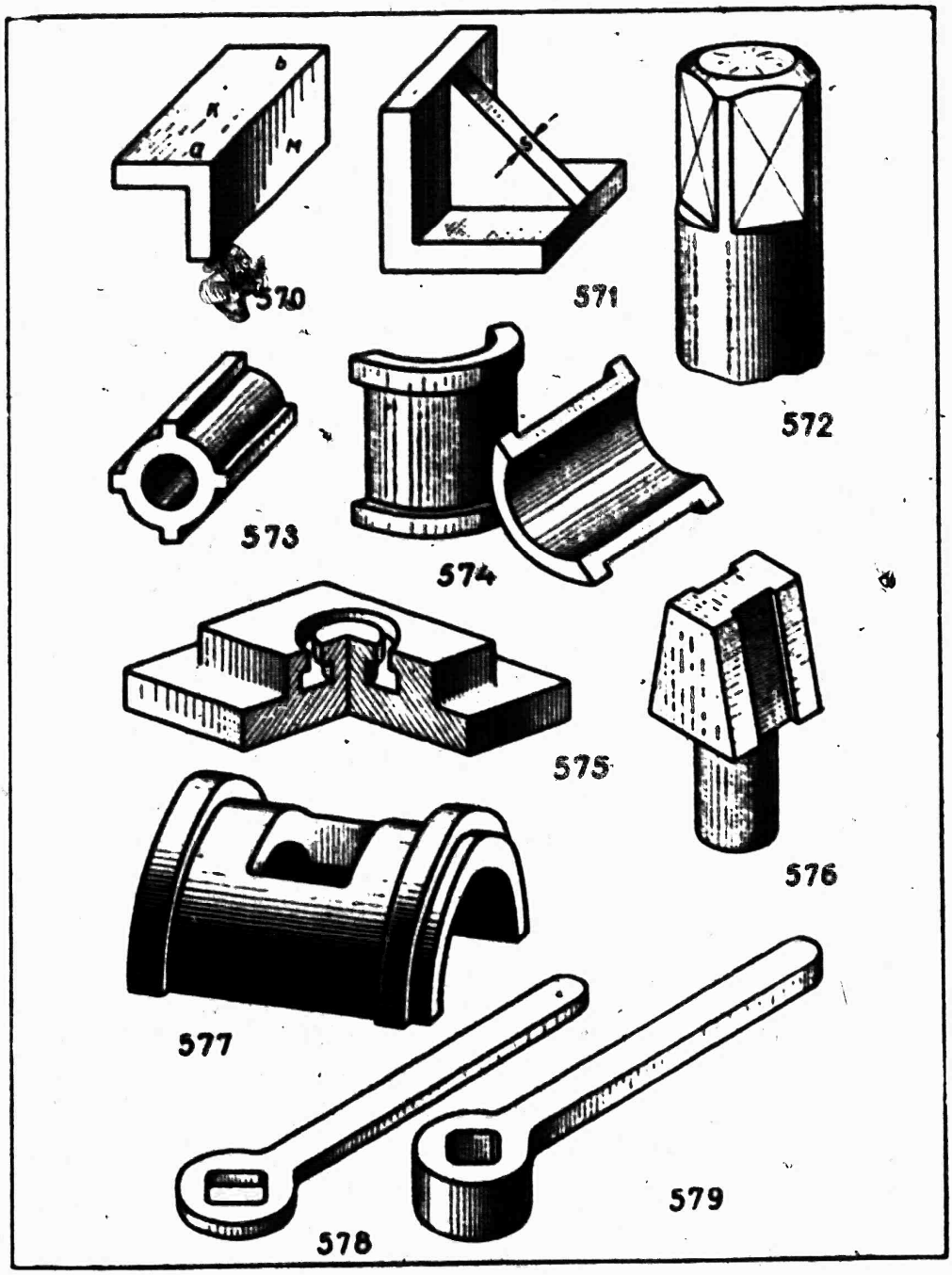
In one school we saw an eighth-grade student working on a lathe making a machine bolt. The machine bolt was not unlike that described in table 7, page 147. The writers asked questions about (1) the number of threads he intended to cut on the bolt, (2) the cutting lubricant he was using, (3) the type of steel, and (4) the names of the parts of the machine he was operating. The student seemed to know the nomenclature of the parts of the machine but had difficulty in answering the first three questions. The teacher had to help him as he attempted to reply. Another student, when asked these same questions, replied to all of them with no difficulty.

Some of the useful articles made in the eighth grade are die wrenches, shafts, wheels, tap wrenches (simple), and hammers. As in the lower grades, production work is carried out, except that now the emphasis is on machine production.

Fundamentals of plant breeding (rural schools, grade 8).—The rural school's polytechnic curriculum varies considerably from that of the urban school's, although there are many elements common to both; for example, both take technical drawing and study machinery. Although the study of machinery and mechanisms in the rural schools pertains to agricultural machinery, the same principles of science as applied to production machinery are taught—transmission of power, gears, levers, etc. Only the application varies.

Eighth-grade students study both fundamentals of plant growing and agricultural machinery. Topics such as conditions of growth, soil, its properties and mineral feeding, rotation of crops, and organization of production and labor on a collective farm are taught. Productive practice during the summer is required when students pass from grade 8 to 9, and also during the harvest period.

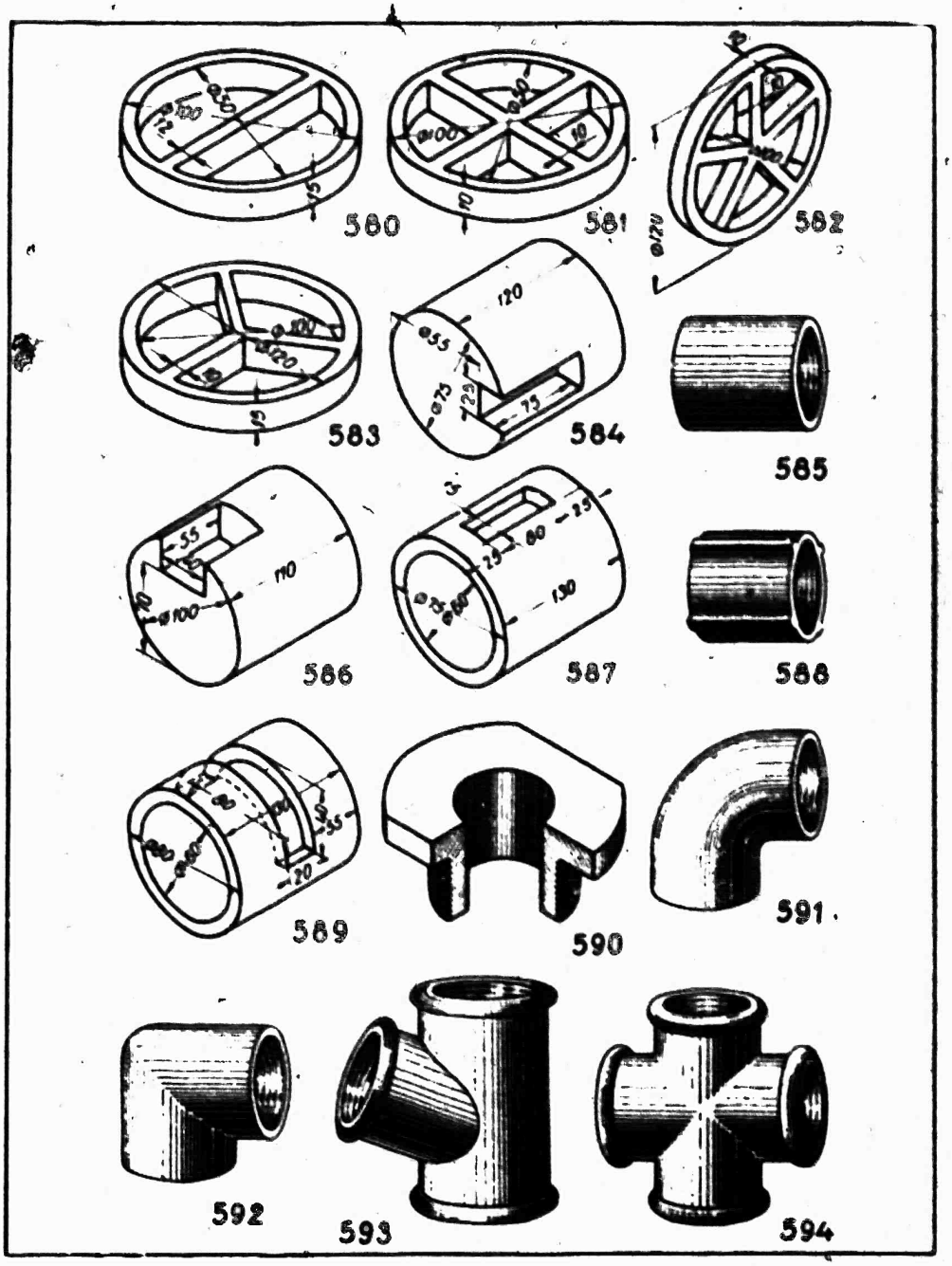
The study and practical work in agricultural machinery is split between the eighth and ninth grades. The eighth grade, for example, takes up plows, harrows, and sowing machines;



(A)

Figure 3-15.—Determining the number of projections needed to make a drawing of each object—a problem in technical drawing.

No. 570, corner iron; No. 571, corner iron with inflexible rib; No. 572, end of cylindrical rod with squares for using wrench; No. 573, bushing with longitudinal rib; No. 574, half of bearing bushing; No. 575, plate of turning vise; No. 576, wedge of jaw for slide valve; No. 577, half of bearing bushing with outlet for oiling; No. 578, handle of wrench (closed, light); No. 579, handle of wrench (closed, heavy).



(B)

Figure 3-15.—Continued.

No. 580, ring with a spoke-rib; No. 581, ring with four spoke-ribs; No. 582, ring with five spoke-ribs; No. 583, ring with three spoke-ribs; No. 584, shaft with key bed; No. 585, muff coupling with thread; No. 586, shaft with lengthwise key bed; No. 587, bushing with lengthwise opening; No. 588, muff with thread and longitudinal ribs; No. 589, bushing with cross sectional openings; No. 590, bushing with thread, made to be used by wrench; No. 591, elbow with thread (curved); No. 592, elbow 90° with thread; No. 593, T-pipe-sloping with thread; and No. 594, cross pipe with thread.

Figure 3-16.—Eighth grader studying machines.

the ninth grade studies and does practical work on harvesting machines for grain, potatoes, flax, beets, and corn. (See appendix IV.)

Fundamentals of industrial production in the form of a specific enterprise (urban schools, grade 9).—With the exception of summer practice, previous production training dealt for the most part with school production work and students participated actively during and after school hours. During grade 9 students get acquainted with a specific industrial enterprise and spend some time in production practice during the year at the plant or building occupied by the enterprise. The 10-year school program calls for 4 hours per week devoted to the fundamentals of industrial production in a specific enterprise. (See appendix I, table B, and appendix IV.)

General acquaintance with the specific enterprise involves studying topics like the production branch in the factory, raw materials used by the plant, technology and techniques of production, and how power is obtained for the plant. Actual participation in productive practice in the main and auxiliary shops is a planned activity worked out by the plant officials and the school's director or coordinator. Each student is assigned

to a machine and works under the supervision of a worker. They work as turners, drill operators, etc. We were told the ninth-grade student can choose the plant in which he wants to get experience. Thus, he can follow his "bent." For example, if he is interested in radio work he can work in a radio-building plant.

As an example of this *work experience education program*, our study team had the opportunity to visit the "Red Proletariat" (Krasnyi Proletarii), a machine-building plant in Moscow, to observe students at work. This particular factory has been given the "Order of Lenin" for its superior work in machine tool manufacturing. Since 1957, they have been producing a metal cutting lathe for exportation to various countries. They produce about 1,000 lathes per month. They also produce tractor parts, railroad wheels, and special machines for polishing. Approximately one-half of the factory workers have at least 15 years experience, and most workers are highly qualified.

In 1936 this plant became "patron" to School No. 16 in Moscow, and helped the school in various ways, such as giving it machines and tools for workshops. In these early years this factory also helped the school in its Pioneer work and extracurricular activities. Since 1953, they have helped the school in production training activities in labor education. Through the efforts of the Ministry of Education, the factory, and the school, the first cooperative plan began in 1953. Three engineers were appointed to help the school with labor training in grades 5, 6, and 7. The engineers worked at the plant and taught school 3 or 4 hours a week in the school workshops, teaching students how to build simple tools, work in wood in the sixth grade, and in metal in the seventh grade.

In 1955 the Ministry of Education introduced the first labor program, sending skilled workers into the schools rather than the engineers they sent in 1953. Teaching guides were prepared to help workers teach. They were released from factory work in the morning to teach in the schools once a week for 3 or 4 hours. Whenever foremen or workers teach in school they get their pay from their regular factory work plus an hourly wage for teaching. We were told some of the workers receive 9 rubles an hour for teaching.

In School No. 16 engineers and teachers of the school worked cooperatively in making out the curriculum for courses in fundamentals of machinery, fundamentals of production, electrotechnics, and automobiles. In the 8th grade, students in this school work in school workshops. In grade 9, they take classes in theory and make excursions to industrial plants. These theory

courses pertain to the tools of the factory and the technological processes involved. In general, the 9th grade polytechnic course is an orientation program and in each of the different schools is implemented by a particular plant.

We were given the titles of some of the theoretical work that takes place prior to actual work in the plant. For example, the students must study such topics as introduction to, and history of, milling machines; materials used at the plant; how to read technical drawings and blueprints; measuring tools (delicate types), tolerance, and standards; administration and management of the plant; and technology of metals, including casting, forging, cutting, assembling, and welding.

After the theoretical instruction given in the school, students spend 1½ months of work experience at the plant for 4 hours a day, six days a week. At the end of this period, they take an examination. For the group we saw in the factory, the test was scheduled June 27. This organizational plan is different from that previously mentioned (4 hours per week for the school year), since School No. 16 is an experimental school.

During this work experience in the ninth grade, students keep a record book of what they do, a daily account of their experiences. As a final project they have to draw the part they were making or assembling; a mark is given on this project. A mark is also given for their practical work at the plant. At the end of their work experience, they write a report. These essays are corrected by the literature teacher. We were told that as a result the literature teachers had to learn technical names, and some went to the factory to learn about the work. We were also told that the teacher of history now includes references to this plant in her courses.

We had the opportunity to observe several ninth-grade students working in the factory. For example, 3 students were working in the central measurement laboratory, measuring the depth of gear teeth and recording the results. One of the purposes of this work was to determine the variation within the depth of each tooth. Another group of ninth-grade girl students were located at a quality control station in the plant, checking various machine parts against specification drawings. We asked one of the girls to perform a check on the concentricity of a gear blank. She quickly found the specification drawing and inserted the gear blank on a splined mandrel between two centers. She used the gage expertly to check the part. She explained effectively that the tolerance was within the necessary limits as specified in the

drawing. A woman inspector was in charge of the girls and she told me they had two weeks orientation and had been on the job about 1½ months. One of these girls wants to become an engineer.

Another group of students were working on benchwork, fitting keyed washers to a shaft. They first hand filed the key on the washer to make a close fit in the slot of the shaft. After they completed this, they screwed a hexagonal nut on the shaft. The work was then repeated. These students had to use a metal vise to hold the washer during the filing, and several trials were made to determine whether the washer fitted properly in the slot of the shaft. Also, some of the other girls in this shop department were cutting threads on bolts, or operating grinding and drilling machines.

An example of the hours of educational and training experience a student would get if he went into a machine-building plant similar to the one described is given here. This listing is taken from the official 10-year school study program.[6]

Machine Building Plant

Grade 9

(Total 232 hrs., 96 in summertime)

I. General Introduction to Machine Building Plant (36 hrs. total)
   - A. Introduction (2 hrs.)
   - B. Basic materials supply and auxiliary shops (2 hrs.)
   - C. Foundry shops (2 hrs.)
   - D. Storage and forge shop (4 hrs.)
   - E. Heat treatment shops (4 hrs.)
   - F. Bases of the technology of machining (6 hrs.)
   - G. Assembly of industrial equipment (4 hrs.)
   - H. Design and working technology of machine production (4 hrs.)
   - I. Power engineering in production (4 hrs.)
   - J. Organization of production (2 hrs.)
   - K. Safety engineering and industrial sanitation (2 hrs.)

II. Industrial Practice (Total 196 hrs., 96 in summertime; no breakdown given for the work in industrial practice)
   - A. Foundry shops
     1. Production of mold frames
     2. Preparation of core box

[6] Ministry of Education of R.S.F.S.R., *Programmy srednei shkoly na 1958–59 uchebnyi god* (Syllabuses for secondary school for the 1958-59 school year.) Moscow, Uchpedgiz, 1958. p. 75–80.

B. Storage shops
   1. Making of bins out of rungs for movable and stationary machine tools

C. Mechanical Shops
   1. Planing of surface
   2. Machining of parts in the cartridges
   3. Machining of graded cylinders
   4. Working with drillers
   5. Milling of parts by using cutting machines

D. Assembly and repair shops
   1. Preparation for assembly parts and assembly units
   2. Repairs of simple units

E. Work of inspector and acceptance of ready made parts

When there are no machine-building plants near a school, the school may cooperate with the kind of industrial enterprise available to it. Often, it is possible that several different enterprises are nearby where students can get production experience. In this case, a greater selection or choice is provided for the student to follow his "bent" or interests. The program of studies for 10-year schools during 1958–59 lists several types of enterprises which can be used for this ninth-grade work experience education program. They are as follows:

1. Machine-building plants
2. Metallurgical production (ferrous)
3. Electric machine building and electric equipment making
4. Textile industry
5. Polygraphic (printing) industry
6. Railroad transportation
7. Building construction
8. Production of building materials
9. Fundamentals of joiner's work
10. Fundamentals of mechanical shop
11. Fundamentals of lathe work
12. Fundamentals of milling

Theory and practice are taught within the allocated 232 hours for this type of work in the ninth grade.

Fundamentals of animal husbandry (rural schools, grade 9).—In rural schools, students study and get practical experience in

animal husbandry, instead of in machine-building or other plants. Topics like the physical build of horned cattle, their productivity (meat or milk, or both), care of agricultural animals, milking of cows and accounting of milk obtained, breeding of animals, etc., are taught. See appendix IV for further details as to topics and the number of hours devoted to each. Summer practice is also required of students passing from grade 9 to 10.

The beginning of tractor study is taken up at this grade level, with discussion of the types of engines and the principles involved. Students also study the fuel and cooling systems.

Electrotechnics (grade 10).—Classes in electrotechnics or electroengineering, as they are sometimes called, deal with electric light wiring, measuring instruments, electrical machines and equipment, and production and utilization of electrical power. In one class we saw students working on experiments involving light wiring, meters, motor control, power calculation, generators, automobile electricity, 3- and 4-phase lines, use of electricity, 3-phase motors, magnetic controllers, transformers, radio (one tube grid leak), vacuum tubes, and a two-tube radio. The electrotechnics laboratory is closely connected to the physics course.

In one school the course in the electrotechnics laboratory was optional but will be required in their new building. Another school offered it for 34 weeks. In still another school, in Kiev, the course was just getting started.

Electrotechnics is taught in both rural and urban schools, but there seemed to be more emphasis on battery work in the rural schools. See appendix IV for further details as to topics and the number of hours devoted to each.

Automobiles or tractors (grade 10).—Urban schools study automobiles, and rural schools study tractors. Both tractor and automobile shops have engines mounted on racks for assembly, and disassembly, and testing. Transmission, brake, and steering systems are also mounted for instructional work. Pupils not only learn to drive a car (urban schools) or tractor (rural schools), but study and do work on the cooling, oiling, and ignition systems. (See fig. 3-17.)

In a 10-year rural school we visited, this type of work was optional in the 10th grade. However, it will be required in their new building. In a Moscow boarding school, all students are required to take driver training, and some receive a license in the ninth grade. After a student is 17½ years of age he or she can receive a chauffeur-amateur license.

In one rural school that had considerable equipment to teach

Figure 3-17.—Instruction in automobiles.

tractor study, we watched students start their school tractor, and a girl demonstrated her skill in driving it. She seemed very proficient in the operation of the tractor, driving it with ease.

The automobile and tractor courses are taught in the school shop for one-half a semester and do not go into detailed work on the various mechanisms, such as grinding valves. As with the course in machine study, the application of science and mathematics is taught relative to the automobile and tractor.

In rural schools tractor study begins in the ninth grade as a part of the agricultural machinery study, and in the 10th grade more detailed work is carried on with transmissions, lubricating systems, electrical equipment, steering mechanisms, and safety techniques.

If facilities are not extensive enough to allow for a separate automobile shop, this type of work is taught in the machine study laboratory or mechanics shop, as was the case in School No. 6, Kiev. See appendix IV for further details as to topics and the number of hours devoted to each.

The New Curriculum Reforms

In Soviet attempts to bring the school closer to social and economic features of Soviet life, experiments in the curriculum in the past few years have brought about an even greater empha-

sis on polytechnic and production education than that described previously in this chapter. Selected excerpts from official study plans of the Russian Soviet Federated Socialist Republic (R.S.F.S.R.) show this emphasis. (See table 5) The R.S.F.S.R. is the largest of all Soviet republics and plays a leading role in standardizing the curriculums for all republics.

Table 5 reveals the increase in polytechnic courses in the elementary-secondary school from 1955–56 to the present. The selected courses in Study Plan II were a part of the total curriculum of 50 percent of the schools during the 1958–59 school year in the R.S.F.S.R.

In the Ministry of Education in Moscow, we were told that they previously had 248 schools in the R.S.F.S.R. on special ex-

Table 5.—Selected polytechnic courses

(Two figures in a column under a grade indicate number of hours for each semester)

Study plan	Hours of instruction per week in grades—										
	1	2	3	4	5	6	7	8	9	10	11
1	2	3	4	5	6	7	8	9	10	11	12
STUDY PLAN I [1] (10-year school, 1955–56)											
Drawing	1	1	1	1	1	1					
Technical drawing							1	1	1	1	
Work and practical exercises	1	1	1	1	2	2	2				
Practicum in agriculture and machine technology and electro-technology								2	2	2	
TOTAL, 1955–56	2	2	2	2	3	3	3	3	3	3	
STUDY PLAN II [2] (10-year school, 1957–58)											
Drawing	1	1	1	1	1	1					
Technical drawing							1	1	1	1	
Work and practical Exercises	1	1	2	2	2	2	2				
Fundamentals of production								3	4	4	
TOTAL, 1957–58	2	2	3	3	3	3	3	4	5	5	
STUDY PLAN III [3] (11-year school, (1958–59)											
Drawing	1	1	1	1	1	1					
Technical drawing							1	1	2		
Practical work	1	1	2	2	2	2	2				
Principles of industrial production								3	2	0–2	
Practical and theoretical training in industry (industrial work experience)									6	12	18
TOTAL, 1958–59	2	2	3	3	3	3	3	4	10	12–14	18

[1] See appendix I, table A.
[2] See appendix I, table B.
[3] One of several plans used during 1958–59 in preparation for new curriculums in schools formerly on a 10-year program. The 9–11 grade program has been experimented with in recent years and is reported in S. G. Shapovalenko, *ed, Soedinenie obucheniia s proizvoditel'nym trudom uchashchikhsia Opyt piatidesiati shkol R.S.F.S.R.)* (Combining instruction with productive work of pupils. An experience of fifty schools in the R.S.F.S.R.) Moscow: Academy of Pedagogical Sciences, 1958, p. 198.

perimental programs and now (1959–60) have about 2,000. The experimental plans now in use will not be altered for the 1960–61 school year, and an example of one in use appears in appendix I, table C. The excerpt shown in table 6 is taken from still another plan. Notice that an even greater emphasis is put on polytechnic courses and production training. The first five grades will be on the new plan during the 1959–60 school year, and each year other grades will be using the new curriculum. It is the Ministry's plan that by the beginning of the school year 1965–66 all schools will be on the new program.

The new curriculum reforms call for 8 years of compulsory elementary education and 3 years of optional study in grades 9, 10, and 11. These reforms have increased the compulsory education by one year and will add one year to the upper grades, making a total of 11 years for complete elementary-secondary general education.

Actually the curriculum reforms are in a state of broad experimentation, and each year, no doubt, the curriculums will be revised in the light of the experience gained. Educators in the U.S.S.R. emphasized this aspect because, although the programs are worked out for grades 9, 10, and 11, they will be on probation for the first year or so. The overall aim, however, of these new reforms has been to develop an 11-year elementary-secondary general polytechnic school.

CONCEPTS, PURPOSE, AND IMPLEMENTATION OF THE POLYTECHNIC REFORMS

To have all pupils combine academic work with practical work

Table 6.—Selected courses from study plan of 8-year and secondary school (urban) with production training[1]

Course	Hours of instruction per week in grades —										
	1	2	3	4	5	6	7	8	9	10	11
1	2	3	4	5	6	7	8	9	10	11	12
Drawing	1	1	1	1	1	1	1				
Technical drawing							1	1	2		
Labor instruction	2	2	2	2	3	3	3	3			
Socially-useful work			2	2	2	2	2	2			
Socially-productive practice (2 weeks each at end of the school semester, grades 5–8)											
General technical subjects, production (theoretical and practical) instruction, and productive labor									12	12	12
TOTAL	3	3	5	5	6	6	7	6	14	12	12

[1] See appendix II, tables E and F, and for variations in rural schools, table G, and other details.

is one of the primary purposes of the new reforms. This plan is an ambitious one, and Soviet educators are striving to realize it fully by 1965. Their belief in this combined educational program was characterized by a statement by the Director of the Institute of Theory and History of Pedagogy, when he said, "We are optimistic here . . . Our aim is to combine manual work with knowledge . . . this is a real human existence." Soviet educators believe that all normal persons can be "prepared from all sides" and that the school should strengthen the link to life and work. It is difficult, they say, for a youngster 15 years of age to make his own decisions to prepare for either college or work. And, they emphasize that education has value when manual labor is combined with intellectual work.

More specific aims of the reforms are: (1) To improve further general and polytechnic education, (2) to lessen the academic load on students, (3) to provide opportunity for higher education to all workers, (4) to increase production education (theoretical and practical) so that students can do productive labor in industrial and agricultural enterprises, (5) to provide for more physical and moral education, and (6) to add more mathematics and science, at the same time making their teaching more effective.

A leading researcher in the Institute of Teaching Methods and Chairman of its Section of Polytechnic Education explained that the 10-year general school program has already a polytechnic education program in grades 1–10. As an illustration, students in these grades study fundamentals of machines, get acquainted with the notions of industry, and do some industrial practice at an enterprise. They also are required to take courses in electrotechnics, and automobiles or tractors. These courses are considered as polytechnic, and *not* vocational.

He further told us that in the 11-year program all the nonvocational polytechnic education of the 10-year school will be preserved, but the new program will have 1,000 hours of vocational training. Theory and practice will be included within the 1,000 hours.

The overall aim of polytechnic education is to give all-around general education, while production training is a supplementary aim. The students who graduate in the new program are qualified *workers*, not technicians or specialists, they say. Furthermore, we were told that if a student upon graduation has learned a certain specialty, such as *fitter*, it does not mean that he will remain a fitter.

Worker specialties.—A worker's specialty is the job classification in a particular industrial or agricultural field. For example, specialties in various fields are: Assembly mechanic, mechanic, machinist, seamstress, typist, laboratory worker, lathe operator, draftsman, machinist and motorist, layout man, cattle breeder, tractor driver, fruit grower, and various mechanics with a wide field of experience. We were told that the worker specialties are now being developed for both the 8-year school (followed by vocational-technical programs) and the 11-year general school.

In one 11-year school in Leningrad they train for 10 specialties. These are: (1) Metalworkers, general, (2) assemblers, (3) tool makers, (4) fitters, repairmen, (5) drilling and milling machine tool operators, (6) carpenters, (7) patternmakers, (8) layout men, (9) industrial motor electricians, and (10) instrument men (electric meters). Different schools train for different specialties depending on the industrial enterprises available for the production training.

Proficiency degree.—Those students engaged in production training in the new program in the factory take a qualification test near the end of the 10th grade for a *proficiency degree*. This degree is indicative of the skill the student possesses in his specialty at the time he takes the test. Proficiency degrees are identified by numbers 1 through 8. Number 1 is the lowest, and 8 the highest. We were told that a number 1 rating does not actually exist as a proficiency rating but rather as a reference point.

In one city, during the 3 days a week work experience in industry prior to receiving a proficiency rating, students were were paid 150 rubles per month and were considered to be apprentices. In another city, the pay received during a similar period ranged from 240 to 270 rubles per month, and the pay was called a *stipend*. It was pointed out to us that the stipend was not really pay, since this work was considered a chance for the student to get his professional experience and the money paid for his food and transportation to and from the enterprise.

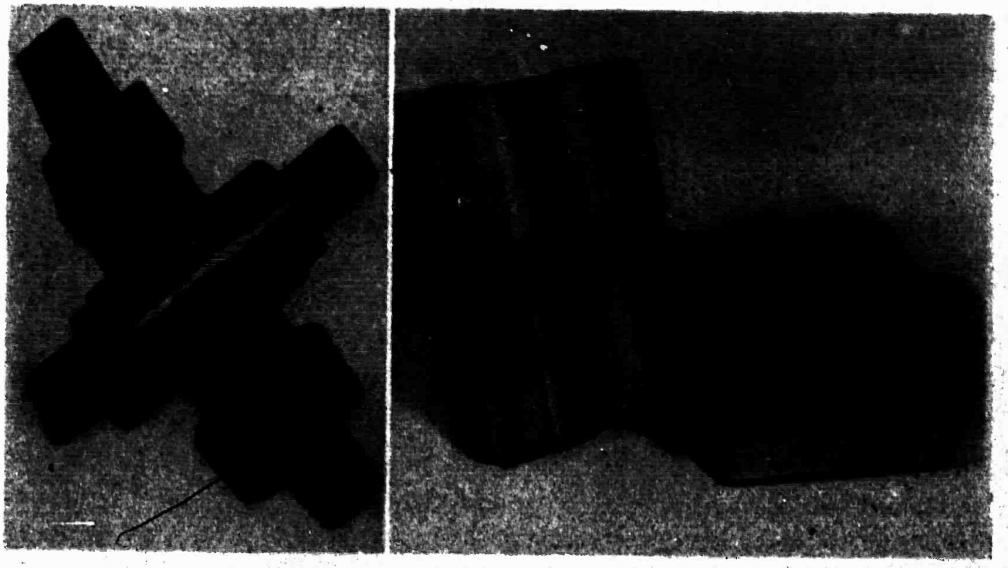
After students pass their qualification test they receive a proficiency degree, for example, of 3, and then they receive a regular worker's wage and a plan of work which they must fulfill. A proficiency degree rating of 3 is usually given to a beginner, but some do get a higher rating. A worker who holds a proficiency rating of 3 can get from 450–600 rubles a month for working 6 days a week.

The production training period in the 11th grade is to allow

the student to increase his skill and experience as a production worker, and some get a number 4 proficiency degree by passing another qualification test. We were told it would normally take 2 or 3 years of work after graduation to obtain a proficiency degree of 7. Regular lathe operators in the plant we visited had proficiency degrees of 4 and 5. Fig. 3–18 shows an example of the work expected of a student with a proficiency degree of 4.

Soviet educators do not consider that students in the 10-year program are qualified workers since a 10-year school does not include enough production training. Nor do students, as a rule, get a proficiency degree in a job classification such as they obtain in the 11-year school. The 11-year school may be terminal for some students, we were told, but it is not intended to be so. Even though much more polytechnic education has been added in the 11-year program, Soviet educators feel that other subjects have been strengthened, not slighted. In experimental programs they find that students grow fond of the enterprises where they work.

One of the most significant changes in the new curriculum reforms is an increase in the number of hours of production training in industry. This *work experience education program*, with its planned curriculum, organized cooperatively by school and industry officials, is being extended through the 10th and 11th grades. The new plan calls for increased hours for this work experience at grades 9, 10, and 11.



(A) (B)

Figure 3–18.—An example of a student's work in patternmaking; A—pattern, B—core box.

CURRICULUM CHANGES

The basic change in implementing the new curriculum reforms is the dual character of the general schools. All students, upon graduating from the 11-year program, are expected to have basic academic background sufficient for college entrance and also be qualified workers in either industry or agriculture.

Changes in grades 1–8.—The new curriculum plan increases considerably the amount of time that boys and girls will spend in polytechnic subjects. The girls will be taking more domestic science in grades 5–8. In both the old and new programs we saw, domestic science classes consisted mostly of sewing, although cooking is being developed. In the new 8-year school, boys will continue to take woodworking while girls take sewing.

Changes in the upper grades (9–11).—Grade 9, as in the 10-year school program, is an orientation period. However, in the new curriculum, 12 hours a week, rather than 4 hours, are devoted in grade 9 to the fundamentals of production. Grades 10 and 11 also have 12 hours required. See appendix II, tables E, F, and G for details and variations of urban and rural schools.

At the time we visited Soviet schools, some schools were in a transitional period where one or more classes were in the experimental program. In 11-year School No. 4 in Leningrad, the students in the 10th grade had the choice of studying in this school and working at the plant to master a specialty or of going to another 10-year school. Soviet educators are considering means to assist students who wish to shift from one school to another. The student who wishes to study a specialty must make his decision in the first 2 or 3 months of the 10th grade as to whether he or she likes the specialty.

Work experience.—During the 10th grade production training in industry, the student pursuing the specialty of drilling and milling machines, would first do the simplest things and then work up to the complicated machines later. For example, he would get experience for the first 2 months on very simple metal parts, such as filing and doing simple drilling operations. For the next 2 to 3 months he would get experience on actual production work, and for the rest of the year he would get experience on the more complicated automatic machines. At the end of this work, we were told, he would be on the "automatic line." Theoretical instruction such as technology of metals, structure and operation of tools, reading technical drawings, safety techniques, and the organization of production also is taught to them.

At the Red Proletariat, the machine-building plant, we had the

opportunity to observe 10th-grade students at work. One of the students was working as a *fitter, assembler*, doing a scraping job on two machined surfaces of a lathe tail stock so as to make a good fit. We asked him to sharpen his tools and perform the scraping operation. He did so skillfully. This student worker had been in this department in the plant during his 10th grade production training and had achieved a proficiency degree of 4.

Another 10th-grade student worker was assembling a turret head for a lathe. His work involved selecting a center post for the turret head and testing its fit. When he was satisfied with the fit, he drilled and tapped a hole for a set screw. The set screw acted as a locking pin. He also had a proficiency degree of 4.

We also observed a student assembling parts on a large motor. He was working alone following the specifications on a blueprint. He too had a proficiency rating of 4. During our discussion with him he showed us a metal hacksaw and hammer he had made at the plant. Two 10th grade girls were working as electricians. Their job was to make a graph on the characteristics of a motor which was under test. Each of them was examining data sheets on the motor. These students were working under the direct supervision of an engineer at the plant. The engineer acts as a tutor, and each girl also was assigned to a qualified worker. They were receiving 150 rubles a month and had a proficiency degree of 3. The girls told us they had repaired switchboard instruments, controllers, wound coils for meters, and visited other plants previous to this particular work.

During the 11th grade in the new curriculum the students have the opportunity to increase their skill in their particular specialty. We were told that in January the 11th graders can take another qualifying test to increase their proficiency rating. During the time we visited the Soviet Union, the 11th graders had returned to attend full-time classes at school, after the qualifying test in January, and were preparing for their maturity examinations.

POLYTECHNIC EDUCATION AND SOVIET VOCATIONAL EDUCATION

Although the purpose of our study did not include vocational education, we were nevertheless interested to learn about the relationships, if any, that polytechnic education may have to Soviet vocational education. In discussing this matter, we encountered varying opinions from Soviet educators. The following statements represent almost word-for-word comments made to us

during our visit by various Soviet educators concerning this aspect of their 10- and 11-year general school program:

1. The vocational school is based on graduates from the new 8-year compulsory school. In the future there will be no trade schools but rather vocational-technical schools.
2. Polytechnic education is not vocational work—not quite, it is polytechnic.[7]
3. To some degree polytechnic education is vocational education. The main difference is that students get practical work and theory in the general education schools. Vocational schools have practical training 6 days a week.
4. The manipulative and technical education is about the same in the 11-year school and vocational-technical school, but the difference is in the general education. Science and technology are heavy in the 11-year general school.
5. Three years ago this school became experimental, dealing with production education. It is not vocational education, but pupils do get an understanding of production.
6. A vocational program is narrow. In a one-year vocational program the student can get a specialty (e.g., tractor driver), but he cannot get a maturity diploma.
7. Vocational training is a part of polytechnic education.
8. Labor production done in school is not vocational education.
9. Instruction in electrotechnics and machine study is not vocational education.
10. We are not certain as to what might happen to the present vocational schools.
11. School production work is not necessarily vocational education. It depends on whether the student wants to try to qualify for a special working degree.

Some of the foregoing comments tend to sound contradictory and indicate to some degree that Soviet educators are still discussing and formulating their concepts regarding polytechnic education and its relationships to Soviet vocational education. Clarification of the philosophy and purpose of polytechnic education for Soviet administrators and teachers would seem to be necessary for the successful implementation of the polytechnic educational program. The immediate burden of solving this problem has been apparently thrust, for the most part, upon the inservice training institutions.

We had the opportunity to visit one vocational school, No. 5, at Tbilisi in the Georgian Republic. This school takes only boys,

[7] We understand this statement to mean that in the U.S.S.R. polytechnic training is definitely broader than vocational training.

ages 14 or 15. It is called a "special school" because only students of parents who fought in the "Great Patriotic War" (World War II) can attend. That is the only reason, we were told, it is called a special school. The school prepares metalworkers with proficiency degrees of 4 or 5.

It is a 4-year school, and it normally takes graduates from the 7-year general school. General courses such as physics, chemistry, foreign languages, etc., are taught. English is an obligatory subject. We were told that the students' *general* education at the time they graduate from the vocational school is equivalent to that of the *ninth grade* in the 10-year general school program.

We visited some of the classes and observed students working on parts for a drill press that the school manufactures. The equipment was much more extensive than in the general education schools. For example, one room had over 20 metalworking lathes, and students were machining small parts for the drill press, such as nuts, sleeves, valves, washers, bolts, and pulleys. A mechanical shop had a large planer, shaper, O.D. grinder, gear cutter, two milling machines, and a boring machine. One milling machine was an old *Cincinnati*, an American built machine. In the assembly room, we saw students assembling drill presses. We also saw a first-year class making a small metal wrench by cutting and hand filing.

The plan of organization is to have alternate days of practical work in the shops and theoretical work in the classrooms—one-half of the students are in the shops, and the other half take theoretical and general studies. The last term of the 4 years is spent in a factory. The plan of study for this school was given to us at the time we visited it. (See appendix V.)

Organization and Operation of School Workshops and Production Training

In Leningrad there are 460 secondary schools in the city, with 170 of them operating on experimental programs, according to information given us. Sixteen of these schools specialized in patternmaking. We also learned that 271 schools had agricultural plots. In Kiev, we learned that one of their most pressing problems was building new schools. They were planning to build 13 to 15 new schools each year. As we visited different schools we learned that the facilities and equipment for polytechnic education varied from school to school. Some workshops were much better equipped to carry on this type of work than others. All

schools, however, planned their curriculum according to the program from their Ministry of Education. This program is obligatory, except where the school does not have facilities to conduct the work. It is now a law, we were told, that all enterprises must give their old equipment to school shops. As a result of this law, school No. 6 in Kiev, for example, will now have a "patron" factory. Although most of the schools we visited contained 10 or 11 grades in one building, we were told that in the future they may have grades 9, 10, and 11 in a separate building. This separate building would be for general education purposes. One Soviet educator made the comment that it might prove to be more economical to set up special workshops in factories than in schools.

BUDGETS FOR POLYTECHNIC EDUCATION

Although we did not collect statistics on overall school budgets nor attempt to analyze this problem, some data on financing the new program indicate the emphasis on it. School No. 6, Kiev, with 723 students and 53 teachers, operates on a total budget of 1 million rubles. This figure does not include salaries. Two workshops in the school get an allocation of 50,000 rubles per year. Students do not pay for anything they make and at the end of the year can take the individual personal articles home.

At a 7-year school in Zagorsk, Russia, they are now building new workshops. Their patron factory, a brick and a paint factory, donated 30,000 rubles to them for their workshop equipment. A new physics laboratory is also being built. This school will soon have 8 grades under the new curriculum. It was pointed out that the parents' committee of the school helped them acquire needed items, and the students themselves "do things with their own hands." For example, the students built their own play yard, and fertilized and planted 100 shrubs as well as many trees and flowers on the school grounds. Students' productive labor at the school is another means by which funds are made available to the school.

DESCRIPTION OF WORKSHOPS AND WORKSHOP EQUIPMENT

Special school facilities for polytechnic education begin at the 5th-grade level. In grades 5 to 8, special workshops for woodworking, metalworking, and fundamentals of machines are designed. For the upper grades, 9, 10, and 11, special facilities are used for electrotechnics, and automobile or tractor study. A description of the garden plots is given in chapter II.

Drawing.—Elementary and technical drawing is taught in regular classrooms. In technical drawing classes students place their drawing boards on regular classroom desks. The desks are generally built for two students. Each of the students in a technical drawing class we observed in one school had a drawing set and wooden triangles. There were charts on two sides of the room showing how to hold the pencil, triangles, etc. These charts, for the most part, showed proper techniques in drawing. We observed, however, that some students did not use good drawing techniques. Mounted on the wall, some of the better pencil and ink drawings the students made were also grouped together to form a display. The teacher's desk was at the front of the room, and one or two cabinets were located nearby for equipment, storage of models, etc.

Labor (manual arts) facilities in grades 1-4.—No special facilities were in evidence, during our visit to schools, for this type of training, except hand tools. See the following list of these. Students did this type of work on their own desks. In one elementary class we visited, which was typical, there were 42 seats for students and 38 students in the class. The teacher's desk was in the front of the room, along with a blackboard and bulletin board. There were flower plants on the window sills and two storage cabinets on one side of the room. It was indicated in one school that, in the future, they hoped to have a separate room for this type of work.

Woodworking shop.—This type of shop, often called a joiner's shop, contains the basic hand tools used in woodworking. See list of equipment in appendix VI. For example, in one school we saw 20 woodworking benches; 2 small wood lathes (length of bed 12 inches); 3 wood lathes, full size; a 5-inch joiner; and a large wood lathe. In School No. 14, Zagorsk, we saw 20 woodworking benches; combination saw and joiner; and various hand tools. An example of the woodworking shops we saw is that illustrated in fig. 3-19.

Metalworking shop.—This kind of workshop is commonly known as a mechanic's shop, machine shop, or locksmith's shop. Typical tools and equipment in this shop are eight metal vises, drill press (one large, one small), grinder, large industrial type metal lathe, arbor press, and various hand tools for cutting and filing metal. Another workshop had 20 vises; drill press; small heat-treatment furnace; grinder; hot plate; soldering irons; and various small tools for cutting and working with metal. Appendix VII contains an inventory of the supplies used in the workshops.

Instruments for Working with Paper Cartons and Fabrics[1]	Quantity
Ruler	40
Ruler (length, 50 cm.)	20
Knife	5
Triangle, 45°	5
Ruler (length, 25 cm.)	10
Angles	10
Scissors	20
Awls	20
Needles	100
Thimbles	40
Knitting needles	50
Embroidery frames	20
Brushes (paste)	40
Brushes (paint)	30
Steel rule (with groove)	5

Instruments for Working with Paper Cartons and Fabrics	Quantity
Knitting hooks	10
Knitting frames	10
Glue pot	2
Glue containers	40
Bookbinder's knife	1
Circle cutter	1
Bookbinding press	1
Sewing frame (book)	1
Bone folders	5
Carton cutter	1
Punches (various sizes)	3
Cutting board	1
Boards for clay modeling	40
Electric plate	1
Double boiler for glue	1

Tools Used in Agriculture for Work on the Plots	Quantity
Shovels	40
Rakes	20
Adze	20
Pan (small)	10
Buckets, children's	10
Watering can	10
Baskets	5

Tools Used in Agriculture for Work on the Plots	Quantity
Carryall (stretcher type)	2
Boxes for sewing	10
Cords	2
Measuring tape	1
Meter	1
Sifter	1
Corner plates (small)	20

Instruments for Working with Technical Modeling	Quantity
Plane	5
Rough plane	5
Hacksaw	5
Special long hacksaw	3
Handsaw	10
Handsaw (for cutting trees)	20
Awl	5
Hammer, carpenter's, 150–250 g.	10
Mallet	10
Cutting chisels	10
Bit	1
Pliers	5
Screwdriver	5
Nippers	5

Instruments for Working with Technical Modeling	Quantity
Pliers, flat	5
Pliers, round nose	5
Axe	5
Files, various types	10
Snips	5
Coping saw and blades	5
Honing stone	2
Hand vise	5
Vise (8 cm.)	2
Monkey wrench and others	5
Bit, gimlet	2
Mechanic's tool set (10 tools each)	2
Screw clamps (wood and metal)	5

[1] Ministry of Education of R.S.F.S.R., *Programmy srednei shkoly na 1958/59 uchebnyi god. (Syllabuses for Secondary Schools for 1958–59 school year.)* Moscow, Uchpedgiz, 1958. P. 22–24.

Size of shops.—Both metalworking and woodworking shops are rather small by our standards. Some shops have about 420 square feet (approximately 19 feet by 22 feet), and this size shop accommodates 18 to 20 students. Another common-size shop has about 646 square feet (approximately 19 feet by 33 feet). This shop is designed for 20 to 25 students. Some shops had classrooms close by for theoretical instruction pertaining to their work. An example of the metalworking shop or mechanic's shop is that shown in fig. 3-19. This example shows how equipment is placed in the workshops and its general layout. The auxiliary room located between the two shops (fig. 3-19) is primarily designed for the circular saw and wood planer as well as a teacher preparation room.

Machine study shop.—The study of the fundamentals of machines is sometimes taught in a separate shop providing more lathes and power equipment than that normally found in the metal shop or mechanic's shop. In the 10-year school at Zagorsk, for example, the fundamentals of machine study had the following equipment: 4 metal lathes, 10-inch swing and 4-foot beds; 1 small metal lathe; milling machine (horizontal); grinder; shaper, 6 or 7 inch stroke; height gage; vertical mill; and 1 small lathe (watchmaker's type). The patron factory of this school gave them their old machines. The students with their teacher repaired them to make the machines useful for the school. While we were in the shop, the teacher proudly explained that one of his students had made the feed pump for the milling machine. The teacher also said the students are going to repair five drill presses for the factory.

Sewing rooms.—Rooms used for the sewing classes that we observed were ordinary-size classrooms with 10 to 12 sewing machines, 2 or more large tables for cutting out patterns, and storage cabinets. A blackboard and bulletin board were located in the front of the room. In most sewing rooms, there was an ample display of the articles made by students. The rooms usually had green plants growing in flower pots by the windows, which helped to make the room look attractive. One of the members of the team said he saw as American-make sewing machine on one of the tables in a sewing class. Some of the sewing machines carried German names.

Automobile and tractor shops.—In some schools we saw a large amount of equipment and facilities for teaching automobile or tractor work; in others this subject was taught along with the fundamentals of machine study shop. In one of the schools, the

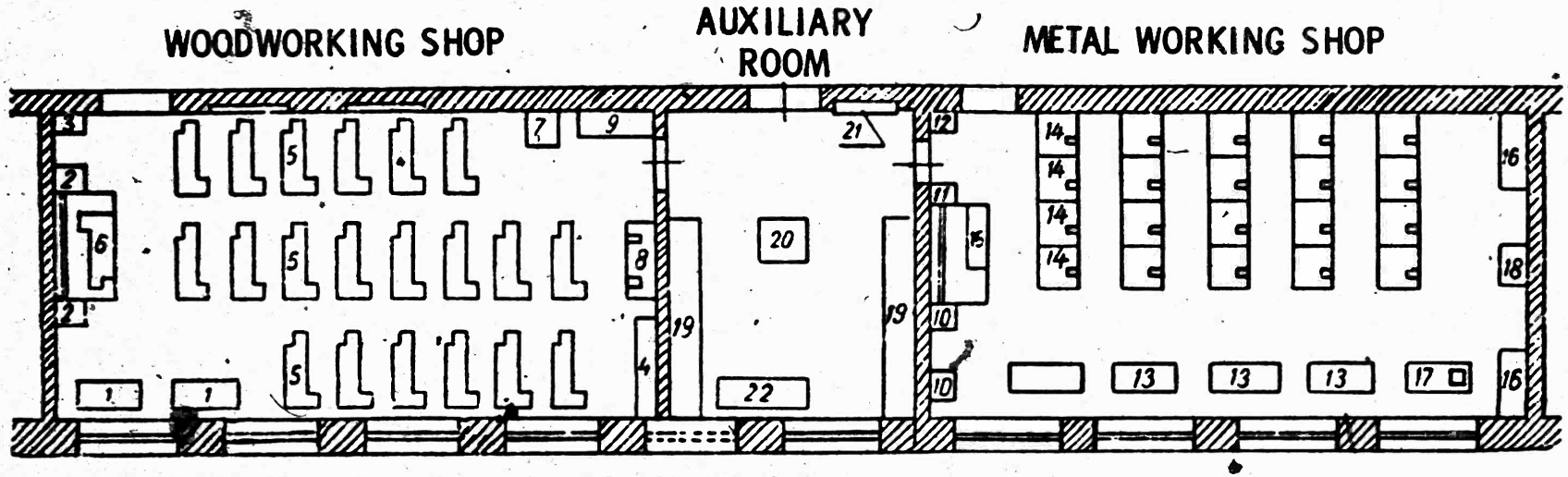


Figure 3-19.—Woodworking (joiner) shop and metalworking (mechanic) shop

1. Turner's lathe (two); 2. driller (two); 3. sharpener (one); 4. tool closets (one); 5. bench for joiner (twenty); 6. bench for teacher (one); 7. wet grinder (one); 8. bench for 2 students—metalwork (one); 9. extra table (one); 10. driller (two); 11. muffel furnace (one); 12. sharpener (one); 13. lathe (two) [sic]; 14. bench for metalworkers (twenty); 15. bench for teacher (one); 16. tool closets (two); 17. extra table (one); 18. table for motion picture camera (one); 19. shelves (two); 20. electric circular saw (one); 21. switchboard (one); and 22. table for teacher (one).

equipment, such as transmissions, steering mechanisms, engines, carburetors, and brakes, was located in a large hallway in the school. Some of the equipment was mounted on portable units that could be moved so students could work around them more easily.

A tractor shop in one rural school had tractor units placed or mounted on small worktables. Different units from tractors included, for example, transmission, steering, engine mockup (gasoline and diesel), cooling system, and fuel system. The room was approximately 18 by 20 feet in size.

Electrotechnic laboratory.—Elementary electricity in the seventh grade is taught within the metal shop with the necessary electrical hand tools, pliers, etc. As mentioned before, this area of instruction was probably the weakest taught and it was reflected by the lack of equipment at these grade levels. Some of the electrotechnic laboratories for the 10th grade were indeed well equipped. However, some schools did not have an electrotechnic laboratory, and one school had just completed building the laboratory. This laboratory had wooden benches with wooden boards for wiring. Each bench had two screwdrivers, 2 pliers, 2 knives, flush type switches and lamp sockets, and knobs (insulated) for circuitry work. They also had a power supply unit, motor, and transformer in the room. Five charts were posted on the wall; one gave an explanation of 3-phase current.

The 10th-grade electrotechnic laboratory in Moscow School No. 16, for example, was quite elaborate. A series of 15 experiments were set up on worktables, with the tables facing one another and a vertical separation between them. On each side of each table was a different experiment. In doing the experiments, the students had used many kinds of equipment, such as wiring devices, electric meters, controllers, transformers, motors, and radio parts. The room was an ordinary-size classroom and could accommodate 18 to 20 students.

ORGANIZATION OF POLYTECHNIC COURSES

Scheduling of classes for polytechnic education is usually arranged so that they can follow one another. For example, when two periods are required per week they are coupled together. If 3 hours a week are scheduled, it is usually taught with all 3 periods following one another on one day of the week.

When classes get too large—for example, 25 students in electrotechnics—they are split into two groups. In workshops where there are only 8 lathes and 16 students, the students are

divided into two groups also. Students are usually rotated every one-half year within the workshops.

In the ninth grade of a 10-year school the students, in one organizational plan, go to an enterprise for 4 hours once a week. The rest of the day students are free to attend technical clubs (circles) or other activities.

Production work of a useful nature used in the workshops for labor training is determined by a factory, or by the needs of the school or other organizations. Students also do individual work according to the prescribed syllabus.

Although we did not see any interschool workshops during our visit, we were told they do exist. These workshops are located centrally, and they serve the needs of two or more schools.

ORGANIZATIONAL PLANS FOR PRODUCTION TRAINING (WORK EXPERIENCE)

All schools on the new curriculum reforms will shift over to a new organizational plan beginning in the ninth grade, and two basic changes in organization occur at grades 10 and 11. First, the academic courses are split in half in grades 10 and 11, one-half in each grade, and second, production training has been increased at the factory in grades 10 and 11.

Coordinating groups.—A good description was given us in Leningrad of the make-up and purpose of a *polytechnic commission.* This group consists of various teachers, in subject areas of mathematics, science, chemistry, and polytechnics, plus representatives from the enterprise where the students get their production training. The representatives from the factory in this group were the assistant chief engineer, and the chief of the school division; in this case the latter was a woman. The vice-director of the 11-year school was chairman of the commission. This commission worked closely with the local *Council of Peoples' Economy,* whose function is to manage certain industrial and economic affairs for that area.

The purpose of the polytechnic commission is to coordinate the school subjects with the technical work at the plant. The specialties for which training will be given are chosen at the plant, and sometimes change yearly. It was pointed out in our discussions that this cooperative effort between industry and the school helps bring the curriculum up to date. They mentioned that, since the school's technical drawing instruction lagged behind instruction at the plant, they upgraded the technical drawing curriculum. Another example, they told us, was that the physics, mathematics, and chemistry courses taught by the school were too theoretical.

With changes in these courses, the students can now better connect the theoretical information with the practical implementation of these disciplines. These changes, they say, have made chemistry and physics instruction more practical, and the student achieves a deeper understanding.

Selection of specialties by students.—An example of how Soviet pupils select their areas of specialization at the secondary school was given us in Leningrad. About 2 weeks before we visited School No. 4 in Leningrad, the director had asked the parents of ninth-grade students to meet with him. He told them of the new plan or organization and the specialties that the plant was to provide. The parents were given two weeks to think it over and help students decide which specialties to elect. Since this school is in a transitional stage, the students had the option of going to another 10-year school that did not offer the new program. Within the specified time, the parents wrote letters to the director of the school indicating their choice for the youngsters. Out of 40 students only 7 did not want to master a specialty. The vice director was in the process of making plans so that these students could work in the plants. In the fall, students will return to school the first day, and then go to the plants the next day to get acquainted.

Schedule for production training (work experience).—When increased production training is introduced in the 1959 school year, students will spend 2 days at the plant and 4 days in school. Under this latter organizational plan students will have 1 day at the plant, 2 days at school, 1 day at the plant, and 2 days at the school. They feel this plan will provide rest and a change for the students.

For grades 10 and 11 one organizational pattern (18 hours per week, 6 hours a day) consists of 3 days at school (Monday, Tuesday, and Wednesday), and 3 days at the plant (Thursday, Friday, and Saturday), or vice versa. Another plan provides for every other day at the plant. Two groups of students, for example 10A and 10B, are rotated. While group 10A is at the plant, group 10B is in school and vice versa. One particular school had to "borrow" another 10th-grade class so that this system could work and still maintain uninterrupted production at the plant.

We learned about another organizational plan from a Soviet teacher. He said that grades 9, 10, and 11 will have 12 hours each, and students will spend 2 days in production training and 4 days of school work each week. This plan, we were led to believe, would be the one adopted for the 1959–60 school year.

According to the newly published curriculums for the 11-year school, this is to be the pattern.

One of the chief factors influencing the program of work experience in grades 9, 10, and 11 is the Soviet labor law regulating the number of hours a youth can work. For example, if a student is over 18 years of age he can work 8 hours per day in a factory or on a farm. If he is between 18 and 16, only 6 hours are allowed; and, if he is under 16, only 4 hours. A student normally is between 16 and 17 years of age at the ninth-grade level in Soviet schools.

Organizational plan for students at plant.—When a student is assigned to a plant for his work experience, he is given a physical examination. Then, the student receives his job assignment. These job assignments are determined by the plant, usually by the foremen.

Each student is assigned an experienced worker to help guide him in the practical work. In each shop department in the plant there are digest reports of information the student must know and of work he must do at the various proficiency grade levels. These act as a guide for him as he progresses on the job. Engineers at the plant, or the teacher at the school, instruct in the theoretical information during this period of work experience.

Another plan for grade 10 was one that gave the theoretical information (3 days a week) in the school until December 15. A final test was given to the students on this information. After that, they spent 3 days a week at the plant for 3 months, as apprentices, and took the qualification test for their proficiency degree in April. Under this plan most students received a proficiency degree rating of 3, and some, of 4.

Enterprises and the school.—Industrial and agricultural enterprises will be coordinated with the schools under the new curriculum reforms. These will be similar to the 10-year school except that the production training of the student will be increased considerably—to the point where students can become qualified workers. We also learned that girls will be able to get their production training in restaurants and accounting houses. Different schools will offer different specialties, depending on the enterprises within the area. Of course, rural schools will use collective farms for their production training.

Organization and Methods of Teaching Polytechnic Subjects

The normal teaching load in the Soviet Union is 18 periods a

week, and the teacher has one free period a day, we were informed. However, a teacher can teach more than 18 periods a week, in which case he receives additional pay. A polytechnic instructor in one rural school was earning an average of 1,000 rubles per month. His wife was also teaching in the same school. They lived in a "dacha" (bungalow) near the school and did not pay rent for the use of the dacha.

TEACHERS

Not only are polytechnic teachers trained formally in the 5-year pedagogical institute and university system, but they also come from the ranks of industry. We talked to many former engineers and skilled workers who teach some of the polytechnic courses. One of the reasons these engineers and workers teach these courses, especially in machine tractor training, we were told, is that the pedagogical institutes have until now trained few people skilled in this area of work.

During our discussions with teachers we asked them to tell us their background. The following are representative of the teachers with whom we talked.

Teacher No. 1.—Graduated from an agricultural academy and worked 19 years in a machine-tractor station; taught for 9 years; and now is attending pedagogical classes and seminars at an institute.

Teacher No. 2.—Graduated from Moscow University in the mechanics and mathematics faculty by correspondence; taught for 10 years and received his university education while teaching; has not had formal pedagogical training, but consultants from a pedagogical research institute have worked with him in developing methods; teaches 28 hours a week.

Teacher No. 3.—Graduated from a pedagogical school and is taking inservice training; has not worked in industry.

Teacher No. 4.—Graduated from a technicum in carpentry and has been in the trade 8 years; taught school since January 1959 and takes inservice courses in pedagogy; plans to attend summer school.

Teacher No. 5.—Graduated from a forestry institute of higher education and spent 9 years in factory work; taught for 5 years and takes inservice education course.

Teacher No. 6.—Graduated from a 10-year school and a 5-year technical institute; was a director of a factory and worked as an engineer; took courses in a pedagogical institute in pedagogy, psychology, polytechnics, and in upbringing of children.

Teacher No. 7.—Graduated from a 10-year school; worked 15

years in a factory and machine-tractor station; attended inservice training institute and took 3 courses: (1) methods of teaching, (2) how to work with students, and (3) general problems of education. This is his first year teaching.

Teacher No. 8.—Graduated from a 10-year school; received a university-level diploma in economics from the Plekhanov Institute of Public Economy; worked for 8 years in a textile factory with a master's rating; took professional courses in pedagogy to qualify for teaching position at a boarding school to teach sewing.

ASSISTANT TEACHERS

As in the case of chemistry and physics teachers, assistants help regular polytechnic teachers in many routine tasks in their classes. One of their main duties is to help students in the use of tools. Some of these assistants are qualified workers with proficiency degrees of 6, 7, and 8. In one school some of the assistants had graduated from a 7-year elementary school and a vocational school and had worked in industry 4, 10, or 20 years. One of the real problems mentioned to us was that these assistants, although qualified workers, did not know about the upbringing of children and had had no special education in pedagogy. Typical of these assistants are:

Assistant No. 1.—Graduated from a 10-year school; attended a technicum (carpenter training) for one year; taught one year and is taking inservice training in pedagogy.

Assistant No. 2.—Graduated from a 10-year general school and was a carpenter for 18 years; took a 3 months course in pedagogy pertaining to polytechnic education and special courses for assistants in an inservice training institute.

METHODS OF INSTRUCTION

Polytechnic instructors use a variety of methods to get across theory and practice to the student. Group instruction as well as individual instruction is used. The individual project method and group participation on a production job are some of their basic methods of teaching these courses.

Techniques used in teaching.—In discussing teaching techniques used in the Soviet Union, a teacher of fundamentals of machines listed the following methods: (1) Keep classes small, around 15 students, (2) divide class into small brigades (groups) while doing practical work on machines, (3) have students take notes, (4) explain aim of course (or lesson) clearly, (5) tell (lecture) students, (6) observe students' work carefully, (7) explain theory

first, (8) give students time to think, (9) use textbooks, if available, (10) use visual aids, and (11) demonstrate processes. The method of teaching we observed most in the polytechnic courses was that of individual instruction. The teacher, or his assistant, would give explanations to the student, demonstrate the process involved, and then observe the student in his work. The teacher would, if necessary, repeat the instruction until the individual or group understood. This technique was used most effectively.

In one workshop the teacher had all the necessary materials laid out for each student on a bench. In this group method of teaching, all students follow the instruction given to them by the teacher. Usually the teacher places the drawing of the part to be made on the board, and the teacher and students discuss the procedure for building it.

The students work according to the prescribed study plan on assigned work. They can do nonrequired work on projects if they so desire, after they have completed the requirements of the course. Generally, both theory and practical work are taught by the same teacher. The theoretical work relating to a polytechnic course is taught in the workshop or in a separate classroom nearby. Sometimes this separate classroom is referred to as a technology room.

In some schools, students are required to copy the drawing made by the teacher from the blackboard. They refer to this drawing while working in the workshops. We saw girl students working on a lathe following specifications from their penciled sketches. All students were making the same article, a machine bolt on a metal lathe. These particular girls had gotten behind in their work and had come to class after school to catch up. Table 7 illustrates the instructional procedure followed in making a bolt similar to the one the students in the school were making. As they progressed, the teacher checked their work carefully. Both the girls and teacher wore smocks or shop coats to protect their clothing. This was a common practice.

In another class students also wore safety glasses. These students were turning wood on a woodturning lathe. Each student in the workshops has his own set of tools, and he is required to keep them in good order. (See fig. 3-20.) All students are taught to sharpen their own tools and to follow safety precautions when using them.

The students in the various classes were using tools and machines in ways not unlike students use them in this country.

Some handled them expertly; others had difficulty and held them awkwardly. The quality of work varied a great deal. We saw some excellent machine work and some poor woodwork. By and large the useful articles made by the students served their purpose well. In some cases we felt the work looked hurried and the finish could have been improved.

One of the most effective methods of instruction, according to

Table 7.—Making manufactured object by means of machines[1]

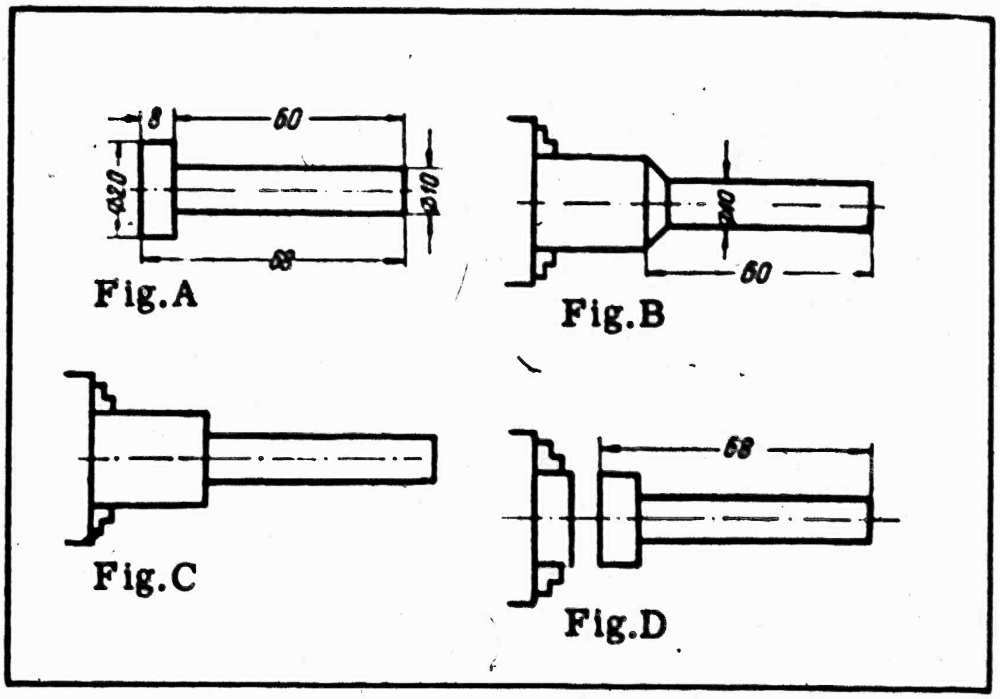
Name of Object.—Preparation for a bolt to fit a 17 mm. wrench
Material.—Steel st. 3 (See fig. A.)
Size.—Rod diameter 20 mm., 100 mm. long.
Equipment.—Turner's lathe, self-aligning three-jawed chuck

Procedure for work	Tools		Remarks
	Lathe tools	Measuring instruments	
1	2	3	4
1. To fasten rod in three-jawed chuck. To place the cutter. To determine low speed of spindle (60–100 revolutions per minute).	Facing cutting tool.	Scale rule.	To be sure rod does not vibrate, check before fastening. Rod must protrude about 30 mm. Check the cutter according to alignment.
2. To face	Facing cutting tool.		
3. To change the cutter; to machine the rod — 60 mm. diameter 10 mm. during several passes. (See fig. B)	Squaring cutting tool (general purpose).	Scale rule, sliding caliper.	To be sure that machine does not cut too much, use hand feed and take off a small shaving.
4. To change the cutter; trim step in order to have straight angle. (See fig. C)	Facing cutting tool.	Sliding caliper.	
5. To cut exact size for bolt. (See fig. D)	Cutting off tool.	Sliding caliper.	Make your cutting in such a way that width of channel (slot) is wider than width of cutter.

[1] M. A. Zhidelev. *Mashinovedenie v 8–10 klassakh gorodskoi shkoly. (Machine Study in 8th-10th Grades of City Schools.)* Moscow, R.S.F.S.R. Academy of Pedagogical Sciences, 1956. P. 162–163.

Remarks

1. Preparation of bolt should be followed by filing sides and cutting the thread. If you have a hexagonal rod of the same size, use it; it is convenient to fasten in the three-jawed chuck.
2. If there are several preparations, one can use material 150 mm. long, and the rod will be machined from both sides (with inversion) 10 mm. When you cut material, you will get 2 bolts; and this procedure will be economical.



our informants, is the excursions students take to industry. These excursions help them to get a better idea of industrial life. According to the curriculum, school authorities plan 6 days a year for excursions, beginning with the fourth grade.

Figure 3-20.—An individual tool set used by students in metalwork.

The head polytechnic teacher in one school explained the methods they used in their school. Each instructor has a prescribed program and teaches both theory and practice in the workshops. He teaches the use of instruments (tools); then students practice using them. Normally, students do their project drawings in the workshops, but in this particular school they do not make their own drawings in the shop. The polytechnic teacher explained that his pupils receive their material from a factory and that they make the drawings in the technical drawing classes at school for the work done in the workshops. In the workshops, he said, they work from a model. At the end of the class period the students clean up their individual work stations, and some students are assigned to sweep the floors.

In School No. 6, Kiev, the teacher of polytechnic courses showed us a small model of a hacksaw which his students had made. In his classes students make their own drawings and then make the article. For example, each student made a drawing and then one or two parts of the model hacksaw as a part of his work in grade 8. The teacher first acquaints the student with his working area, tools, and safety rules. Then, he instructs students in the use of the simplest tools, emphasizing their safety precautions. Finally, he demonstrates processes and shows each student how to use the tools and machines personally.

It is generally believed by Soviet educators that the student should know handwork before he uses machines. During the first three grades and handwork is closely connected with academic lessons.

Another method, not mentioned before, is the use of persons from industry to talk to the classes. At rural School No. 14, Zagorsk, for example, workers came from the factory to talk to the pioneer clubs. This practice aroused the students' interest. Films, slides, charts, and collections are also widely used. In fact, many schools had extensive collection of charts on all types of subjects. In the workshops, charts were hung on the wall or stacked in one corner of the room.

Table 8 shows an example of study plans for workshops in schools for polytechnic instruction, grades 5, 6, and 7. It lists the sequence in which the content is taught, and gives suggestions as to methods, visual aids, tools, materials, and objects to be made.

Examples of methods of instruction in production training.— In Kiev, at 10-year School No. 43, eighth graders were working on a production job making full-sized doors. Industrial workers from the neighborhood factory were working on production

Table 8. — Example of study plans for workshops in schools[1]

Plan for Grade 5

Sequence number	Content of subject	Object to be made	Material	Tools	Visual aid	Remarks
1	2	3	4	5	6	7
	Introduction					
1.....	The task of practical studies. How to make the article. Manufacturing of parts according to given size and machining. Demonstration. Showing shop's equipment. Working place and organization. Internal arrangement. Main rules of safety engineering in shop.	.....	.....	Supply of tools for machine and joiner.	Show examples made by students, such as box, shelf, hammer, 2 or 3 models.	First lesson, all students are included; second lesson, according to groups in mechanical shops or woodshops. Second lesson group selects student leader.
	Woodwork					
2.....	Sawing longitudinally and across grain. Bench for carpenters; way to grip working material. Handsaw and hacksaw and its working principle. Type of saw teeth. Procedures for preparation of saw. Way of sawing wood — longitudinally and cross grain.	Box. Cutting boards for making a box.	Preparation for sawing grain longitudinally and two cuts across the grain; boards 550 by 140 by 25 mm. (pine and fir).	Pencil, ruler, handsaw or hacksaw.	Sample of a box to be made in the future. Plywood or cardboard models for various types of saw teeth (three types for cutting wood: longitudinally, across, and in combination).	.....
3.....	Planing. Planing both sides, marking out according to drawing and control of surface. Structural texture of wood. Jack plane and plane (smooth). How to use Jack plane and plane (smooth). Elementary teaching of sketches and technical drawings for describing parts in details. Ways to check the surface.	Box. Cutting boards for making two walls for the box.	Board 550 by 140 by 25 mm. (pine and fir).	Handsaw or hacksaw. Jack plane, plane (smooth), pencil, angular ruler, mallet.	Piebe of wood with various shearings for using during the demonstration of structural texture of wood.	.....

[1] A. G. Dubov, *Prakticheskie zaniatiia v uchebnykh masterskikh; Metodicheskoe posobie dlia prepodavatelei trudа V-VII klassov.* (Practical Studies in the School Workshop; Methodical aid for teachers of workshops, from grades 5–7.) Moscow, R.S.F.S.R. Academy of Pedagogical Sciences, 1957, p. 183–196.

4	Finishing planing in limits of given dimension and marking by means of ruler, square, and surface gage. Cutting boards into two parts (two walls for box). Miter box, application and its purpose. Ways to measure angle between the surfaces. Surface gage. Facing on controlling surfaces. Procedures of setting jack plane and plane (smooth).	Box, two sides	Board 550 by 140 by 25 mm. (pine or fir).	Same as above and marking tool (surface gage).		
5	Making two remaining sides for the box (sawing, planing, marking, and checking). Main type of woods and their particular characteristics and features. Drawing a sketch of object pertaining to work explaining several parts in details.	Box	Board 550 by 120 by 25 mm.	Same	Drawing a box. Chart of various types of wood.	
6	Sawing bottom out of plywood. Assemblying box. Nailing parts together. Sand papering and using mordant (stain) and lac. Brief information on using this material. Ways of countersinking with aid of bit or using drilling machine.	Same	Plywood, thickness 4–6 mm. Size 320 by 210 mm.; sand paper ½ page; mordant; lac; nails 20–25 mm.; or screws.	Same as above. Use hammer, pincer, tampon, brushes (depending on type of covering). For screws use awl and screw-driver.	Chart — "Nails and Screws." Chart — "Purpose of Countersinking with Use of Screws."	
7	Students who were not able to finish their assignments on the previous lesson will continue working on the box. Students who already finished their assignments could work on handle for hammer which could be accomplished during one or two lessons. One could repeat the information pertaining to drawings which consist of several parts drawn in detail. Reading of drawings. To apply the information which is given on the blueprint as to materials to be used. Allowance for finishing.	Box, handle for hammer, name plate, cutting board, etc.	Plywood, board	Same	Chart with drawings pertaining to subject of study, showing parts for experience in reading and checking the knowledge of students.	Accepting and evaluating the work.

Sequence number	Content of subject	Object to be made	Material	Tools	Visual aid	Remarks
1	2	3	4	5	6	7
8	Analyzing and explaining drawings of shelf for washbasin. Marking material, sawing side-walls, back of shelf, and cover of shelf. Repeating way of using hacksaw and saw, and marking.	To make shelf for wash-basin.	Board dimension 700 by 180 by 20 mm., plywood 350 by 140 mm.	Ruler, square, pencil, hacksaw or saw.	Table of drawings for shelf with indication pertaining to order of making the shelf.	
9	Planning parts for shelf. The design of the bit and way of drilling holes. Drilling machine, its design and the way to drill. Rules for safety engineering during drilling. Finishing ends of sidewalls for shelf.	Same as above	Same as above	Same as above, jack plane, plane (smooth), bit, device for using a bit for drilling (if there is no drilling machine).		
10	Ways of making round rod for shelf to be used for washbasin. Methods of cutting a hole and trimming with a chisel. Cutting wood block for rod. Making rod with round joint tongues at the end. Assembly of shelf for washbasin. Trimming, sanding, and using lac, etc.	Shelf for washbasin.	Piece of board, thickness 25 mm. for cutting block 25 by 25 mm. 300 mm. long.	Same as above. Chisel 12–14 mm., brushes.	Chart showing how to make round rods with aid of plane (according to various stages of work).	
11	Try to finish shelf. Students who complete their assignment during three lessons will do the other work which is designed to be accomplished in one or two lessons.	Same as above	Same as above	Same as above	Same as above	

12	Drawing a straight line on sheet metal. Marking, using squares. Cutting sheet metal according to marked lines. Connecting two sheets with simple seam. Organising working place; vises and their use. Main type of sheet metals. Illustrate on drawings the parts which are to be made from sheet metals. Ways of marking sheet metal with aid of square, ruler, and marking tool. Ways of cutting sheet metal with snippers (for metal). Joining together by means of simple seam; its purpose and application.	Two plates which are united by means of simple seam.	Black sheet metal thickness .4–.5 mm. The size 200 by 100 mm.	Ruler, square, marking tool, center punch, hammer, mallet, snippers and mandrel stake.	Chart — "Using a Simple Joining Seam," showing the stages of work drawings, and general picture of juncture. To show various types of samples of the sheet metal.	----------
13	Marking, cutting, unfolding, and bending of walls for dustpan. A drawing made for using on sheet metal. Transfering data from blueprints to material. Sequence of how to bend the sheet metal.	The dustpan	Roofing or galvanized sheet metal thickness from .3 to .6 mm. the size 230–250 sq. mm.	Ruler, square, marking tool, hammer, mallet, snippers, center punch, and mandrel stake.	Type of dustpan. Dustpan made of cardboard for demonstration of ways of bending the walls.	The first stage of marking and bending should be conducted on paper.
14	Continued marking, unfolding, cutting, and bending of dustpan walls. Trimming dustpan with aid of file and emery paper.	----------	Same as above	Same as above	Same as above	----------
15	Making a handle by cutting, bending the metal, filing ends, and drilling holes. Joining handle with dustpan with aid of rivets. Explaining the drilling machine and its design. Ways of drilling the holes and using rivets. Ways of cutting the strips by handsaw or using chisels. Files and the way to use them.	Same as above	Strip 25 by 30 by 2–2.5 mm.	Handsaw or chisel, rivet set, and flat files — bastard file and smooth-cut file.	Chart showing various types of rivets.	----------
16	End of the work. Removing projected edges. Painting of dustpan. Making 4 laps to reinforce the handle. Brief information about oil painting, metal treating, and use of enamel painting. Ways of bending laps and use of vises.	Dustpan and accessories for the box.	Oil painting, enamel, and lac.	Same and brushes. The sheet metal size is 50 by 80 mm.	----------	Receiving and evaluating the work.

Sequence number	Content of subject	Object to be made	Material	Tools	Visual aid	Remarks
1	2	3	4	5	6	7
17	Try to finish work in making of laps, painting them with oil lac. Make two handles out of wire — 4 mm. Transfer the drawing on material. Ways of bending and filing ends of handle.	Accessories for the box.	Steel wire 3–4 mm. The length is 300 mm.	Ruler, square, marking tool, hammer, shears, punch, smooth-cut file, and brushes.	Show sample of box with accessories. Chart drawings and accessories for the box.	----------
18	Try to finish making accessories for the box and place it together. Ways of placing metal accessories upon finished wooden parts.	Same	Nails and screws — 8 pieces.	Ruler, square, marking tool, hammer, awl, and screw-driver.	----------	Receiving and evaluating the work.
19	Making window corners from sheet steel — thickness 1.5–2 mm. — with marking, cutting with chisel in vise, straightening, filing, drilling, countersinking, and trimming corners.	Window corners.	Plate made of sheet metal steel 18 by 18 mm., thickness 1.5–2 mm.	Ruler, square, marking tool, punch, hammer, chisel, flat file bastard, barrette file, and smooth-cut file.	The drawings of window corners with indication of sequence for making. Show the sample window corner.	During the 19–21 lessons some students finish their [unfinished] work early.
20–21	Ways of marking corners and holes, punching the lines which were marked; ways of cutting with chisel in vise following the level of jaws, filing the corners, drilling and countersinking holes for screws, filing corners with file and emery paper.	Same	Same	Same	Same	If the students complete their assignments (completing one or two corners ahead of time) then it is desirable to have them make loops or hinges with marking according to templet. Receiving and evaluating work.

COMBINING WOODWORK WITH METALWORK

22	Divide class into groups and give assignments. Study drawings and preparation of materials. The group should be acquainted with contents of work. Brief description of articles and parts (in the field of their use).	Feeding rack for chickens. Making birdhouses. Stand for soldering iron. Awl and screwdriver. Wind vane. Steam turbine. Hanger with metallic hooks.	Material needed for making parts and for other purposes.	Necessary carpenter's and mechanic's tools.	----------	The work should be completed by groups of two or three students. During the 12 lessons (24 hours) the groups, depending upon the number of students, could make one or several objects.
23	Using the sketch and technical drawings, show how the parts are put together. The sequence of how to make and assemble the parts. Making the parts. Assembling parts and finishing the models. Conclusions.	----------	----------	----------	----------	Receiving and evaluating work.
24	To evaluate students' work for the whole year. Selecting the best work for school exposition.	----------	----------	----------	----------	----------

NOTES.—1. If there are two shops, one for woodwork and the other for metalwork, the second group will begin their work with metal, (see lesson Nos. 12–21). During the first lesson, the student group is getting acquainted with the working place, how to work with metal, with vises, and with other basic mechanical and assembly tools.

2. The theme for combining work and technical models is identical for both groups of students.

3. To get acquainted show students how to sharpen the tools. The practical work on how to sharpen the tools must be done by 2 to 4 men during each lesson.

4. Excursion to be carried out in enterprises for acquainting students with machining of materials and organization of production. These excursions are done at special allocated times for the excursions.

Plan for Grade 6

Number of lessons	Content of subject	Object to be made	Remarks
	INTRODUCTORY STUDY		
1	Sawing, planing, filing, drilling are explained as various processes of cutting. Different shapes of cutters. Machine and hand-machining of metals. Productivity and quality of work which is done by means of machine and hand tools. Contents of work for whole academic year.		Place students according to working places. First lesson is given to the whole class. In second lesson students are divided according to shops by groups. At end of second lesson students elect their own leader.
	WOODWORKING		
2	Sawing the wood. Sorting wood material. Explaining blueprints and the sequence for making a box with a cover. Prepare boards for walls and cover. Rules of safety engineering during work with wood using hand tools.	Box with cover	During the marking, pay attention to allowance. Cover and bottom could be made out of plywood.
3	Raw and dry wood. Repeat information pertaining to types of wood. Sawing and planing of wood for making wall and cover for the box.	Same	
4	Defects in wood. Chisels. Chiseling depression. Marking tongue joints and ears on the walls of the box. Filing tongue joints and chiseling ears.	Box with cover	Show slides or films pertaining to work in sawmill.
5	Assembling of box and sanding tongue joints. Using wood glue and the way to join by means of tongue joint.	Same	
6	Sanding box after gluing. Cutting covers and placing hinges. Finishing box with mordant and applying lac.		
7	Finishing the wood box. Installing a handle in place, and hooks.		Receiving and evaluating work.

8	Explaining blueprints and the sequence of how to make shelf for books. Prepare material for walls and shelves.	Shelf for books	During the marking, pay attention to allowance for working with material.
9	Planing parts. Marking the junction. Cutting tongue joints and ears.	Shelf for books	
10	Chiseling ears. Trimming tongue joints and ears and preparation for putting together. Assembling of shelves using glue.		
11	Sanding shelf after gluing. Treating shelves with mordant and lac. Placing ears for hanging.		Students who complete their work ahead of time will make a handle for hammer or other object which could be finished during one or two lessons. Receiving and evaluating work.
	WORKING WITH METAL		
12	Ferrous and nonferrous metals. Cast iron and steel, their particular quality. Different types of steel. Rules and safety engineering, during the working with metal. Study of the blueprints of accessory for the box (handle, hooks, and straps). Making two straps.	Accessories for the box (handle, hooks, and strap).	
13	Making handle and hooks	Same	
14	Try to finish making straps, handles, and hooks for hanging.		
15	Making hanging hooks for shelves	Hooks for hanging shelf	
16	Completion of making hanging hooks	Same	
17	Files, their type and purpose. Ways of filing flat and curved surface. Checking. Sliding calipers. Ways of using sliding calipers. Studying prints and sequence of making hammer. Marking of hammer. Filing hammer.	Hammer 200–300 grams	

Number of lessons	Content of subject	Object to be made	Remarks
18	Drilling hole. Making hammer	Same	
19–20	Ways of filing hole		
21	Purpose of thread. Internal and external thread and their principal elements. Various types of cutting thread instruments and devices. Cutting bolt and nut M–6 or M–10.	Bolt and nut	
COMBINING WORK AND TECHNICAL MODELING			
22–33	Studying blueprints of patterns and models of apparatus. Preparing material for making the parts. Assembling of parts. Finishing.	Box with glass wall for observation of roots growing. Inclined prism. Maxwell pendulum. Hand roller. Apparatus for comparison of heat conductivity. Hacksaw. Coping saw.	Models, apparatus and instruments are made by groups of students. Each group consists of three students. Each group prepares one or two objects.
34	Conclusion. Evaluation of students' work for whole academic year. Selection of students' work to be used for school exposition.		

NOTES.—1. Group No. 2 began its study about mastering ways of work in metal. (See from 13 to 21.)

2. Theme of work and technical modeling are identical for both groups.

Plan for Grade 7.

Number of lessons	Content of subject	Object to be made	Remarks
1	Contents of work during the academic year. Understanding about technical process and technological chart. Analysing drawings of instruments, models which are to be made during the study work.	----------	First lesson is given to whole-class. Second lesson is given to separate groups. At end of second lesson, students elect their leader.
2	Design of wood turning lathe. Ways of operating lathe. Preparation of block. Fastening the block to the lathe for machining. Ways of using flat and semicircle chisel.	Handles for tools. Legs for apparatus. Cams for abacus. Cylindrical shafts made for shelves and other objects.	Turner's work conducted according to diagram. For each lesson on turning lathe, two students are working (each one 45 minutes).
3–15	Dividing groups by two or three students. Studying drawings. Planning to make objects. Preparation of material and making the parts. Trimming.	Handsaw for metal. Garden saw. Demonstration dynamometer. Installation of mortice lock. Apparatus for demonstrating waves. Cage for birds. Medical kit with lock. Level for carpenter. Grass cutter. Tubular dynamometer.	----------
16	Principal rules of wiring cords and wires. Conventional sign for electrotechnical charts. Rules of safety engineering during work with electrical current.	----------	----------
17	Splicing and branching wires. Soldering wires. Terminating wires for connecting with fixtures.	----------	----------
18	Taking apart and assembling fixtures (lamp socket, fork, switch, on-off switch, fuse). Connecting lamp socket and plug.	----------	----------
19–21	Making switchboard and planning the wiring and assembling. Switchboard should include cut-in safeguard, lamp socket, switch, and plug.	----------	----------
22	Construction and the purpose of everyday use electric apparatus, such as iron, plate, teapot. The way to repair them.	----------	----------

Number of lessons	Content of subject	Object to be made	Remarks
TECHNICAL MODELING WITH APPLICATION OF ELECTRIC ASSEMBLY WORK			
23	Coiling and assembling wiring. Clamp. Design of coils. Ways of making frames and winding coils.	Coils for electromagnet and other models and apparatus.	
24	Making of framework and winding coils		
25–33	Analyzing drawings for apparatus and model. Making parts. Assembling parts. Testing apparatus and model. Finishing.	Electromagnet. Electromagnetic amperemeter and voltmeter. Electric pendulum. Electric bell. Models of electric motor. Models of telegraph apparatus. Rheostat for demonstration.	
34	Conclusion of study. Evaluation of work of students for whole year. Selection of work for school exposition.		

along with the teacher and pupils. After a short time the worker and student exchanged work stations. The workmen would show the student what to do and then let him try it for himself. On the wood planer, for example, a student fed long boards into the machine and a worker removed them as they came out and stacked them in a pile. Individual and small group instruction were the predominant methods of instruction. Theoretical instruction is taught in a separate classroom by the teacher who is a university graduate, and wood technology in this school is taught by a graduate of a wood technology institute.

Other processes going on simultaneously in the woodworking shop were sawing with the circular saw, joining, boring, making lap joints, planing by hand, and gluing. Various operations besides these were being conducted in other shops; and nearly always students worked along with a qualified worker from the factory. Other production work done by this school involved the making of cashier boxes, bookcases, and some individual jobs. The production job was coordinated with class study by the teacher and with work in the industrial plant by plant officials. This school is one of the largest general education schools for production training in the city of Kiev. It had 1,150 students enrolled at the time of our visit.

Fig. 3-21 shows a small grease cup and its cap, which were made at another school. This grease cup is another example of the production jobs involving machine work.

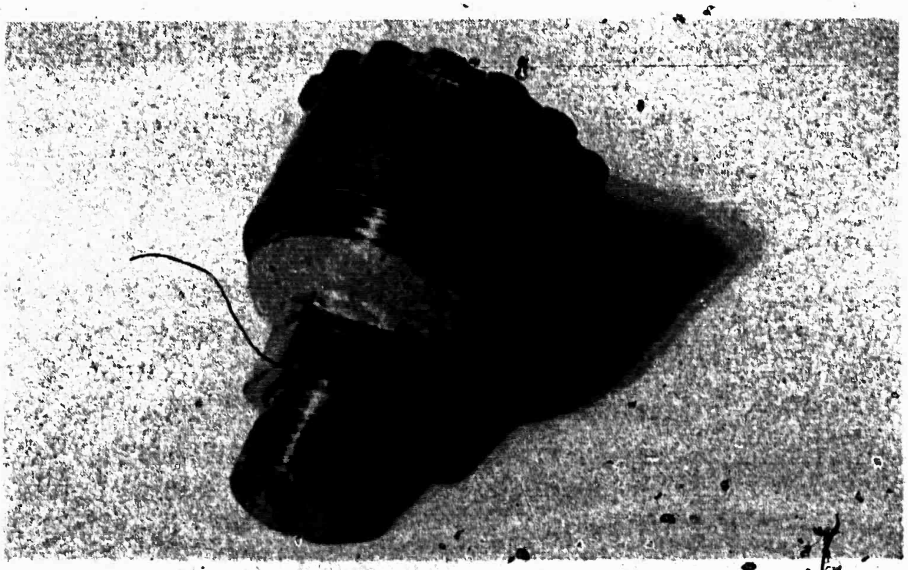


Figure 3-21.—Grease cup made by students in school workshop.

HOMEWORK

Although no homework is regularly assigned in polytechnic courses, one of the interesting comments we heard during our visit dealt with homework. We heard from teachers, directors, and research people that improvement of classroom instruction was the best way to help students learn, and that the homework assignments were being reduced. In fact, one educator stated they are "doing away with homework." This was a generalized statement pertaining to the whole school and not any particular course or group of courses. We were made to feel during our visit that Soviet educators are concerned at the amount of homework the students are required to do and are taking steps to reduce the load. One of the basic steps is to improve the effectiveness of the teacher in the classroom.

Books.—Generally speaking, homework assignments are not given to pupils who take polytechnic courses in grades 5 to 7. In fact, at present they do not yet have a textbook for these pupils. However, one is being prepared for this level. The teacher has a guide (textbook) which he uses in the preparation of his lessons and in determining details of content (theoretical and practical) for these courses.

Starting with the eighth grade, textbooks are used in the various polytechnic courses, and students purchase them at a nominal fee. In one school we were told that in grades 8 and 9, the students are not given homework assignments in their fundamentals of machines course. They are supposed to get all the information in school. This procedure seemed strange because the texts were quite comprehensive and it would appear to be difficult for pupils to assimilate this knowledge without homework in these courses.

Although the schools have libraries, the polytechnic reference books are often kept in the workshops for the students to use there.

CORRELATING SUBJECTS

One of the major problems Soviet educators face in attempting to relate school to life is that of introducing a better correlation between all subjects, especially with the polytechnic courses. Table 9 shows a plan for relating physics problems to production work. This particular plan of polytechnic instruction was devised by a physics teacher in order to relate more educationally the theoretical problems in physics to the practical problems illustrative of theory applied in industry. Methods by which this relationship is taught are stated in the columns on the right.

This general plan was incorporated into the reference book used by teachers in experimental schools during 1958–59.

EVALUATION

As in other classes, students in polytechnic courses are evaluated and graded using a numbering system from 5 to 1. A mark of 5 is considered excellent; 4, good; 3, passing; 2, unsatisfactory; and 1, failure. When a student does an assignment, or completes a specific job, he is given a mark. The teacher keeps these marks in a notebook and averages them at the end of the course for his final grade. In the workshop courses in grades 5 to 7, one teacher

Table 9. — Plan for relating program topics in physics to problems of production[1]

Physics topics	Problems in production training	What is the relationship?	
		Preliminary explanation of scientific principles during lesson period	Application of principles in production by pupils in physics
1	2	3	4
Electric capacity	Preparing, assembling, and working with capacitors.	Measurement of electrical capacity; units of measurement, design of capacitors.	Excursion; write report on subject — — "How capacitors are made and their application."
Resistance of conductors.	Applying and using various types of resistors which are manufactured by a plant.	Physical nature of resistance; units of measurement; solution of problems.	Give general conclusion on the use of resistors; question pupils.
Current in liquids	Insulating parts with protective covering.	Explanation, solution and calculation of problems.	Excursion to electroplating shop; make report about trip.
Heating effect of current.	Using heating effect of current in devices and their parts.	Schematic drawings of main apparatus and devices which are used in plants (soldering iron, smelting furnace, etc.).	Explain devices and their construction during excursions to plants.
Magnetic field	Constructing gages (ammeter, voltmeter); insulating separate apparatus in units and junction points; designing and repairing D.C. and A.C. motors; designing and repairing transformers.	Explanation of principle of construction and operation in apparatus and machines.	Excursion to control and testing laboratory, to transformer shop, and to motor repair shop.

[1] Shapovalenko, S. G., *ed. Soedinenie obucheniia s proizvoditel'nym trudom uchashchikhsia. Opyt piatidesiati shkol R.S.F.S.R.* (Combining instruction with production work of pupils. An experience of fifty schools in the R.S.F.S.R.) Moscow, Academy of Pedagogical Sciences of R.S.F.S.R., 1958. P. 69.

said he grades on each operation, and the summation of these grades is the mark for a particular object made by the student. Generally, written tests are not given in these grades in polytechnic work; however, practical tests are. The practical work is compared to the drawing specifications and a grade is given for this test.

Written tests, or control work, as they are called, begin in the eighth grade. During the production training at the plant, they also have a qualifying test which, if they pass, determines their proficiency rating. Written tests, however, are used to evaluate the student's knowledge in the theoretical work. One of these tests on the tractor follows.

Examination on the Tractor[1]

Pupil of 10th Grade, School No. .....
Family name ..... Name .....
School address .....

Date ..... Month ..... Year ..... of the completion of work. .....

1. Name and point out the purpose of the principal machinery parts and the engine system:

Name of machinery parts and engine system	Purpose
1.	
2.	
3.	
4.	
5.	
6.	
7.	

2. Indicate in the table the direction of movement of the piston and the position of the valves in the cylinder of the tractor engine.

Timing	Direction of movement of piston in cylinder	Valve positions	
		In-take	Exhaust
In-take			
Compression			
Working stroke			
Exhaust			

3. Enumerate the possible causes of overheating in the engine's carburetor.

4. How does the tractor's pulling power change through shifting in the gear box from a lower gear to a higher one?

[1] Form of examination used at 11-year School in Gorki-Leninskie, Moscow Oblast.

Research

We had many discussions with educational researchers in the Soviet Union. There are 17 specialized institutes of pedagogical research in the U.S.S.R., and it is intended in the future to develop this system further, including creation of a separate institute for polytechnic education. We learned that this plan would be in line with the new 11-year school program, which in the last three grades (9, 10, and 11) will devote two-thirds time to general education and one-third to polytechnical and production training. Of the polytechnical and production training program itself, one-third is to be theoretical and two-thirds production training.

RESEARCH PROBLEMS

At the Scientific Research Institute of Methods of Teaching in Moscow, syllabuses are developed in all subjects as well as the methods for teaching these subjects. In the polytechnic section of the institute, there are 3 groups dealing with problems of polytechnic education. Group 1 deals with polytechnic education in the 8-year school; group 2, polytechnic education in the city schools (grades 9, 10, and 11); and group 3, polytechnic education in the rural schools (grades 9, 10, and 11). Films for polytechnic education are developed; at present, one is being completed on the chemical industry. There are three experimental schools in Moscow where new methods of teaching and new curriculums are tried out.

Interrelationship of subjects—Each school subject in the Soviet view has an area of knowledge unique to itself, yet each subject is a part of the whole educational scheme. Therefore, Soviet educators eschew the idea of general science courses, or a combination of biology, physics, and chemistry. It is their belief that the child must have the fundamentals of each individual discipline separately. The problem they face, we were told, is to give a system of knowledge in each subject and an instructional approach that provides the interconnection. For example, in biology, first comes the teaching of botany. The students are taught to see botany in relation to raising fodder for animals. If the instructional approach is neglected there will be no connection between the two, they say. Soviet educational authorities said that unfortunately some teachers do not see this point of view and expect students to get only their individual subject.

In the field of polytechnic education, for example, such as in mechanics and machine technology, which applies the laws of

physics, there is an interconnection of principles. Soviet educators state that they cannot see definite boundaries in the industrial application of these principles. The basic connecting link between school and life is through polytechnic education and labor at the enterprise. This, we learned, was the "golden thread" which is the interconnecting link.

Specific research problems in polytechnic education—Some of the problems Soviet specialists are concerned with in their research involve the study of constructive and technical abilities in students. They admit that it is complicated, but that some of the components can be separated. The following are examples: First component—skill development; second component—spatial ability; third component—time factor (its effect on exhaustion, and shift of thinking due to rapidity of machines and automation); fourth component—technical thinking (the ability to solve technical problems and being prepared for technical progress). Soviet psychologists are directly interested in these components and are studying them.

Research procedures were described to us. Specialists sometimes go to the schools to study and observe teachers at work, get reactions from students and teachers, and record observations. Then they study a number of classes and make quantitative and qualitative analyses of their work. A psychologist, methodologist, hygienist, and others may all observe the same class and report different points of view. Following these procedures, they analyze the material separately and then meet as a group to discuss their data. Some of their published research in the Russian language deals with (1) the role of labor in the process of schooling and upbringing of children, and (2) self-controlled attitude toward labor—formation of this attitude.

Examples of Research—Two examples of reports on research in the Soviet Union (printed in English) which were given to us are *Researches in Psychology of Learning* and *Some Problems of Labour Psychology and Labour Training.*

An excerpt from the first report touches upon some problems of the psychology of learning being dealt with by the Research Institute of Psychology under the Academy of Pedagogical (Educational) Sciences in Moscow. It is as follows:

> Soviet educationalists and psychologists are facing the task of finding most effective ways to combine theoretical knowledge with practical activities, to teach pupils freely [to] apply their knowledge in solving the learning and life-practical problems and to overcome all formalistic traces in knowledge. That is why a great number of works in psychology are devoted to the analysis of the process of applying knowledge to the solu-

tion of various problems by pupils, to the analysis of those difficulties that pupils meet with and the ways of their overcoming.

Examining the use of knowledge in the solution of learning problems, we came, in a number of cases, across the following facts: a textual abstract problem, requiring to find the relation between abstract values, came out to be easier for some pupils (of 11–13 years of age—5–8 years of learning) than identical textual problem with concrete content (including concrete quantities) while this type of problems, in its turn, appeared to be easier than identical visual-practical problems that required for their solution actions with objects. This fact has been proved on different learning material: solving problems in physics (the works by Z. Y. Kalmykova and E. A. Fleshner), geometry (researches by V. Y. Zykova), constructive-technological problems (works by P. M. Yakobson and Kurdriavtsev).

How this fact can be explained? It may seem at the first glance, that this fact contradicts to the generally accepted thesis that in the evolution of the child's thinking the transition is happening from concrete to abstract, from the manipulation with objects to the actions 'in mind.'

This, however, is only a seeming contradiction. The concrete problems in two, above described, cases are of different character. Some of them do not require from pupils to go out over the limitations of the concrete, while others, belonging to those, that present certain difficulties for pupils, contain some general abstract principle. Pupils must 'perceive' this principle in a new concrete situation, drawing themselves off from its non-essential features.

After that it becomes clear why such concrete problem appears to be even more difficult for pupils than the corresponding abstract problem. In the first case the pupils must draw an independent abstraction on the basis of particular features of some concrete data whereas in the second case they deal with ready products of abstraction.

In the course of solving concrete problems, requiring the use of a general principle, of primary importance is one of the sides of the process of abstracting which is usually called 'negative abstraction' and which means throwing aside non-essential concrete properties of objects.

Naturally, the question may arise: what are the grounds to consider that the main difficulty lies in the negative abstraction and not in the positive one? Perhaps, pupils, going through certain difficulties in solving some concrete problem, assimilated the principle which is being realized in it not well enough?

The researches have been made under special circumstances that exclude the possibility of an insufficient comprehension or ignorance in regard to the corresponding notion or principle.

Before the chief experiments the research workers purposely 'equalized' the scope of learning material that should be used by pupils in 'experimental' problems. Moreover, in some cases, before starting the solution of the problems, the experimentalist [re] minded the pupils about a chance to use the principle they had studied.

Thus, for example, before 6 and 7 grade pupils were required to give the projection of an excavator, they received preliminary instructions under the title: 'Mind of jacks and their arms.' (*sic*) Besides, only those pupils were admitted to make experiments who successfully solved the

corresponding abstract problems, using schematic drawings (study by Yakobson).

Under such conditions some pupils successfully accomplished the projection of an excavator while others failed to 'perceive' in a new concrete problem the principle of a jack, known to them. Separate details of the concrete mechanism 'screened' an abstract scheme, in other words, they could not draw a negative abstraction.[8]

Excerpts from the second report dealing with some researches of the Laboratory of Labour Psychology, Research Institute of Psychology, under the Academy of Pedagogical (Educational) Sciences of the R.S.F.S.R., are the following:

. . . it was shown that one of the chief reasons for few cases of insufficient control and low quality of the products is the change in the structure of the working process that have been made by the worker without sufficient grounds due to an insufficient understanding of technological requirements, underestimating of losts, connected with correcting defects and insufficient control of the quality of products manufactured by the worker. The comparison of the psychological features of workers with various qualities of production showed that the workers, combining high productivity with better quality of production, possess a wide technological outlook and higher level of general culture and industrial skills and more serious attitude towards their work.[9]

And further:

Labour training in the Soviet Union is started at the lessons of manual labour in primary classes; it is continued in school workshops and is completed in senior classes with industrial practice at works and factories. In accordance with polytechnical education principles pupils are required to acquire that general knowledge, skills and abilities that would allow [them after school graduation] to easily master various kinds of vocational work in industries.

At the same time, the labour training has its aim the development of such personal qualities of pupils as love for work (as the source of high satisfaction), activity, resourcefulness, creative initiative, abilities of using in practice the knowledge and habits, acquired at school, ability to independently overcome difficulties in work, persistence, sense of responsibility for both individual and collective work. . . .

Favourable conditions for the development of technical thinking, creative activities, resourcefulness, inventiveness are being created with an active method of labour training when the teacher encourages pupils to act not only in strict accordance with the instructions, but independently, under the conditions of partial fulfillment or absolute absence of the instructions. In such cases the pupil has to choose actions and set up the labour process on the basis of his own analysis of the labour process and its conditions, examining the correctness of his actions and decisions in practice.

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[8] E. D. Mrs. N. A. Menchinskaya, Vice-Director of Research Institute of Psychology, Academy of Educational Sciences. *Researches in Psychology of Learning.* Moscow, 1958. P. 2–4.

[9] Dr. E. V. Gurijanov, Director of the Laboratory of Labour Psychology, Research Institute of Psychology, Academy of Educational Sciences. *Some Problems of Labour Psychology and Labour Training.* Moscow, 1958. P. 4.

To find the methods of activation of pupils' mental activities in the course of accomplishing labour assignments and forming their abilities to organize an easy labour process independently, we have arranged, in cooperation with school teachers, experimental teaching. During the teaching the pupils, after exercises that provide the possibility of successful accomplishing separate operations were suggested the tasks, requiring an independent construction of series of actions, first short ones, consisting of two-three actions, and then more complicated. A comparison of results of control-works, executed at the end of a learning year by the pupils of experimental end control classes, showed essential advantages of the experimental class pupils in regard to the abilities to organize the labour process independently. The general quantity of wrong actions of the experimental class pupils in the course of fulfilling control-works was two times less as against control class pupils (experimental class—70 wrong actions, control class—157 under more favourable general learning conditions). The experimental class pupils were more successful in the transition of previously adopted abilities in the course of accomplishing a new task that had not been taken before.

In order to define the role of separate elements of instructions in the process of forming labour abilities by the pupils of vocational schools, V. V. Chebysheva has made a study with the aim of establishing the role of word, image and action in teaching. The pupils were required to execute a series of new to them work assignments' on the basis of a mere explanation or a mere demonstration. The examination has shown that the works which have been done on the basis of verbal explanation were of better qualities, but required more time. Demonstration has led to worse quality if compared with an explanation, but it was done quicker. The combination of these methods eliminated the mentioned drawbacks and provided quicker fulfilment than in the first case and better quality of work than in the second one. A weak point of this combination was the possibility of their mutual influence upon each other. Trying to better understand and remember the instructions during the explanation, some pupils did not sometimes notice the details before their eyes and, on the contrary, concentrated the attention on the assimilation of the shown objects, missing separate points of the explanation. The difference between explanation and demonstration was also exposed in the methods, used by the pupils in their actions. In the course of the demonstration the pupils imitated the leader and used methods he had shown to them whereas in the explanation the pupils independently used methods they chose though these methods were not always effective.[10]

Other research in polytechnic education—Research is proceeding also to find the interconnection between physics, chemistry, and mathematics, and fundamentals of production. They are also investigating the methods of teaching machine technology, electrotechnics, and automobiles. We were told that the main goal of work at the industrial plants is to teach fundamentals of production in a polytechnic sense.

Researchers go to the plants and study students, workers, proc-

[10] *Ibid.*, pp. 5, and 7–8.

esses, etc. They feel quite strongly that students should know certain theoretical information about the machines, technical processes, and the technology involved.

At the Scientific Research Institute of Psychology, Moscow, we learned that they are doing research dealing with "habits" involved in polytechnic education. One of the researchers is trying to find ways of developing skills of a generalized nature; for example, skill in planning, self-realization, and self-control.

In the Institute of Theory and History of Pedagogy, Moscow, specialists in comparative education are conducting a major study on "Practical Arts Education in General Schools of Different Countries." Some of the countries under study are Bulgaria, England, France, Germany, India, Italy, Japan, Poland, United States of America, and countries in the Middle East. They expressed a keen interest in the place of industrial arts in American education.

Results of some research—As a result of their researches, Soviet educators feel that a student, in the early stages of his schooling, should be given "a lot of words and less scope," and as he progresses he should have "less words and more work" so he can create and use his own initiative more.

One factor important to learning, which is agreed upon all over the world, they say, is *motivation*. If the student knows what his knowledge is good for, then the knowledge is better understood. We were told about an experiment which illustrates this latter point involving two schools in Moscow—one with a garden plot, one without. When the students of both schools were asked similar questions about the earth, sun, and water there were considerable differences in their replies. The students who had worked on the plots gave more meaningful answers than those who had not. Furthermore, Soviet educators find that the work at enterprises has a psychological base. Operating machines at an enterprise help students to understand fundamentals of machines and production.

One of the large educational experiments conducted in the Soviet Union in the last few years dealt first with 50 schools, then with 248; and, as was mentioned before, now about 2,000 schools are on an experimental basis in the R.S.F.S.R. Last year in Ukraine, there were 2,000 experimental classes. The results of these continuing experiments are contributing to the new curriculum reforms being implemented in the Soviet Union at the present time.

The examples of the research reported to be under way at the

time of our visit in the Soviet Union indicates the range and scope dealing with both fundamental and practical problems. Some of their major problems deal with solving the interconnection of various subject matter areas, improving labor training instruction, and relating education closer to Soviet life. The impact of these and other researches, no doubt, will continue to influence Soviet education in the years ahead.

CHAPTER IV

Teacher Education

SOVIET EDUCATIONAL LEADERS firmly state their belief that the key element for sound, effective instruction in the schools is a well-trained, dedicated corps of teachers. To this end they have developed an extensive and rigorous program of preservice and inservice teacher education and training. This program puts heavy emphasis on knowledge of subject matter to be taught but does not seem to slight professional aspects which are designed to enhance the skill of the teachers in imparting this instruction to their pupils.

In imperial Russia there were few teacher training institutions of university rank, although there were many with academic standing of secondary level. Today, however, teacher training institutions constitute one of the largest groups of Soviet colleges. Further evidence of the importance of teacher training in the Soviet Union is the fact that since 1957 the program of training has been lengthened from 4 to 5 years for secondary teachers of grades 5 through 11, and that at the present time the training of elementary teachers for grades 1 through 4 is being changed from programs that are 2 or between 2 and 3 years in length at the pedagogical schools, to a 4-year program in the pedagogical institutes.[1] All of these programs are based on completion of secondary education. As of 1958–59, about 63,400 future elementary teachers were completing studies in the pedagogical schools, while teachers graduating from higher institutes and universities totaled 113,600.

Control of Teacher Education

The primary responsibility for preparation of teachers rests with each Ministry of Education in the 15 Republics. The

[1] See W. K. Medlin and N. Apanasewicz, *Programs in Secondary Teacher Education in the U.S.S.R.*, "Information on Education around the World," No. 9, U.S. Department of Health, Education, and Welfare, Office of Education, December 1958.

U.S.S.R. Ministry of Higher and Specialized Secondary Education, however, exercises certain supervisory responsibilities in this field. It has ultimate control over questions of science, methodology, research, and teaching, and it shares with the Republic ministries of education responsibility for curriculums. This joint control over teacher education aims to insure programs which are of high quality and ideologically consistent.

Annual admission quotas for the day program are established for the entire U.S.S.R. and for each institution separately. Not one student in excess of the established quota is permitted at any institution. There are no quotas for the evening or correspondence programs, which account for 43 percent of the students enrolled in higher education.

Pedagogical Institutes

The primary function of the pedagogical institutes is the training of secondary school teachers; i.e., teachers of grades 5 through 11. A pedagogical institute normally has both internal (regular day) students and external (correspondence or evening) students; in some instances an institute enrolls only day or only correspondence students.

These institutes have been primarily responsible for upgrading the qualifications of secondary school teachers over the past 25 years. This upgrading has taken on particular emphasis during the past 10 years, when length of study as well as enrollments have steadily increased. This process has led to a deeper subject-matter preparation of Soviet secondary school teachers than was possible under earlier programs, where professional requirements in education took a larger portion of students' time, in terms of course work. At the same time, and particularly since 1955, universities have been supplying greater numbers of teachers for grades 5 to 10 in single subject areas. These teachers do not have so much professional preparation as do pedagogical institute graduates. As of the 1958–59 school year, 85 percent of Soviet secondary school teachers had completed a higher education. The importance of the institutes in higher education is evident in their total enrollments: over 500,000 students, or nearly 25 percent of all Soviet students in higher education, attend the pedagogical institutes.

ADMINISTRATION AND ORGANIZATION

Each institution is headed by a director, whose role roughly

Figure 4-1.—Physics laboratory at Kiev Pedagogical Institute.

corresponds to that of a president of an American college. The teaching staff is organized into faculties, similar to our departments or schools within a college or university. Each department, or faculty, is administered by a dean. The number and types of departments vary from institute to institute, as shown in the list of institutions with their departments, which our group visited. Students are enrolled in one department, but they may take courses offered in a number of departments, depending on their programs of study. The various kinds of "specialties" or majors offered in the institutions visited, and the different offerings and enrollments in the three separate programs (regular or day, evening, and correspondence), appear in table 10.

Organization of Faculties in Pedagogical Institutes Visited

1. Krupskaia Pedagogical Institute, Moscow
   a. Philology
   b. Foreign Language (in process of being disestablished and incorporated into the department of philology)
   c. Physics and Mathematics
   d. Biology, Chemistry, and Fundamentals of Agriculture
   e. History
   f. Physical Education

2. Lenin Pedagogical Institute, Moscow
   a. History and Literature
   b. Geography and Biology (excluding agricultural biology)
   c. Biology (agricultural) and Chemistry
   d. Physics and Mathematics
   e. Defectology
   f. Pre-School Education
   g. English Language
   h. German and French Languages

3. Gor'kii Pedagogical Institute, Kiev
   a. Physics and Mathematics
   b. Language and Literature
   c. Pedagogy
   d. Engineering (pedagogical)

4. Pushkin Pedagogical Institute, Tbilisi
   a. Philology
   b. Physics and Mathematics
   c. History and Literature
   d. Biology and Chemistry
   e. Geography and Biology (excluding agricultural)
   f. Library Science

5. Hertsen Pedagogical Institute, Leningrad
   a. Philology
   b. Pedagogy
   c. Biology and Chemistry
   d. Physics and Fundamentals of Production
   e. Mathematics and Technical Drawing
   f. Geography
   g. Physical Education
   h. Foreign Languages
   i. Defectology
   j. Aesthetic Education

Each faculty is composed of "chairs," each of which is headed by a professor. For example, in the Lenin Pedagogical Institute in Moscow, the faculty of physics and mathematics consists of 9 chairs: General physics, theoretical physics, methods of teaching physics, astronomy, basis of engineering, algebra, geometry, mathematical analysis, and methods of teaching. At the Hertsen Institute in Leningrad there are three chairs in mathematics—mathematical analysis, algebra and geometry, and elementary mathematics and methods of teaching mathematics—and three chairs in physics—general physics, theoretical physics, and the methods of teaching physics.

Table 10.—Offerings and enrollments by type of program in certain pedagogical institutes (1959)

Institution	Day program		Evening program		Correspondence program	
	Specialties	Enrollment	Specialties	Enrollment	Specialties	Enrollment
1	2	3	4	5	6	7
1. Krupskaia Pedagogical Institute in Moscow.	Russian language, literature, and foreign languages; mathematics and mechanical drawing; physics and fundamentals of production; biology, chemistry, and fundamentals of agriculture; geography and biology; physical education.	2,500	[Not indicated]	2,000	History; Russian language and literature; mathematics and physics; natural science; geography; foreign language; physical education.	3,000
2. Lenin Pedagogical Institute in Moscow.	Russian language, literature and history; mathematics and mechanical drawing; physics and fundamentals of production; biology, chemistry, and fundamentals of agriculture; pedagogy and psychology; defectology, Russian language, and literature; defectology and mathematics; geography and biology; foreign languages (English, German, and French).	4,000				
3. Gor'kii Pedagogical Institute in Kiev.	Ukrainian language, literature, and tutoring at boarding school; Russian language, literature, and singing; mathematics and mechanical drawing; physics and fundamentals of production; pedagogy and psychology (preschool); defectology and methods of elementary education.	950	[Not indicated]	100	Ukrainian language and literature; Russian language and literature; mathematics; pedagogy and psychology; defectology.	2,000
4. Pushkin Pedagogical Institute in Tbilisi.	Russian language and literature, Georgian language and literature; literature, and history; Azerbaijan language, literature, and history; Armenian language, literature, and history; mathematics and physics; physics and fundamentals of productions; biology, chemistry, and fundamentals of agriculture; geography and biology; library science; methods of elementary education.	1,908	Russian language and literature; Georgian language and literature; library science.	300	Georgian language and literature; Russian language and literature; history; mathematics; natural science; geography; library science; methods of elementary education.	3,500
5. Herteen Pedagogical Institute in Leningrad.	Russian language, literature and history; foreign languages (English, German, and French); mathematics and mechanical drawing; physics and fundamentals of production; biology, chemistry, and fundamentals of agriculture; geography and biology; physical education; defectology, Russian language and literature; defectology and mathematics; pedagogy and psychology (preschool department); methods of elementary education. Department of Nationalities populating Northern areas of the U.S.S.R.	6,000	Russian language and literature; mathematics; history; natural science; geography; pedagogy and psychology (preschool department).	3,000	History; Russian language and literature; mathematics and physics; natural science; geography; defectology; pedagogy and psychology (preschool department); physical education; methods of elementary education.	7,500

SOURCE.—*Spravochnik dlia postupaiushchikh v vysshie uchebnye zavedenia Soiuza SSR v 1958 g.* (Manual for students entering establishments of higher learning in U.S.S.R. in 1958.) Moscow, "Sovetskaia Nauka" 1958, 271 p.; and information given by personnel at pedagogical institutes.

ADMISSIONS

To be eligible for enrollment in the day program in a pedagogical institute, a student must have completed the regular 10-year schooling, or in some instances an equivalent education in a technicum or special secondary school which is a semiprofessional school for the training of various kinds of specialists. The student may apply to one institution only in any one year. Since there is competition for the available places within the established quotas, students usually apply at an institution and for a type of program where they believe they will have reasonable likelihood of success. An applicant who is unsuccessful one year may try another year. Some students have applied two or three times before being admitted. Persons over 35 years of age and not eligible for the day program may apply to the evening or correspondence programs.

Under a new decree issued in 1958, applicants who have had 2 years' experience in production work in industry or agriculture are given preference in the filling of 80 percent of the first-year enrollments. Work experience is absolutely obligatory for those who plan to specialize in journalism, law, and philosophy. Military service is regarded as equivalent to work experience.

Entrance examinations commence on August 1 and last for 10 days. Every student must appear before examining committees and take oral and written examinations in Russian language and literature, and the foreign language studied in the secondary school. In addition, the student is examined by the faculty in which he proposes to study. Applicants who rate highest in the examinations are permitted to enroll up to the limits of the established quota. Classes begin each year on September 1, unless this date falls on a Sunday, and continue until the end of May.

CURRICULUM

Students in the regular day program must take a double (in a few cases triple) major in related subjects. The following combinations may be offered in the pedagogical institutes of the U.S.S.R.:[2]

Russian language, literature, and history
Russian language, literature, and foreign languages
Foreign languages
Mathematics and mechanical drawing

[2] See appendix VIII for the details on the curriculums.

Mathematics and physics

Physics and the fundamentals of production

Biology, chemistry, and the fundamentals of agriculture

Geography and biology

Physical education

Although the programs of study for pedagogical institutes are established by decree which is applicable to all institutes, local training facilities and needs sometimes require modifications of official plans. In practice, therefore, the total number of hours may not be distributed exactly as indicated in the program of study. For the purposes of general study and analysis, however, our observations tend to confirm that the programs as published represent substantially what obtains in all pedagogical institutes in the U.S.S.R.

Subject-matter content in the majors taken occupies the main portion of the curriculum for each student. However, professional education in the art of teaching is considered to be very important. Not only must the students take a year's course in principles of education, called pedagogy (120 hours), and a year's course in the history of pedagogy (72 hours), but also they must take special method courses in teaching the main subjects for which they are preparing. In addition, students during the last 2 years are required to complete a program in supervised practice teaching lasting 16 full weeks (discussed on page 180). Student teaching is performed at schools in the area near the pedagogical institute or in demonstration schools of the institutes which have them.

The curriculum does not offer broad, general (liberal arts) education, the assumption being that the students had received a solid foundation during their secondary education. Under this philosophy, for example, students specializing in foreign languages do not take any science or mathematics; while on the other hand, students specializing in science and mathematics take only a limited amount of the work in the humanities and social sciences area. A good portion of this work is in the field of Marxist ideology and Soviet Communist history.

In spite of having studied a foreign language for 6 years in previous schooling, a student is nevertheless still required to study that language or a new language during 2 years of his college program. He or she may elect to continue to study the foreign language after the second year. Physical education is obligatory for the first 2 years and optional for the remaining years. Also

required of every student are the following subjects: History of the Communist Party of the Soviet Union, political economy, dialectical and historical materialism, psychology, and school hygiene.

If a student has entered a curriculum which later proves unsuitable, he or she may change to another curriculum or to another institution. Even in changing from one curriculum to another in the same institution the student must start from the beginning again. However, this situation is considered inefficient and expensive and seldom occurs.

A significant characteristic of Soviet teacher education is that its programs do not normally lead to a diploma in education but rather in a subject specialty (physics-mathematics, history-literature, etc.). It is possible to acquire a diploma in education (pedagogy), but this program is offered in only a few institutes.

PROFESSIONAL TRAINING FOR NEW TEACHERS

Theory and general methods.—During the first year all students take a course in psychology. In addition, there are visits to schools to make observations and orient the students to their future profession. During the second year, students take a course in pedagogy. An outline of this course is given in the appendix.[8]

In the pedagogy course, the role of the "leading teacher" *(vospitatel')* is introduced. There is one such teacher for each grade, and this teacher is responsible for that part of the school program which concerns the cultural and moral upbringing of the pupils. In addition, this teacher does some administrative work, such as taking care of the class register, the student day book, conferences with pupils, assistance with Pioneer activity, and coordination of field trips and excursions with subject-matter teachers. The "leading teacher" has responsibility for an entire grade, and this role with a particular class of students is not for one year only but extends over several years. Thus, this teacher, who is in effect a class adviser, gets to know the pupils very well.

The importance of "circle" activity and field trips and excursions is stressed in the course of pedagogy. At the Hertsen State Pedagogical Institute, lectures are given on how to conduct tours for children. As an example of the interest shown in "circle" activity, even the director of this institute, a specialist in geography, is the leader of a "circle" in geography and also serves as Chairman of the All-Union (national) Society of Excursion Circles.

[8] See appendix X.

During the course in history of pedagogy taken in the third year students study the history of education, including the origin and development of pedagogical ideas from ancient times to the present. The main emphasis is on Russian and Soviet education, but the history of education in such countries as England, France, Germany, and the United States is studied briefly as well. The study of education in Western European countries commences with John Locke.

Special methods.—In addition to taking the general courses in the history and theory of pedagogy, each student is required to take a special methods course in each of the two specialties the student is studying. In each faculty there is a chair of special methods. The faculty members in this chair are specialists who combine competence in both subject matter and pedagogy. In special methods courses the students learn specific techniques in teaching various subjects.

Practice teaching.—In the fourth year each student is assigned full-time to a school at which he or she spends 6 or 8 weeks in

Figure 4-2.—School children of experimental school No. 16, Moscow.

practice teaching. The Lenin State Pedagogical Institute in Moscow has 107 schools in the Moscow area which cooperate in its teacher training program. The Hertsen State Pedagogical Institute in Leningrad has three demonstration schools attached to it and has ties with 180 cooperating schools. Usually several students, sometimes as many as 20, are assigned to a school, and each student teacher is placed under a regular teacher who teaches one of the student's specialties. This regular teacher acts as the student's supervisor. The supervising teacher receives extra remuneration for each student assigned to his or her class: 10 or more rubles per hour for each student teacher supervised. Assignments are made mostly to grades 5 through 7, less frequently to grades 8 through 10. During the first week, the student teacher becomes acquainted with the class. In the second week, he or she may give one or two demonstration lessons under immediate supervision. Thereafter the student teacher begins giving regular lessons while still being rather closely supervised by the regular teacher. To assist in the training process a methodologist from the institute makes occasional visits to observe and confer with students and supervising teachers. Methodologists normally are responsible for 12 to 14 students. During the training period, in addition to teaching a limited number of classes, the student teacher acts as the regular teacher's assistant, correcting papers, taking children on excursions to museums and factories, etc.

In the fifth and final year students engage in 8 or 10 weeks of practice teaching in schools to make a total of 16 full weeks in all for each student. The school in which a student does his or her second period of practice teaching may be the same one as in the fourth year or it may be a different one. This second practice period may be scheduled at any time during the school year before April, but is usually completed during the fall term. The student teacher, under the guidance of the supervising teacher, is expected to perform all of the functions of the regular teacher, such as preparation of lesson plans, actual teaching, and marking of the pupils. Practice is also gained in teaching the second subject-matter specialty of the student teacher. Methodologists and other student teachers practicing at the school frequently attend a demonstration lesson of one of the practice teachers and hold critiques soon after to point out strong and weak points and to give suggestions for improvement. Upon completion of the practice teaching assignment each student teacher is required to submit a written account of the teaching experience.

In addition to their regular program of teaching, teachers in

the Soviet Union are expected to direct extracurricular or "circle" activities related to their specialties. This program is conducted during the after-school hours to provide enrichment to the school curriculum and permit the pupils to follow and develop their special interests and abilities. For this reason, student teachers are expected to be prepared to direct such activity and are given training during their school practice period. In addition, each student in a pedagogical institute is required to spend part of one summer (about 3 weeks) after the second or third year in leading activities at a Pioneer camp, which is an out-of-doors recreational program for school youth under overall Communist supervision.

SCHEDULE OF INSTRUCTION

The academic year is divided into two terms: The autumnal term which lasts from September 1 (September 2 if September 1 falls on Sunday) until January 23, and the spring term which begins on February 7 and ends on June 30. The students are scheduled for no more than 36 (usually 32 to 34) hours a week in the first 3 years, 28 to 30 hours a week in the fourth, and 20–28 hours in the first half of the fifth year. The final semester is spent on writing a paper based on elementary research. Students come to the institute 6 days a week for 4 to 6 hours a day during the first 2 years. In the last 3 years they come 5 days a week for 4 to 6 hours a day, which gives them an extra free day besides Sunday.

At the Lenin Pedagogical Institute in Moscow, the classes start at 8:30 a.m. Six academic hours of 50 minutes duration each are scheduled each day. Each subject is always taught during two consecutive periods, with a 5-minute break between periods. There is a 15-minute interval between classes on different subjects. The schedule is so arranged that the lecture portion of the instruction is completed by 12:30 p.m. and the practical studies by 2:15 p.m. each day.

METHODS OF INSTRUCTION

Attendance at lectures and participation in practical exercises are obligatory. Lectures are given substantially according to the State syllabus. Normally each course has its textbook and other required readings to supplement the lectures and provide exercises and problems for the students to do. The books are purchased at relatively modest costs by the students and become their property.

The students are permitted to raise their hands and ask questions, or else they may write questions on a slip of paper to be handed to the instructor. In the college classes which we visited, however, there appeared to be but little interplay between instructor and students during the lecture.

Homework is required in all theory courses. In junior courses, small assignments are given each day based upon the previous lecture and in preparation for the next lecture. In senior courses, big projects or tasks are assigned in which each student is required to do his own planning. The student is allowed a week or 10 days to plan the project and then show it to the instructor, who approves it and who will set a date by which it must be completed.

Laboratory work is required in all science courses. In one second-year general physics laboratory visited we inspected tables with equipment used to perform different experiments. Each student had to complete in one semester 16 experiments, of which 13 were required and 3 were optional. At any one time students would be working on different experiments. Then, they would rotate.

Before doing the experiment the student must read up on it and then make plans for performing it. These plans must be approved by the laboratory instructor. After the experiment is completed, the student writes an account of it and submits it to the instructor. No special mark is given, merely an indication made that the experiment was or was not successfully completed.

After 2:15 p.m. students may have consultations with their instructors, and they may also generally work in laboratories until 8 p.m. Laboratories have their own time schedules. To act in his place during his absence from the laboratory, each science professor or docent has one, two, or three assistants who usually are candidates for higher degrees.

At the Lenin Pedagogical Institute, the library remains open until 10:30 p.m. on each weekday, and from 8:00 a.m. to 8:00 p.m. on Sundays.

Grade point averages, commonly computed in United States colleges and universities, are not determined in the U.S.S.R. The Soviet educators with whom this matter was discussed were surprised at the question, and they saw no value in having a grade point average for each student. They replied that the worth of a student's academic performance could be simply ascertained by an examination of his document. Students with all 5's, or mostly 5's with some 4's, would obviously be the honor students.

EXAMINATIONS AND GRADING

At the end of each semester a student is given a final examination in each main course, not to exceed five subjects. These examinations are quite comprehensive and extend over a period of 3 to 4 weeks.

Quizzes (both brief written type and oral reports) are scheduled for each subject and are given from time to time at the professor's option. Students who have been absent because of illness must make up back work. They may get help from the instructor or other students. Each professor is obliged to schedule 2 hours each week for private consultations. A student may get to see a professor at another time mutually convenient to the professor and the student.

At the end of the fifth and final year a State examination is given. The Ministry of Education publishes for each subject-matter area a list of topics that a student is expected to know.[4] The student is told that he might be examined in any of the topics. An examining committee is set up, consisting of three professors and a recorder. Sets of examination tickets *(bilety)* consisting of three topics or problems are made up by examining committees of each institute in accordance with established requirements.

At the time of the examination, the student is asked to select one ticket from the set of tickets which are placed face down on the table. The student is then given a little time to reflect on the topics and question, after which the examination commences. At the termination of the examination, which may last from one-half to one hour, the student receives a mark: 5 (excellent), 4 (good), 3 (passing), 2 (unsatisfactory), or 1 (failing). An example of the content of one examination, based on ticket No. 11 in inorganic chemistry, which we observed at the Hertsen Pedagogical Institute in Leningrad, follows:

State Examination in Inorganic Chemistry

1. Pauli's exclusion principle and quantum characteristics of electrons.
2. Calcium and its compounds.
3. Allotropy and polymorphism

[4] In appendix XI will be found two examples, one in mathematics and one in physics.

RECORDING OF STUDENTS' PERFORMANCE

Each student has a special booklet (student book) which contains a page for each semester in which are listed the courses taken and the final grade entered by the instructor from whom the course was taken. Students are always graded according to the number system referred to above, whether the work being evaluated is a small amount or pertains to that done during the entire course. On the page opposite the course lists, the completion of any required practical exercises (sometimes called "practicums") is recorded. A duplicate of these records is filed in the institute's administrative office. A student who successfully passes all of the examinations is graduated with a diploma. A student who fails any of the final examinations is not given a diploma, but instead retains his student book which shows the subjects which have been successfully passed. This student may, nevertheless, receive employment as a teacher, but his wages will be lower than they would be if he or she had received a diploma. The student who fails any of his final examinations may, during each of the next 2 years, retake the examinations at the regularly scheduled time at the end of the school year. The student is then reexamined in each subject-matter area except those in which a mark of 5 has been received.

STIPENDS FOR STUDENTS

About 80 percent of regular daytime students in Soviet higher education receive stipends to enable them to finance their education. These are, in effect, State scholarships provided so that students may devote full time to their studies unencumbered by the necessity of having to work on part-time jobs to make their education possible. Thus, pursuit of higher education in the *day program* in the U.S.S.R. is considered as a full-time job, and satisfactory performance is expected. A student who fails to measure up to the minimum standards loses his stipend and may be dropped from the program.

Following is the schedule of ordinary stipends for a student in a pedagogical institute:[5]

Year of studies	*Amount in rubles per month*
First	220
Second	240
Third	265
Fourth	290
Fifth	330

[5] The official Soviet commercial rate of exchange is 4 rubles to 1 dollar; the rate of exchange for an American tourist in the Soviet Union is 10 rubles to 1 dollar.

Students who receive high marks in all their courses are eligible to receive honor stipends which pay 25 percent more than the ordinary ones. These stipends, which are fairly common, may be received anytime after the first semester. Students who are truly outstanding may even receive higher amounts. These stipends are given in the name of some famous Soviet leader, past or present. For example, the Stalin stipend pays 800 rubles a month, and is usually awarded during the third or fourth years, although it may be received as early as the second year.

The stipends for students studying in the faculty of defectology are 50 percent higher than the corresponding ordinary stipends. Soviet educators explained that this differential was attributable to the more difficult and unpleasant work encountered in dealing with backward children and also to the need for a stimulus to encourage students to elect study in this area. Likewise, it was pointed out that stipends are not uniform throughout all higher education in the U.S.S.R., differing somewhat according to the type of program or higher school. Stipends at certain technical institutes, for example, are higher than the stipends at pedagogical institutes. Thus, a powerful system of incentives is used to encourage students to enter certain branches of higher education

Figure 4-3.—Krupskaia State Pedagogical Institute, Moscow.

on which high priority is placed, as well as to motivate them to achieve their maximum potential in studies.

The stipends received by Soviet students, ranging from $22 a month up, may seem small by United States standards. However, in the U.S.S.R. this amount of money is sufficient usually to take care of all of the student's expenses, such as meals, lodging if away from home, purchase of books and supplies, incidentals, and even a little money for entertainment. Students whose parents assist them financially while at college may use stipends for cultural purposes or "pocket money." There are no medical or dental expenses, as these are furnished without direct cost to all Soviet citizens.

STUDENT LIFE

Although the primary emphasis is on the academic program of the institute, other aspects of student life are not ignored. There are clubs and cultural activities, such as chess clubs, plays, orchestras, outings, etc., in which students can follow and develop special interests and talents. There are also intramural and extramural athletic activities for the students, such as gymnastics, volleyball, ping pong, football (soccer), basketball, and track. Gymnasiums and athletic fields are provided for these purposes. Athletic competitions, involving the best athletes, are held with other institutions, and interested students turn out to cheer their teams.

Canteens, snack bars, and lounges are provided so that students may meet together socially. Students who do not live at home are housed, facilities permitting, in hostels or dormitories. Women and men may live in the same hostel though they will generally be housed on different floors or in different parts of the building. A room arranged for washing, ironing, and some cooking is usually provided in the hostel.

COMPOSITION OF THE STUDENT BODY

Better than 80 percent of the student body in the day program of the pedagogical institutes we visited were women. Soviet educators explained that the men had a greater interest in enrollment at a technical institute. At the Lenin State Pedagogical Institute about 90 percent of the students were women. Examples of the approximate percentages of women enrollment in specific faculties of this institute are the following: Foreign languages, 97 percent; history and literature, 92 percent; physics and mathematics, 80 to 85 percent.

GRADUATION AND JOB PLACEMENT

Annually at the end of the school year in June a graduation ceremony is conducted at which diplomas are awarded to those graduating from the undergraduate program. At the same ceremony graduate degrees are conferred. No special ceremonial dress, such as a cap, gown, or hood, marks this occasion for either the graduates or the faculty. A special speaker, usually an official from the Ministry of Education, gives an address and offers congratulations ot the recipients of diplomas and degrees.

Each graduate is assured a teaching position. Several months before graduation a list of available positions is made known to the future graduates. They may apply for the positions they prefer. In recent years there has been a heavy demand for teachers in such rapidly developing areas as Siberia. If quotas in these areas are not met voluntarily, it is necessary to assign some of the graduates to them in accordance with the State requirements.

TEACHING STAFF

Rank and salary.—The teaching staff at a pedagogical institute, as in all institutions of higher education in the U.S.S.R., consists of three ranks: Assistant *(assistent)*, docent, and professor. The average wage of an assistant with 5 years of teaching experience is 1,700 rubles a month; and with 10 or more years of experience, 2,500 rubles. A docent with 10 or more years of experience receives 3,200 rubles a month, which is the maximum wage of a docent. Salary increases for an assistant or docent occur only at the completion of 5 and 10 years of experience as a teacher. A professor receives anywhere from 4,000 to 5,000 rubles a month, depending upon his highest graduate degree and the number of years of experience as a teacher. A salary of 5,000 rubles, or roughly $500 a month, is considered a very good wage in the Soviet Union.

Assistants are chosen from among the outstanding graduates of the 5-year program of Soviet higher education. The best students are encouraged to stay on as assistants and at the same time continue their studies as *aspiranty* (aspirants for the first graduate degree) in the postgraduate program of the institute, to seek the degree of *kandidat* (candidate). This degree is in some respects close to a Ph.D. degree in the United States and is awarded at the end of not less than 3 years of postgraduate study. The possession of the candidate degree will entitle the holder to qualify for the rank of docent (similar to associate professor) on the institute teaching staff.

The rank of professor is usually awarded only to those who have the doctor's degree. The doctor's degree is conferred upon the relatively few who have made major contributions to research and the advancement of knowledge. This honor may be earned soon after achieving the candidate degree, or it may take many years. To receive a doctor's degree, the candidate for this degree must have the results of his work published. He then defends it before a selected academic council which has the right to confer doctor's degrees. The decision of the council is based on a vote taken by secret ballot. The decision to confer a candidate or doctor's degree is subject to confirmation by the Supreme Qualification Commission of the Ministry of Higher Education and Specialized Secondary Education of the U.S.S.R.

Work loads.—The teaching loads of teachers are generally as follows: Professors—6 to 10 hours per week; docents—12 to 14 hours per week; and Assistants—16 to 18 hours per week.

At the Krupskaia State Pedagogical Institute there was one faculty member per 10 students in the regular day program, and one faculty member per 70 students in the correspondence program.

Besides the teaching load, each faculty member is expected to have research work in progress. Two months of vacation are granted each year to each faculty member.

Faculty members may, like anyone else, write textbooks and seek to have them adopted by the Ministry of Education. Many faculty members are successful in this endeavor of writing textbooks for all levels of education. For each 17 pages an author may receive anywhere from 1,000 to 3,000 rubles depending upon the quality of the book. The chairman of the geography chair at one of the inservice institutes for teachers in Leningrad recently received 38,000 rubles for a primary school geography textbook that he wrote. If later reprints are made of his book, he will receive additional compensation.[6]

Selection.—The academic council determines whether or not a professor is capable of holding a position. This determination depends in part upon the competition for the position. Every 5 years a position is open for competition, usually in April or May. A special competition council in the chair concerned is set up, and an announcement is made in the newspapers that competitions for certain positions will be held. Candidates apply to compete for certain positions and submit their qualifications in

[6] Royalties for authorship of books are described in L. A. Karpov and V. A. Severtsev, eds., *Vysshaia shkola, (The higher school)*, Moscow, "Sovetskaia Nauka," 1957. P. 685.

terms of experience, research, and publications. The winner of the competition is chosen by the council in a secret election. The incumbent in the position more generally wins than not.

By the competition procedure each institution thus attempts to employ the best teachers available. If an incumbent loses out in the competition, he usually goes to another institution where the staff is less qualified. The Ministry of Education attempts to give each professor so displaced a job somewhere else.

Retirement.—In Soviet education there is no compulsory retirement age for teachers. A professor may work as long as he wants and is able, provided that he can demonstrate in open competition with others who may desire his position that he is the best qualified. Professors aged 80 or 85 years old are not at all uncommon. A professor may retire at age 60 at an average salary of 2,000 rubles a month. The professor, however, may choose to continue working, in which case he or she is paid the regular salary for the position and draws the retirement pay in addition to this salary.

Training of faculty for pedagogical institutes.—In addition to its program for training teachers for the general schools, a pedagogical institute will usually have a postgraduate program, the primary purpose of which is to continue the education of those students whose academic achievements indicate that they are good prospects to become future docents and professors.

Each faculty of the pedagogical institute conducts its own postgraduate program, and each chair in the faculty commonly has two or three postgraduate students *(aspiranty)* attached to it. Each aspirant has an individual program planned for a 3-year period. This program may involve further advanced course work in the specialty area. The aspirant receives further practical training as a teacher by working as an assistant but is not required to take any further course work in professional education, although he may enroll in a class. A thesis is required. This thesis must be a major project and must be defended at a public hearing before a selected committee of examiners. An aspirant who successfully completes all the requirements is awarded the candidate degree.

Postgraduate work may be taken by correspondence study. In this case, however, completion of the program normally requires 4 years rather than 3.

At the Lenin State Pedagogical Institute in Moscow there were in the 1958–59 academic year a total of 220 full-time aspirants

Figure 4–4.—Experiment in physics laboratory, Kiev Pedagogical Institute.

distributed among the 45 chairs of the institute. At the commencement exercises of June 1959, between 25 and 30 of these were scheduled to receive their candidate degrees. An additional 25 aspirants had finished their course work but were not eligible for the degree until the completion of the thesis requirement. At the same exercises, five or six doctor's degrees were scheduled to be awarded.

Training of Teachers for Polytechnic Education

The men and women who teach polytechnic education in the general schools have come from various sources: (1) The 5-year pedagogical institutes; (2) universities; (3) skilled workers; and (4) graduate engineers. In chapter III, data was given on some of the educational backgrounds of polytechnic teachers with whom we talked. An increased effort is now being made by Soviet educators to have greater numbers of future teachers specifically trained to do this kind of teaching.

The close relationships between mathematics, sciences, and polytechnic courses are reflected in some of the teacher-education

programs: Physics and the fundamentals of production; mathematics and mechanical drawing; biology, chemistry, and the fundamentals of agricultural production; biology, geography, and the fundamentals of agriculture.[7] Practical inservice training is provided future teachers of these specialties in factories, repair shops, electric plants, machine-tractor stations, etc. In the curriculum of physics and the fundamentals of production, out of a total of 4,530 hours the student spends 1,904 hours in lecture, 1,198 hours in laboratory, and 1,428 hours in practical work.

The new emphasis on polytechnic education is making itself felt still further in some of the training programs at pedagogical institutes. At the Gor'kii Pedagogical Institute in Kiev, we were told that they were organizing a new faculty in 1959–60 to be called the "Faculty of Engineering Pedagogics." Teachers of senior secondary grades will be trained by this faculty, and the graduates will have approximately the same technical education as an engineer. To facilitate this new training the institute is planning to expand its own workshop facilities. We observed classes in technical drawing and radio, and we visited the metalworking, woodworking, automobile, and electrotechnic workshops.

At the Hertsen State Pedagogical Institute in Leningrad a new faculty is also being established to train a new kind of teacher for the 8-year school. These teachers will conduct courses in drawing, technical drawing, and labor training. The present faculty of physics and fundamentals of production will continue to train teachers for grades 9, 10, and 11. They are also experimenting with a new combination program—physics and electrotechnics. The graduates of this new program will teach courses like machine study, electrotechnics, radiotechnics, automobile, and tractor. We visited the laboratories and shops for radiotechnics, general physics, electrotechnics, metalworking, woodworking, automobile, and tractor. This pedagogical institute is expanding its present laboratories by about 50 to 60 square meters, and a whole wing of a building will be devoted to physics.

At Pedagogical School No. 2 in Moscow, we saw newly designed single-place, wooden desks for the use of third and fourth grade pupils in the demonstration school. These desks, we were told, were good for manual arts work. Prospective primary teachers in this school are required to take practical work in the school workshops 2 hours a week during each of the four terms of their training program.

Polytechnic emphases in the Soviet general elementary-

[7] See appendix VIII for Curriculums.

secondary school are causing a minor "pedagogical revolution" in the training institutions for teachers. New concepts, new methods, new facilities, and new "products" are now in full course of development.

Pedagogical Schools

The pedagogical schools have long existed to train teachers for the elementary grades 1 to 4. These schools, which offer only a 2-year program and which are not considered to be at the higher education level, are passing out of existence as teachers go for training to a 4-year program of a pedagogical institute. Indicative of this trend is the fact that, whereas in Moscow there were eight such schools a few years ago, there are only two operating at the present time. Although there were 280 schools as of 1957, the trend has been steadily to upgrade the programs to 4 years, especially in the large cities.

We had opportunity to spend a half day at Pedagogical School No. 2 in Moscow. There were 530 students enrolled in this school, of whom only 7 were young men. The staff consisted of 66 teachers, including 6 teachers of foreign languages and 18 teachers of music. A demonstration school, attended by neighborhood children, was attached to the school in order to provide practice teaching experience conveniently for the students. The curriculum of the school covers a variety of subject matter because an elementary teacher teaches all the subjects in a grade. In tune with the new emphasis in polytechnical education all students are required to take practical shop work. This experience includes work in the artistic (paper, clay, etc.), woodworking, and metal shops. Aided by this training the students are considered to be better prepared to teach to their future pupils the rudiments of socially useful work.

For their professional training in pedagogy, students spend a whole day each week during the first semester of the first year in observation of teaching at the demonstration school. During the second semester each student performs demonstration lessons after the lesson plans have been approved by a methodologist.

During the summer between the first and second years, each student is required to spend a minimum of 15 days at a Pioneer Camp in order to learn how to direct this kind of activity.

During the first semester of the second year the student engages in one full week of actual teaching which is supervised by the regular teacher of the class as well as the methodologist. Then in

the final or fourth semester, 4 full weeks more are devoted to supervised practice teaching.

Upon completion of the 2-year program the graduate receives a diploma which certifies him or her to teach in the elementary grades. The salary for a beginning elementary teacher is 575 rubles a month and is less than that paid to secondary school teachers who require more educational training. This salary is based on the weekly teaching load and does not include benefits or income received by other educational or administrative activities and work outside school.

Only the best students, up to 5 percent of the graduating class, are permitted to enter the day program of a pedagogical institute as *first year* students. The rest of them become teachers. These teachers may, if they so desire, enroll in an evening or correspondence study program of a pedagogical institute while they are teaching. A large percentage of the evening and correspondence study enrollment in pedagogical institutes consists of such teachers.

University Programs for Teacher Training

Future teachers for Soviet schools are trained in the universities as well as in the pedagogical institutes and pedagogical schools. However, at the universities the program is more subject-matter oriented and there is considerably less emphasis on professional preparation of teachers. For example, chairs on methods of teaching do not exist in the universities. Curriculums at Moscow University and other higher institutions, designed for preparing persons qualified to teach high school subjects, are available in various sources.[8]

Students in universities are divided into two major classifications—the natural sciences and the humanities. The majority of the graduates in the natural sciences go into research and industrial work. Of the graduates in the humanities about 60 percent become teachers and about 40 percent enter into nonteaching careers.

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[8] For material on university programs, see W. K. Medlin and N. Apanasewicz, *Information on Education Around the World*, No. 9, Washington, U.S. Department of Health, Education, and Welfare, Office of Education, pp. 28–32; American Society for Engineering Education, *ASEE Engineering Education Exchange Mission to the Soviet Union* (reprint from *Journal of Engineering Education*, Vol. 49, No. 9, 1959, pp. 800–810); and Edward M. Corson, "*An Analysis of the 5-year Physics Program at Moscow State University*," in *Information on Education Around the World*, No. 11, Washington, U.S. Department of Health, Education, and Welfare, Office of Education, Feb. 1959.

Correspondence and Evening Programs for Teacher Training

Correspondence study and evening study are widely used forms of higher education in the U.S.S.R., consisting of over 40 percent of all students enrolled. The reasons that these types of instruction are so well patronized are several.

First, not all those who apply can be admitted to the regular day program because of the quota limitations, whereas there are no quotas for correspondence or evening study. Likewise, there is no age restriction for correspondence or evening study; while 35 is the maximum age for admission to the day programs.

Second, under a new law requiring that 80 percent of the new admissions to the day programs in higher education have had 2 years of practical work experience, students generally want to keep active in study and thereby improve their chance of admissions to the day program when they are eligible.

Third, since individual advancement and success in the Soviet Union depend to a considerable extent on educational attainment, there is strong incentive for each person to go as far in education as his or her capabilities permit. In the teaching field, there are great numbers of teachers who have not completed diplomas. Elementary teachers, most of whom have had only 2 years of preparation, earn less than the secondary teachers who require longer training. Many of these teachers are seeking to qualify for better positions through advanced study. The correspondence and evening programs enable them to do so while they are continuing in their present jobs.

An example of the magnitude and scope of the correspondence and evening programs is the program carried on by the Krupskaia Pedagogical Institute in Moscow, which has a combined evening-correspondence enrollment of 5,000 and a daytime enrollment of about 2,500 students. In the evening program alone, there were 2,000 students enrolled. Those students living in the Moscow commuting area come to the Institute two or three evenings a week and all day on Sunday.

There are 3,000 students enrolled in the correspondence program at Krupskaia Pedagogical Institute who live outside the Moscow commuting area. Five years are required to complete a specialty and receive a diploma. The correspondence courses are the same as those required of students in the regular program, with the exception that only one specialty or major is taken. This arrangement naturally limits the number of subjects an individual cor-

respondence student completes, as compared to a regular student. But the unified character of the curriculum in both programs ensures that the material covered in all required courses will be the same. Thus, a correspondence student enrolled in a program leading to a diploma as a teacher of foreign languages will cover the same material and meet the same requirements as day students. A diploma earned through correspondence or evening study is considered to be of equal value, for a specific specialty, to that earned through the regular day program.

In order to form a direct pedagogical link between the institute and correspondence students, "consultation points" are established in the rural areas. The Krupskaia Institute has eight such points. Every student is attached to one of these. Each week, on Saturdays and Sundays, the regular professors of the Institute go out to these points to give lessons of a summary or review nature and to offer special assistance to students. About 200 attend these sessions at each point. Normally between five and seven professors, according to a schedule, go out together on consultation during any one weekend. Depending on the way in which each "chair" at the Institute is organized, professors have a teaching program, part of which usually includes correspondence teaching. Travelling expenses are paid, and pay for the teaching service is taken into account in the professor's regular salary.

Figure 4-5.—Physics laboratory, Lenin Pedagogical Institute, Moscow.

Libraries related to the courses offered are established at each consultation point for students' use. For each course, students are required to submit one written examination done at home, which covers the essentials required in the regular program. Correspondence students come to the Moscow Institute twice during the year, from January 1 to 10, and in the summer months from June to August for a period lasting 35 to 40 days. During these periods they are required to do practical work, laboratory assignments, and examinations. Review lectures are also given. Special leaves from regular jobs are granted for these trips, and students are offered lodging in hostels, free of charge.

Although we were unable to visit any of the consultation points to observe the educational work going on there, we were impressed with the apparent organization and control of this large correspondence education program. It appears that Soviet teachers institutes are providing educational opportunities to thousands of rural persons and also to teachers who wish to upgrade their qualifications. Most of these correspondence students have already had some post-secondary education. Very few students enter the 5-year diploma program with only a 10-year maturity certificate. Actually, the majority of the correspondence students hold 2-year diplomas in elementary education or the old (now defunct) 2-year diploma entitling them to teach at the secondary level.

Correspondence programs also provide graduate studies. The duration of the postgraduate program is 4 years for correspondence students, rather than the 3 years for the regular day students.

Inservice Institutes

Great stress is placed on the inservice training of teachers in the Soviet Union. Toward this end a considerable number of inservice institutes have been established throughout the U.S.S.R. At least once in every 5 years teachers are urged, though not required, to take this kind of refresher training.

A typical inservice institute for teachers is the one we visited in Leningrad, a city with 23,000 teachers and 460 schools. This institute, which has eight faculties, 14 chairs, and six special departments is staffed by 109 teachers, and has as its objective the improvement of the subject-matter knowledge and the teaching skills of teachers. The inservice programs are of four types: (1) Academic-year courses; (2) summer courses; (3) seminars; (4) conferences.

ACADEMIC-YEAR COURSES

During the academic year regular courses of instruction are given 6 hours a day, 6 days a week, from the first of September to the first of June. Teachers who attend the institute are given time off, with pay, from their regular teaching jobs one day a week in order to attend the institute. They each take three subjects, and at each meeting each subject is taught for 2 consecutive hours. The program of instruction covers the following: (1) Theory of pedagogics; (2) subject matter knowledge; (3) methods; and (4) teaching practice (demonstrations). At the end of the year, each teacher must write a paper concerning the experiences and training acquired.

SUMMER PROGRAM

Summer courses of a month's duration are given each year from the last part of June to the last part of July. Approximately 3,500 teachers annually receive training at this institute during the academic year and summer programs.

SEMINARS

Teachers who are unable to attend the institute on a regular basis may attend one of the numerous seminars on different subjects and problems. In 1958–59 there were 137 such seminars held at this institute. Teachers come to these seminars twice a month. They read the pertinent literature, prepare papers, make presentations, etc. The seminars are directed by professors from this institute, other pedagogical institutes, universities, or pedagogical research institutes. Frequently lectures are given by guest specialists. One of the advantages arising from attendance at a seminar is the opportunity for the participants to receive consultation from the professors at any time. At the end of the seminar program the teachers write accounts of their experiences and submit them. The outstanding ones are put on exhibition.

CONFERENCES

In addition to the seminars, major conferences on theoretical and practical matters in education are held to enable teachers to exchange experiences, learn of new developments, read papers, etc. The conferences are usually held in March or April during the vacation period.

The essentially "grass-roots" approach which is being used by the inservice institute with large bodies of experienced teachers evidently has a substantial impact on Soviet educational practice.

New theories, for example, are tested and discussed. New textbooks for which adoption is being sought are evaluated, tried out, and criticized. The findings are forwarded to the appropriate authorities to assist them in making their decisions.

One of the principal problems of this institute at the present time is that of working out suitable programs of industrial work experience for pupils in the regular schools as a result of the new emphasis on polytechnic education. To achieve this goal the institute has set up a Technical Council composed of representatives of the institute, the local economic council *(sovnarkhoz)*, the local trade union, and the Russian Academy of Pedagogical Sciences.

Another area of current concern at the institute is the program of rapidly expanding "boarding schools." In 1956–57 in the Leningrad area there were 7 such schools; in 1957–58, 12; in 1958–59, 15; in 1956–60, 39. In the period of 1960 to 1965 it is expected that the number of "boarding schools" in the area will increase to about 150, with an enrollment of over 58 thousand. The announced national goal of pupils enrolled in boarding schools in the entire U.S.S.R. by 1965 is 2½ million. Many of the teachers at this institute have spent considerable time at the boarding schools in order to observe them in action and appraise the relative effectiveness of their programs.

Teachers who take courses of instruction at an inservice institute have examinations during and at the end of each course. Certificates are awarded at the completion of the program of instruction. Even though a teacher may not possess a diploma, he or she can receive no credit applicable toward it from an inservice institute. Such credit can only be obtained through enrollment in a regular pedagogical institute or university.

LOCAL SCHOOL PROGRAMS OF INSERVICE TRAINING

An interesting example of inservice training of teachers at the local school level is that at School No. 204 in Moscow. Here an academic board has been set up consisting of the director (principal), all the teachers of the school, and the chairman of the parents' committee. One function of the board is to plan the "inner life" or activity program of the school for the year. The second function is to discuss effective teaching methods. Experienced teachers are called upon to help inexperienced teachers. If reports come in that a teacher is not doing a good job of teaching, members of the board attend classes of that teacher and try to bring about improvement.

We were told that there are two supervisors in this school who supervise the work of the teachers daily. Frequent meetings are held between the mathematics teachers, between the science teachers, etc., to discuss common problems and to improve coordination of programs.

Pedagogical Readings

The various Republic ministries of education support an annual program of competitive teacher reporting on experiences, innovations, and contributions of various kinds in the cause of education. The forum for these competitive reportings is usually a pedagogical institute or inservice institute, where the papers written by teachers are read and judged by committees of experts and authorities in the field of education. The best papers emerging from local districts are submitted to Republic competitions for further hearing and sifting. Finally, the papers judged to be outstanding at this level are entered in the national competition held in Moscow under the auspices of the Russian Academy of Pedagogical Sciences. Most winning papers in Moscow are eventually published, while others are put on display as examples to teachers and students.

We examined many pedagogical readings that were on display, in various educational exhibits, and some of them were particularly impressive in length (50 to 100 pages), form and quality, and interest. Most of the readings appeared to be on methodology. Authors of winning papers naturally earn publicity, royalties, and often become nominees for State awards like "merited teachers," which bring additional material and prestige benefits.