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# Psychological Research in Soviet Education

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Recent reports on the rapid training of scientists in the U.S.S.R. have led to a great deal of interest and speculation. To most of us it seems incredible that a nation, half-illiterate only a generation ago, should outstrip the United States in the size of its technical roster (*1*). In view of our own shortages, the Soviet figures are disconcerting. They would, indeed, be alarming, were it not for some tendency on our part to question the caliber of Soviet scientific training.

The intent of this article is to suggest that disparagement of Soviet education may be based on emotional, rather than on factual, grounds, and that the better part of valor is to assume that the Soviet system is capable of producing competent scientists. This conclusion was reached after a survey of reports and directives of the R.S.F.S.R. Academy of Pedagogical Sciences, which serve as sources of guidance for school workers. Because these publications are intended primarily for home consumption, they expose failures as well as successes, thus yielding a fairly accurate portrayal of what goes on in the Soviet schools. And the net impression from this portrayal is that the system is highly efficient, despite some rather absurd opinions on the philosophy of education which emanate periodically from the Kremlin.

A factor which has contributed significantly to the efficiency of Soviet education is the active participation of psychologists in the development of teaching methods. This may sound strange in view of our tendency to identify Russian psychology with Pavlov's experiments on salivary conditioning, which seem quite remote from classroom problems. Our appraisal, however, is not entirely accurate. Soviet psychologists, despite assertions to the contrary, have been quite sensitive to the work done abroad, and some current formulations show unmistakably the influences of Sherrington, Adrian, and Head. Sechenov, regarded as the father of Russian physiology and psychology, paid many a generous tribute to Helmholtz. And Pavlov's own work with anthropoid apes was unquestionably inspired by Köhler.

The impact from abroad is evident in the efforts to deny it, made in 1950 by the joint session of the U.S.S.R. Academies of Sciences and Medical Sciences. At this meeting, dedicated to the centenary of Pavlov's birth, a small group of "distinguished" academicians achieved further "distinction" by groveling before Stalin and by denouncing their more courageous and intellectually honest colleagues. One apparent basis for these denunciations was the willingness of many Soviet scientists to admit that Helmholtz, Hering, Wundt, and Freud had something useful to contribute to psychology (*2*).

Some principles which find current acceptance in Soviet psychology are described in later paragraphs, in connection with research on teaching methods. First, however, it may be pertinent to examine the manner in which psychologists were drawn into pedagogy and the problems with which they were confronted.

## Political Control

The initial step in directing the work of psychologists to education was taken in 1943 with the establishment of the R.S.F.S.R. Academy of Pedagogical Sciences. This is described as a body of distinguished scientists entrusted with jurisdiction over nine research institutes concerned with problems of education. The Scientific Research Institute for Psychology has been specifically included within this jurisdiction (*3*, pp. 212–213).

Three years later the Central Committee of the Communist Party issued a directive introducing the teaching of psychology in secondary schools. In this directive, the new academy was instructed to engage in the preparation of textbooks and training of psychology teachers (*4*, pp. 105–106).

In 1950 the joint session of the U.S.S.R. Academies of Sciences and Medical Sciences passed a resolution instructing presidiums of the two academies to take steps toward development and utilization of Pavlov's doctrines in pedagogical practice (*2*, p. 131).

The progress made in carrying out this resolution was reviewed unfavorably 2 years later by a member of the Academy of Pedagogical Sciences. This hint at a more active implementation was undoubtedly precipitated by the decision of the 19th Congress of the Communist Party to introduce compulsory 10-year schooling and to convert all secondary education to polytechnical training (*3*, pp. 205, 252).

To appreciate fully the predicament of Soviet psychologists, it may help to keep in mind the fact that the Central Committee has some definite opinions on individual differences in intelligence. According to one "authorized" definition, intelligence is merely "a well-organized system of knowledge," which clearly implies rejection of the theory of innate differences (*5*, p. 78). In line with this position, the Central Committee, in its 1936 directive, prohibited segregation of children on the basis of tests, ordered restoration of the majority of retarded children to normal classes, and abolished child psychology as a specialized field of activity in primary and secondary schools. In a parallel decision of 1937, the R.S.F.S.R. Council of Commissars ordered that methods of education in the so-called "exemplary" and "experimental" schools for gifted children be restored to standard pedagogical practices, and that the academic criteria in ordinary schools be raised to the level at which these "exemplary" schools operated (*4*, pp. 95–101).

Responsibility for school failures is thus placed directly on the teacher. It

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has been emphasized repeatedly that all pupils have the capacity for successful academic performance, and that expectation of a certain percentage of failures is untenable (*6*). Moreover, the criteria for success are the absolute academic standards set forth in the 1944 directive of the R.S.F.S.R. Commissar for Enlightenment (*4*, pp. 174–176). Should any pupil fail to satisfy these standards, the failure is attributed to the negligence or incompetence of the teacher as well as to the laxity of those entrusted with research on teaching methods.

The way in which Soviet psychologists are meeting this challenge is a story of circumvention without obvious compromise of scientific principles. The circumvention is mainly one of giving credit where little or no credit is due, of citing Pavlov, where mention of Sherrington would have been more pertinent, and of treating Marx, Lenin, and Stalin as fountainheads of original philosophic profundities. This lip service, however, does not seem to affect the actual research program, which is generally designed along established psychological principles. To Soviet psychologists the problems of educational methodology are primarily problems of motivation and learning, perception and thought. With this initial assumption, research on pedagogy becomes basic rather than applied, with the classroom serving as the laboratory. Thus, it may be instructive not only for the teacher but also for the professional psychologist to examine the initial assumptions, the nature of experiments, and the ultimate conclusions. The research described in the following paragraphs is presented with this end in view.

## Scientific Framework

A concept which has been prominent in Russian psychological theory for many years is that of the *orienting reflex*. In his original description of the phenomenon, Pavlov stated: "If in the surroundings of the animal there appears some new agent . . . then the corresponding receptor surfaces of the organism become focused on it, in a manner which will bring about the most favorable stimulation" (*7*).

In recent years many Soviet psychologists have favored the broader term, *orienting-exploratory activity* (*8*). Current descriptions of this phenomenon include two important physiological components: (i) inhibition of movement which might interfere with maximal receptivity, and (ii) tonic innervation, vasomotor and skeletal, preparatory to ensuing action (*9*). Inclusion of these components makes current definitions of the orienting reflex practically indistinguishable from Henry Head's concept of *vigilance*, proposed more than 30 years ago (*10*).

According to evidence gathered in Russian psychological laboratories, the orienting reaction is an essential mediating variable in learning. Thus, in an experiment on sensory preconditioning, it has been shown that acquisition does not occur unless there are clearly observable head movements in the direction of each of the stimuli. Correspondingly, as long as these movements occur, there is no extinction. With continued orientation the associative connection presumably persists for months and even years (*11*, p. 298).

Orientation, however, may be a hindrance to learning if the locus of attention is other than the conditioned stimulus. Eighty years ago Sechenov made the penetrating observation that "when a man does not listen to a voice, it is only because he listens to another voice" (*12*, p. 308); but it was Pavlov who translated this idea into the workable concept of *external inhibition*—a paradigm for the effect of distractors, which has served as a source of research in psychology as well as in education.

The importance attached by Soviet psychologists to orientation has led to some significant deductions and experiments in teaching methods. It is deduced, for instance, that visual aids are useless if their irrelevant details happen to capture the child's attention. Such "external inhibition" apparently is not uncommon in first-grade arithmetic, where toys and blocks are used as aids in addition and subtraction. An important step in teaching arithmetic is to teach the child to recognize that terms like *bought, came,* and *acquired* imply addition, whereas *lost, spent,* and *departed* imply subtraction. This distinction, however, is in no way illustrated by the mere presence of concrete objects; in fact, children tend to orient to the shape or color of the object, disregarding the required operation.

The use of objects, however, may be quite effective if accompanied by some visual illustration of the required arithmetical process. In a study demonstrating this principle the teacher, while reading a problem, accompanied words like *came* and *bought* with the action of shifting a few blocks toward the child; conversely, words like *sold* and *departed* were accompanied by a shifting of blocks away from the child. On subsequent tests these children showed a higher degree of progress than the controls, who heard the same problems and manipulated the same blocks but were not shown the movement illustrating the nature of the process. "The use of visual aids in the teaching of arithmetic," say the investigators, "appears to be especially effective when illustration is made of those links of activity which are in the process of forming at the given moment. . . . If in the early stages we obtained better results in the understanding of new material with visual aids maximally representative of reality, at the higher stages we reached such results through the use of the more 'stingy' illustrative materials which underlined and made prominent the essential link in the activity being mastered" (*13*).

## Limitations of Visual Aids

Another study of visual aids was conducted in a class on botany. Here the pupils were supplied with real flowers and, after preliminary instruction, they were told to practice identifying the calyx, the corolla, the stamens, and the pistil. Within the stamens they were to differentiate the filaments from the anthers, and in the pistil they were to point out the ovary, the style, and the stigma. In a comparable class the same procedure was followed, except that the teacher's preliminary instruction was accompanied by references not to the flower itself but to an enlarged drawing of another flower, in which the various organs were shown.

In an examination of the results of these two approaches, it was found that the second group was markedly superior to the first group, not only during practice, but also on subsequent tests with flowers which had not been used in the initial demonstration. Explanation for the relatively poor performance of the first group is offered in the following quotation: "A natural object has immediate significance for the child; it elicits interest which has no direct relation to the organs of the flower. During immediate perception of the flower a teacher's words do not produce sufficient effect." The use of drawings, on the other hand, interferes with the child's initial reaction to the flower and directs his orientation to features which are pertinent to the lesson. In the ultimate outcome, "the stamens and the pistil of a flower are no longer regarded as its merely interesting or pretty parts; they acquire their own special and important significance" (*14*).

Orientation to nonessential features can also hamper progress in the more advanced courses on mathematics, if the illustrative material is not selected judiciously. One investigator points out that many pupils have difficulty in recognizing a right triangle when the right angle is at the vertex. This difficulty is attributed to the fact that, in most textbooks, illustrations of right triangles are always drawn with the right angle at the base. Thus, orientation toward the critical feature is confounded with orientation toward a particular location.

The point is demonstrated further in connection with the concept of diameter. A beginner in geometry is asked to draw a circle and inscribe a diameter. The pupil inscribes two diameters, one horizontal, the other vertical. This leads to the following dialog:

*Teacher*: How many diameters can be inscribed in a circle?

*Pupil*: Two.

*Teacher*: Aren't there any more diameters?

*Pupil*: No, there aren't.

*Teacher (inscribing a diameter at a 45° inclination)*: What is this?

*Pupil*: A diameter.

*Teacher*: So, how many diameters are there?

*Pupil*: Two more. Four altogether.

*Teacher (inscribing a diameter at a slight inclination from the vertical)*: How many diameters are there?

*Pupil*: Any number. I was wrong.

This little misunderstanding is also ascribed to stereotypy in diagrams, since most textbook writers, as well as teachers, illustrate the concept by drawing the diameter in a horizontal position. As a result, the irrelevant feature of location obscures the essence of the definition. It is suggested that such confusion may be avoided if the essential characteristic is illustrated in a variety of positions and in many different contexts (*15*).

This suggestion is indicative of the attitude of Soviet psychologists toward the role of repetition as a factor in learning. The effect of sheer repetition in a constant environment is generally regarded as trivial, particularly when one expects some positive transfer. On the other hand, repetition in a variable environment is held to be immensely effective. The attitude reflects Pavlov's observation that responses conditioned in one context fail to occur when the context is changed. But the idea of varying the context stems from Sechenov's opinion that perceptions develop from "frequent excitation of receptors under varying conditions of the perceiving organ." This opinion was expressed more than 80 years ago in defense of Helmholtz's concept of "unconscious inference," and it is one of Sechenov's many tributes to his great contemporary (*12*, p. 267).

## Creating Interest in Science

The functional significance of orientation is not restricted to learning. Another field of psychological inquiry in which the orienting reaction is assumed to be a crucial factor is motivation. In application to pedagogy, this assumption has served as the starting point of research on methods of arousing interest and motivation for scientific study.

Soviet psychologists are well aware that dull books are lethal to pupils' interests, and they concede that books may be dull merely because the subject matter lacks the intrinsic quality of arousing curiosity. Books of this nature may, of course, be made more attractive by insertion of material having the so-called "human interest appeal," but this recourse invariably generates the possibility that such extraneous material may become the principal focus of orientation, to the detriment of the essential scientific topic.

For an illustration of such misdirection of interest, a Soviet psychologist singles out a proposed treatment of a scientific topic, submitted by a contributor to a popular book on geography. The topic, which, according to the psychologist, has little appeal on its own merit, is that of determining geographic location. In an attempt to arouse interest, the contributor introduces description of the method with stories of explorers, adventurers, mountaineers, and fliers who somehow manage to get lost. Each story ends with the question, "Where are we?" Following this introduction the author describes steps in determining the location.

The results of this attempt at popularization are rather sorry. After reading the lesson, children have been asked to name the main theme, to give the lesson a title, to point out the most interesting parts, and to suggest additions to the lesson. As a rule, most children refer to adventures, discoveries, and various heroic incidents described in the stories, while only a small number of the pupils are aware of the main geographic theme.

At this point the psychologist introduces three variations on the human interest appeal. The first of these contains a hero who is bound by duty and honor to discover the location. In the second variation, the hero's primary incentive is ultimate discovery of certain mineral deposits. In the final variation, the hero's motives are of secondary importance, the stress being placed on struggles and frustrations attending his direct attempts to find the location.

While the first two variations produce some improvement in results, the effect of the final variation is in startling contrast to that of the original contribution. For instance, in pointing out the most interesting parts of the original story, only 5 percent of the children mention the essential geographic topic—discovery of location. With the final variation, however, this figure rises to 88 percent. From these results the investigator concludes that "to arouse interest for scientific inquiry we must bring into the text a living, active man, and his living, searching, exploring thought in its historical development. . . . We should not present ready-made results of human thought and experience, but we should introduce the reader to the very process of investigation, gradually exposing the overcoming of difficulties and the search for the true method. Moreover, to evoke a pupil's interest precisely for the given scientific question, we must treat the search for answer as the main goal of the hero's action, rather than as a means of reaching some other goal. The strife and survival of the hero must be developed around attainment of the given aim" (*16*).

## Language and Thought

The foregoing experiments illustrate the variety of studies in pedagogy generated by just one principle in Soviet psychology. There have, of course, been other points of departure, but space permits only a brief mention of these.

A number of studies are derived from Pavlov's views on the intimate relation between language and thought. In discussing higher nervous activity, Pavlov had postulated two distinct cortical processes, which he called the "cortical signaling systems." The first system, common to man and lower animals, is one connected with immediate perception of environment. The second system is that related to the development of speech; it is man's exclusive property, and it forms the basis of his ability to abstract and synthesize (*11*, p. 258).

The implication of speech in the development of thought has been described somewhat more specifically in current Soviet literature. According to one investigator, "at various stages of a child's mental development, objects and events are reflected within his cranium in a variety of ways, but they always remain designated by one and the same word. The word remains unchanged. The concept, however, which it denotes as a generalized reflection of objects and events in the environment, becomes altered." From this interpretation the investigator concludes: "Familiarization with language has decisive significance in the formation of consciousness of a growing man. Familiarization with vocabulary and with grammatical structure of language is an essential condition for a child's development of abstract thinking, acquisition of mastery over logical operations and the higher processes of analysis and synthesis. Without language the formation of man's higher sensibilities and of his intelligent will is impossible" (*17*).

The role of language has been examined at several levels of intellectual development, and the results confirm, with monotonous regularity, its importance as a factor in concept formation. An experiment with 2-year-old children, for instance, shows that a visual demonstration of a simple skill is less effective for

acquisition and transfer than the same demonstration accompanied by a spoken word which names the movement involved in the skill (*18*). Another study, dealing with a more advanced level of development, shows that confusion in differentiating between causal, temporal, and conditional relations is generated by the ambiguity of the conjunctions *if* and *when*, which are used to introduce subordinate clauses. As an example, the investigator states that a purely conditional statement—"if the weather is good we shall go to the country"—is interpreted by pupils as representing a cause-effect relationship. The implication of the study is that, since this source of confusion is inevitable, the topic of correct identification of relation should be given special consideration in education (*19*).

## Ideation

Several experiments are devoted to the role of imagery in educational methodology. In Soviet psychology, imagery is defined as "a unique form of reflection of objective reality . . . an intervening link in learning about the world: from sensations and perceptions through images toward concepts. As distinguished from perception which is elicited by direct action of an object on analyzers, an image is evoked by stimuli reviving previously formed temporal connections. For man, the specific stimulus capable of evoking imagery is the word." It is pointed out, further, that imagery is not restricted to the visual field but exists as well in other sense modalities (*5*, p. 29).

Recourse to imagery as a pedagogical technique is shown to be effective in the training of "intellectually passive" pupils —children who, by our standards, would probably be classified as "slow learners" or "retarded." The investigator points out that, in the teaching of addition and subtraction to such children, there is very little transfer from the successful manipulation of blocks to mental operations. On the other hand, if the child doing mental arithmetic is urged to visualize the blocks and to describe his operations aloud, his mental performance can be brought up to the general level of the class after six or seven such sessions (*20*).

Imagery has also been used in training first-grade children to abstract the main theme of a story. Usually children tend to repeat the story in part or *in toto*. If, however, they are asked to visualize a picture conveyed by the story and to provide a caption, the concept of the main theme becomes meaningful (*21*).

A few psychologists have worked on the application of Pavlov's finding that differentiation between a positive and a negative stimulus is achieved most effectively when the two are interspersed during conditioning. The suggestion to teachers of mathematics is that addition and subtraction be taught simultaneously (*22*), and that understanding of functional dependence is enhanced if pupils are trained in finding the inverse of a function (*23*). Even in the teaching of psychology it is found that mere definition of a psychological concept is insufficient for long-term retention, and a suggestion is offered that each such definition be accompanied by an active attempt to "criticize, reject, and overcome incorrect, unscientific treatment of the concept" (*24*).

## Conclusions

A conspicuous feature in Soviet research on pedagogy is its high degree of coordination, with every study generated by some psychological principle. Attempts at mere correlations between methodology and success in examinations are practically unknown. In fact, examinations are generally regarded as criteria subordinate to the ultimate goals of long-term retention and transfer.

This concentrated effort is the result, in part, of a commonly accepted premise which many of us regard as untenable—an assumption that "different kinds of habits based on training, education and discipline of any sort are nothing but a long chain of conditioned reflexes" (*25*).

Whether or not we agree with this formulation, we cannot deny that knowledge is built on previous knowledge. It is highly probable that the Soviet psychologists do not take the statement literally but regard it as a convenient approximation or a workable formula. With this formula it would be inconceivable that a Soviet psychologist would undertake improvement of high-school teaching without examining all the previous links in the chain, from the kindergarten up. Any academic failure, whether resulting from lack of interest or of ability, is attributed to one or more missing links. Unless these are found and repaired, all further efforts at training in this particular direction are regarded as futile.

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