V. V. DAVYDOV

THE CONCEPT OF THEORETICAL GENERALIZATION AND PROBLEMS OF EDUCATIONAL PSYCHOLOGY*

1. THE LINK BETWEEN DIALECTICAL LOGIC AND PSYCHOLOGY

The task of bringing our education system up to the level demanded by the scientific-technological revolution requires not just an ordinary change in the content and methods of teaching but the complete replacement of the traditional principles for selecting subjects of instruction and for developing didactic materials. Up to now, these principles had mainly to do with forming the students' empirical judgement. The new principles should facilitate the formation of scientific [theoretical] thought. Development of such principles is a complex problem for all branches of psychology and educational theory.

We are here interested in certain psychological questions having to do with the *concrete "techniques"* for building such educational subjects, the mastering of which will lead children to acquiring the habit of concrete generalization. Our entire investigation has led us to the problem of how educational material should be organized in such a way that children in mastering it form the appropriate theoretical constructs. This chapter will examine certain aspects of this problem, and present some data gathered during experimental educational projects.

One important presupposition for this research is the strong link between psychology and logic (epistemology). Some psychologists (S. L. Rubinštejn, Jean Piaget *et al.*) have clearly understood this link, while most of the others ignored it for the simple reason that they take thought to be a psychic function of isolated individuals (the 'epistemological Robinsonade'). A formal-logical description of such a function corresponds more or less to the results of psychological observations, merely translating them into the "normative" language of logic.[1] Traditional formal logic ('textbook logic') can agree with psychology since the objects of these disciplines were formulated on the same epistemological basis, namely on the basis of sensualistic empiricism.

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But, already in the 19th century, one had begun to revise the very interpretation of the *object* of logic. Both Hegel and the classics of Marxism developed logic as epistemology, i.e., as dialectic.[2] In this logic thought is understood as a *supra-individual ability* of a co-operating mankind. This peculiar collective activity which reproduces in thought (thanks to practice) the universal forms of nature, finds its embodiment in knowledge and in technology (i.e., in material and spiritual culture). It is precisely the history and laws of such thought — the "author" of which is all mankind — that is studied by dialectical logic. The object of logic is the study of the concrete-historical laws of the development of the *categories* of thought as a *supra-individual, collective* activity, bringing man toward objective truth. "*Not* psychology, *not* phenomenology of spirit, *but* logic = the question of truth", wrote Lenin, talking about logic *coinciding* with epistemology.[3]

Psychology cannot occupy itself with these historical processes of social activity. It has its own object of study. In the process of education and up-bringing, every individual *forms* himself and turns into forms of his *own* activity those conceptual elements and processes that are established by society in a given historical era. The conceptual activity of the individual is the more productive and logical, the better he masters the universal categories of thought. Psychology studies certain aspects of the process of individual *acquisition* of the supra-individual, social activity, the categories, elements and modes of which are studied by logic.[4] This activity establishes various means of idealization, e.g., various semiotic models. The path toward *individual* appropriation of these means and the processes of the formation of idealization as an individual capacity — is one of the most important objects of *psychological* research. Study of the paths toward individual appropriation of these means reveals the concrete sources of individual differences in mental activity, the individually subjective forms of which are approximations to universal, human thought.

The psychological study of the formation and functioning of thought in the individual remains fundamentally empiricist as long as it is not based on the results of logical studies of the structure and "mechanisms" of the supra-individual thought that is appropriated by the individual and transformed into forms of his own subjective activity. We find useless the efforts of many psychologists to discover *specific* psychological laws and mental "mechanisms", other than the logical

ones.[5] Of course, by "specific" one can mean various stages in the appropriation of universal logical categories or diverse subjective forms of their expression; but, these "specifics" are basically the object of a psychology that is studying various modes of individual acquisition of categories and its consequences, i.e., the different forms taken by universality. These last are not "logical"; i.e., they do not fall within the study of the universal supra-individual activity of thought as such.[6]

With great perspicacity, I. M. Sečenov once wrote that "scientific psychology cannot be anything other than a series of doctrines concerned with the origins of psychic activities".[7] It is noteworthy that theoretical innovations in the interpretation of the object of psychology have brought no significant corrections to this understanding.

Lack of attention to the logical structure of thought has had a negative effect on psychological theory and on the elaboration of experimental data. We noted elsewhere the difficulties Vygotsky had because he did not adequately distinguish between the formal and concrete forms of generalization. "Brutal" consequences for psychology (and for the dialectic) flow from this one-sided presumption that the sole existential form of the concept is its *verbal* definition. Another example is provided by the interpretation that V. A. Kruteckij gave to his experimental data.[8] Kruteckij believed that he had discovered a special form of generalization, occurring without learning as an "insight". Instead of using dialectical logic in defining this generalization as a theoretical one and then elaborating students' appropriation of this sort of generalization, Kruteckij sought explanation of this phenomenon in some sort of *innate* neural activity of children (losing sight of the fact that such a higher generalization is a function of developed human logic and not a property of the nervous system as such).

Logic thus shows to psychology the fundamental structure of thought as a supra-individual activity, as well as the tendencies of its transformation under the influence of the development of production and of culture. At the same time, logic itself uses psychological data which, in the activity of individuals, can *reveal* modes of actualization that are not yet touched by logic and not yet seen as necessary elements of the social capacity.[9] Both psychology and, in particular, the history of infant development were designated by Lenin, along with some other domains, as those which "should contribute to epistemology and dialectic".[10]

Recently, interesting propositions toward a definition of the subject

matter of psychology have been put forward by P. Ja. Gal'perin.[11] Noting, in particular, that Piaget refers phenomena of children's thought to a certain stages of "logical development", Gal'perin emphasizes that Piaget writes about logical but *not psychological* development.[12] Leaving aside the question as to the key to Piaget's position (examined above), it is to the point to show the inadequacy of counterposing the terms (concepts) of "logical" and "psychological development". The fact of the matter is that the "development of logic" in the child — occurring in the process of *appropriation* of categories — happens not according to the laws studied by logic but according to the psychological laws of the formation and acquisition of *individual* consciousness. Psychology is precisely interested in the conditions, causes and modes of activities of the child, whereby he moves from one category to another, and from one logical level to another. This transition in individual consciousness, although following the 'stages' of logical categories, falls within the competence of psychology and not that of logic, which studies the development of the categories in the history of mankind rather than in individual cognition.

When we talk about "development of the logic" of the child, we are establishing, (and should always first establish) *what* he acquires, but the question as to through *which* activities and in *which* subjective forms this occurs is a specific question that belongs to psychology and not to logic. Therefore, use of the term "logical development" does not, just by itself, exclude the need to explain this "development" on the basis of properly psychological principles and concepts.

Gal'perin sees the specificity of psychology in the fact that it studies the *orientational activity* of the individual; it does not study things and images in themselves, but the *orientation of the individual* among things on the basis of their images. "Orientational behavior . . . based on the image", writes Gal'perin, "is that specific 'aspect' of human and animal activity that is studied by psychology."[13] In this general context, thought is described as follows: "Executing a concrete activity (*predmetnoe dejstvie*) in order to find out what happens if such an activity is actually carried out — its orientational execution — constitutes the isolated act of thought."[14]

A description of the psychic as "sizing up the level of images", revealing what can in fact be achieved — i.e., orientation on the basis of

images — seems to us characteristic of the psychological approach to the subject's activity.

Such an approach fully agrees with the understanding of psychology as a doctrine that centers on the "*origin* of psychic activities". One or another orientation in concrete situations is not innately *given*. First the appropriate concrete activities have to be set up; then they are transformed into thought; and only then is it possible to "size up".[15] These transitions are effected through learning (*obučenie*).[16] Many of the investigations of Gal'perin and his colleagues illuminate the special traits of this process of learning, its various types, and the corresponding variety of orientations that are involved.[17]

According to the general position of Gal'perin, the entire human psyche comes to man from outside.[18] Consequently, a man is also given all the *categories* of logical thought. The psychologist and educationalist must know their structure, so as to study and then to develop children's thought.

The questions on the relationship of logic and psychology were a special object of discussion by Gal'perin and D. B. El'konin in an article devoted to analyzing some ideas of Piaget.[19] In particular, they disagree with his statement that "logic is the sole or at least the main criterion of thought".[20] The logical, from their point of view, reproduces some general traits of reality, which as a whole cannot be reduced to logical relations. They see reality as possessing mathematical, physical, chemical, and other properties. It is important for thought to be logical (here meaning formal or mathematical logic), but it is even more important for it to have an "intuition for the process", and to be able to reach the "logic of the things themselves". The ideal for thought is not just to have well-organized knowledge and good methods for carrying out formal-logical operations; but also to have a good 'school' and, most importantly, to have an orientation toward essential relations. These relations have to be extracted from the mass of non-essentials, and also detected in the concrete and particular forms of their occurrence.[21]

One cannot but agree that mathematical logic does not reveal the nature of thought, since the execution of formal-logical operations is not what thought is — and, on this level, the critique of Piaget is fully justified. However, Gal'perin and El'konin assert that *in general* logic is not a principal criterion of thought, since reality, in addition to "logical

properties" supposedly possesses mathematical, physical, and other properties; and this cannot be accepted. As a matter of fact, there are *no* "logical properties" that things might possess alongside their other properties. Things do have mathematical, physical, etc. relations to other things, and in each of these fields one finds the essential and non-essential connections, the general and the particular, etc., which are studied by the appropriate sciences. Only these particular sciences can penetrate to the "logic of things themselves". Logic as a specific science — like epistemology and dialectic — studies the universal forms (categories) of *thought*, which enable man to reflect this "logic of things", to detect in their properties the essential and non-essential, universal and particular, etc., during the study of mathematical, physical and other relations. Only such mathematical, physical, etc. thought that is *logical* (i.e., elaborates its material in terms of logical categories) can really reflect its object. Thinking as "intuition for the process" in the "logic of things themselves" cannot be distinguished from, or opposed to, logical thought, since only through logical forms of thought can one penetrate to the content of things themselves and to their essential relations.[22] It is pointless to talk about some purely "logical" movement of thought, isolated from the concrete elaboration of empirical material in the concept — these are one and the same process of conceptual activity.

Thus, it is only by giving an individual a concrete generalization that one may expect the individual to *orient* himself among the essential properties of things and select them from the mass of non-essential properties, i.e., to possess the "intuition of the process". The criteria of such a generalization (as of all other categories) are provided by *dialectical logic* with the main criterion being the supra-individual activity of man.

What Gal'perin and El'konin seem to forget is that a greater and more complete mastery of the criteria of *this* logic makes thought able to be more logical in that it can reach the real connections of things, i.e., their "logic", and makes us capable of attaining the "intuition of the process".

The weakness of Piaget's position lies not at all in choosing logic as the sole significant criterion for thought, but in his exclusive dependence not on dialectical logic but on a mathematical logic, which studies only *isolated* aspects of theoretical thinking.

Let us examine yet another question of importance for a correct understanding of the correlation of logic and psychology. The fact is that different concrete abstractions (mathematical, physical, etc.) are produced via definite concrete activities. Neither the particular sciences (mathematics, physics) nor logic *studies* the objective structure of these activities, mastery of which reveals to man the essential relations of things and provides concepts about them. Research into these activities (e.g., activities through which the child discovers the general form of number) is a matter of *psychological analysis.* Such an analysis uses the data of the particular sciences (mathematics, physics, linguistics, etc.) and also logic's doctrine on categories, but in its goals and methods it remains psychological.[23] To the extent that such research is systematically carried out in *theoretical* form, it is often called logical; but it is clear that such a name is only a metaphor that stresses the analytic character of the study of the objective structure of the activity; it does not characterize the content and goals of such research, that remain essentially psychological.[24]

It is true that up to now the methods of studying the objective structure of individual activity have not been well developed. It is possible that the development of such methods should be done by a special psychological discipline, one at the interface of logic and the other branches of psychology.

2. PRESUPPOSITIONS FOR NEW METHODS OF CONSTRUCTING EDUCATIONAL SUBJECTS

We detailed above the views of L. S. Vygotsky, S. L. Rubinštejn and J. Piaget, where a recurring theme is the critique of the empiricist theory of thought, as well as certain new approaches to understanding its nature and the conditions of its formation. A series of propositions advanced by these psychologists can serve as solid foundation for the elaboration of a *contemporary* theory of learning in school. In addition, there have recently been a number of philosophic, psychological and educational studies directly criticizing the existing modes of constructing educational subjects. In many of these works one can sense that the authors are — consciously or spontaneously — groping toward an

educational process that would correlate with the dialectical-materialist understanding of knowledge.

We will later look at some of these works. First, however, we have to describe briefly the position of Hegel who was the *first* philosopher and educational theorist who consciously and consistently espoused learning based on a dialectical theory of thought. Some of his statements relate directly to our theme.

Hegel constantly stressed that conceptual thought originally takes as its object something *general* or abstract, although ordinary thought is first directed toward some concrete singularity.[25] Accordingly, learning also "reasonably must begin . . . with the most abstract, since only it can touch the child's soul."[26] Hegel also notes that in *early* training children attain only "*representational* thought"; they do not yet understand the internal bonds of the world. However, some understanding of the world is present in such children and one cannot be satisfied with saying that they have only sense-impressions. Here is Hegel's comment: "Even in antiquity children were not confined to the sphere of the sensible. The spirit of modernity rises even more above the sphere of the sensible. Whence the suprasensible world is in our day even closer to the conceptions of the child."[27]

Relative to training in various disciplines, he proferred the suggestion that the initial subjects of study have to be chosen with an eye to a dialectical understanding of the abstract and concrete, and the universal and particular. For instance, in the study of *physics* the diverse properties of nature have to be freed "from their multifarious involvements in concrete reality, and presented in their simple, necessary form".[28] Training in *geometry*, then, should begin not with concrete spatial images, but with point or line, and then triangle and circle.

Relative to the notion of triangle, the following must be said. Examining the philosophy of Aristotle, Hegel points out that Aristotle distinguishes the formally universal as merely abstract ("pure construction of thought"), which corresponds in reality to nothing in a definite and simple form, from the basically or fully universal, to which corresponds something definite and simple. For example, there really exist figures like the triangle, square, parallelogram, etc. But, the triangle could also be found in the square and in the other figures. The triangle is thus a *reduction* of *every* figure to simple determinacy. This is why it

is the first, truly universal, figure. "Thus", writes Hegel, "the triangle, on the one hand, stands alongside the square, pentagon, etc., while, on the other — and here lies the greatness of Aristotle — it is the basically universal figure."[29]

This passage demonstrates well the sense of the truly universal as distinct from the formally general. It also shows why Hegel includes the triangle among the figures with which one must begin training in geometry. The triangle is the simplest figure, to which one may reduce the others and from which the others may be derived.

In counterpoise to the narrow sensualism and empiricism that dominated education in his day, Hegel consistently developed the viewpoint that basic to education in conceptual thought is the truly abstract and the really universal (and not the sensible concrete and not the formally general). The abstract as spontaneous thought should be brought out as early as possible in a child's education and he should not be kept at the stage of sense impressions. These ideas have remained in force since then. To our mind, they can still serve as theoretical framework for structuring subjects for learning in school.

Let us return to the present. The problems of generalization and concept formation in education have long remained without special analysis from the viewpoint of dialectical logic. There are, of course, a number of dialectical clichés used in educational psychology, but they are more often than not misunderstood. Lenin's famous statement about the generally dialectical course of knowledge (see above) is often understood in a crassly empirical-sensualist sense. The study of the relationship of abstract to concrete is carried out with the essence thereof being crushed beneath the traditional psychological understanding of the rational and the sensual.[30] The bond between education and one of the most important categories of dialectical logic — the process of ascent (*voschoždenie*) from abstract to concrete — has often been denied.[31]

A turning-point of sorts is to be found in one of the works of E. V. Il'enkov, dedicated to the question of how to teach thinking in school.[32] We find there a short characterization of dialectical *thought*, discovering and rationally solving living contradictions. Also exposed is the link between the formation of such thought in students and educational activities aimed at fostering students' creativity. The traditional educa-

tional system is critically examined and its cold and formal presentation of scientific results without reference to how these results were acquired is exposed. It is shown that the traditional system ignores inner conditions and presuppositions, which alone give a concrete meaning to what appear as the "absolute truths" of textbooks.[33] Such a traditional approach cannot be effective in forming in the students a basically creative attitude toward the science.

Such a situation is connected with the fact that many authors of texts are themselves "at an obsolete scientific level" of understanding of the categories of abstract and concrete, general and particular, rational and sensible. For example, the concrete is very often confused with the immediately given, while it is well-known from logic that such "concreteness" is "only a mask, which hides the most insidious enemy of concrete thought — knowledge that is abstract in the full sense of the term; it is something empty and separated from life, activity and practice".[34]

Il'enkov stresses that education of creative capacities in students requires careful reconstruction of the whole education process "on the basis of logic and the epistemology of contemporary materialism". This requires, above all, an education that "contains in condensed and abbreviated form the actual process of the birth and development . . . of knowledge".[35] Of course, the student cannot independently "invent" all that has been accomplished by people; but he has to *repeat* in adequate form the discoveries of people of previous generations. In such an education, the general nature of any concept has to be exposed to the student — through his own activity — before any of the particular manifestations.

Il'enkov calls upon philosophers, psychologists and other specialists to undertake the complex study of the application of dialectical logic in education. In another work, he continues the analysis of these problems from an epistemological viewpoint, extensively exposing the tremendous and specific role of imagination in the activity of our conceptual thought.[36]

An analysis by A. N. Šimina of contemporary (Soviet) psychological-educational writings shows that the concepts of abstract and concrete that they use differ significantly from the dialectical-logical understanding of these categories, and look like borrowings from the tradition of Locke.[37] We find that the concrete understood only as sensible-

concrete is widespread in educational practice and educational psychology.[38] Šimina has shown that many educational works use the category of "living intuition" not in the dialectical but in the empirical-sensualistic sense.[39] She also found data indicating that, despite all the declarations about "activity", the leading educators factually are not using the *principle* of activity for explaining the essence of education.[40]

A series of investigations of activity as the basis of thinking have been carried out by a group of Moscow logicians (V. M. Rožin, A. S. Moskaeva, *et al.*). They stress, in particular, that traditional formal logic could not study the *links* of the forms of conceptual activity with certain objective contents. As a consequence, it cannot study the main peculiarity of thought — its orientation toward isolating units of the content from the general "pool" of reality, and further "development" along the lines of this content. All traditional logical research assumes such content as given. In other words, this logic does not study the *emergence* of concepts or their concrete sources and remains entrapped within the sphere of semiotic forms, concentrating its attention on the formal rules of inference.

The basic functions of the semiotic forms of thought can be understood only in correlation with a certain type of objective content, *represented* by this form. Modelling "development" in semiotic forms "absorbs" into itself the experience of the objective acts and presents them in abbreviated form. The basic structure of the concrete, objective acts cannot be reconstructed, if what is given is only their semiotic form. It is necessary to follow the whole "history" of different solutions of one and the same problem, in order to see in the abbreviated forms of thought its original course; i.e., one should uncover the laws and rules of this abbreviating and then "recapitulate" the full structure of the processes of thought being analyzed.

Such a logic, that studies the activity of discovering certain types of content of knowledge and their formulation in the historically multi-layered semiotic systems, could be called contentful-genetic logic. On the basis of this initial view, a group of logicians has developed and described concrete methods of analysis of the various levels of conceptual activity, using a variety of empirical data.[41] Often the object of study was the structure and development of preschoolers' conceptual activity in solving mathematical problems.

This group of works demonstrates the untenability of the *naturalistic*

interpretation of the content of knowledge, and shows the complex structure of such forms of it as the concept. They rightly stress the need to use logic in the construction of educational objects and in the defining of their contents.[42]

Of great importance for psychology and education, in our view, are the logical investigations of V. S. Bibler, where there is a consistent and profound elucidation of the role of activity in the formation of concepts, and of the specific function of the sensible-concrete and conceptual experiment in theoretical knowledge (see our use of this work above[43]). M. K. Mamardašvili's book contains a detailed analysis of the sources of the "epistemological Robinsonade" and the naturalistic understanding of knowledge. It also shows the social nature of all forms of thought and their active role in the process of coming into contact with reality.[44]

The need for a contentful generalization of educational material flows — in our view — from the central principle of our psychology, according to which, at the basis of all our mental functions, including thought, lies the real object-oriented activity of collaborating people (the works of L. S. Vygotsky, S. L. Rubinštejn, A. N. Leont'ev, B. G. Anan'ev, D. N. Uznadze, A. V. Zaporožec, P. Ja. Gal'perin, D. B. El'konin *et al.*).[45] An important concretization of this principle is the assertion that our material and spiritual products *objectify* the internal psychological conditions of their realization.[46]

If the forms of mental activity — concepts in particular — are regarded as the idealization of certain modes of concrete activity, and if in the products of activity one finds the conditions of their social actualization, that determine the future behavior of man, then such attitudes lead inevitably to discarding of the naturalist conception of acquisition and, in the final analysis, to overcoming of passive sensualism, conceptualism and associationism. Thereby it also becomes clear that the absolutization of formal generalization is unjustifiable. An alternative to it is the generalization of a contentful character. Of course, such conclusions assume an actual application of the principle of activity in the solution of educational-psychological problems, and not a verbal recognition with no follow-up.

The problem of the relations of everyday and scientific concepts has drawn the special attention of L. S. Vygotsky (see above). His research

of the 1930s was continued under the direction of A. N. Leont'ev by a group of Kharkov psychologists (V. I. Asnin, L. I. Božovič, A. V. Zaporožec, and others). The results of this research showed the specific role of childrens' activity as basic to the formation of generalizations and concepts, and oriented psychology toward a study of that *specific* activity, within which arise *scientific generalizations and concepts.* Theoretical expression was given to these results in a paper given by A. N. Leont'ev in 1935.[47]

Leont'ev stresses above all the untenability of associationist psychology with its efforts to present generalization according to the "classical schemata of formal logic". In reality, behind each generalization there is a special activity — an activity of transition, a movement of thought from one content to another. Only in the form of *transition* from one concept to others can reality be represented. "Every concept — as a psychological structure", says Leont'ev, "is the product of an activity . . . One can organize, construct in the student an activity by putting him in an appropriate relationship with reality which would correspond to the concept. It is not because of the concept that the child is capable of acting conceptually, but, on the contrary, he acquires concepts because he starts to act conceptually, because his practical acts are "conceptual".[48]

Therefore, in order to form concepts in the child, one has to find and form in him *adequate* activity. Basic to the *scientific concept* is the *discursive activity* of the child, allowing him "to possess the concept in its verbal expression".[49] But, how does one go about constructing this activity? Leont'ev notes that the general condition for this is a change in the relationship of the child to reality. But, he does not supply the concrete traits of this process in his work.

Such an approach to the problem of the concept breaks with the conceptualist interpretation but does not carry the critique to its logical conclusion because it gives only a schematic account of the activity that is adequate to the concept. The assertion that discursive activity is specific for scientific concepts is close to the traditional identification of "theoretical" and "discursive", on the one hand, and, on the other, contradicts the idea expressed in the same paper that the very practice of the child can be "conceptual." The latter idea requires clarification of the *concrete sources* of discursivity and, consequently, a special analysis

of the real concrete acts, the idealization of which forms the concept in its mental form.

It is known that an important step forward toward exploration of these sources was taken by Leont'ev and Gal'perin, in their later elaboration of the theory of interiorization. But, because of an insufficient attention of these authors to the *logical* aspect of the problem, even this theory cannot give a definite answer to what specific content is reflected in theoretical generalizations and concepts, and via which activities. What remains unexplained is the specificity of those concrete activities which expose in the material the universal genetic ground of a certain system of things.

A more definite characterization of these activities is to be found in the article by Gal'perin, Zaporožec and El'konin. There they emphasize that existing methods of education are still locked into a narrow sensualism and naturalism. The influence of sensualism is to be found, for example, in the fact that children are *in the first place* "made aware of the [physical] traits or properties of objects which can be directly sensed and detected through varying the properties".[50] Such recognizable traits, however, are not at all enough to allow an orientation among the phenomena and objects being studied.

The Gal'perin *et al.* article stresses that in the mastery of one or another field of knowledge the initial data cannot be represented by the empirical traits of the material but by its "limit units", i.e., such units "into which the given sphere of reality is divided at the contemporary level of scientific knowledge".[51] These units are discovered by "rational-genetic methods", applicable to any structures in the given field. The specificity of the activities making up this method consists in the fact that they *reproduce* (model) such units in a novel (as compared with the initial state), but necessarily material, form. Defining the "limit units" and the corresponding activities for each concrete domain is a matter of special research.

Of great import in this context is the assertion that the "limit units" of the material are distinguished *genetically* by being reproduced in some sort of material *models.* Psychological orientation according to these *basic units* (that make up the field) and the laws of their association and, first of all, according to the methods of defining the latter and the former is characterized by Gal'perin as the third type of orienta-

tion.[52] Such an orientation gives a child an understanding of on what grounds a particular activity is distinguished and its structure defined. The chief means for forming this understanding is the use of socially elaborated *standards* and *measures*, with the help of which the qualitatively diverse aspects of the object are distinguished, i.e., those basic units which are not given to man in immediate perception. Thanks to this, the child makes the transition to *mediated assessment of objects*, and he develops "his own line of theoretical conduct".[53]

From Gal'perin's viewpoint this third type of orientation is connected with the transition of the child to mediated, theoretical thought which is dictated, in particular, "by organized mastery of the activity of using standards and measures — these basic tools of intellectual activity".[54]

The research of Gal'perin and his colleagues has uncovered an internal link between a certain type of orientation and the means for constructing educational subjects. In the traditional mode of constructing them, separate phenomena were studied *before* the general rules ("principle of induction"). The formation of activities modelling the basic units of the material made it possible to show to the students the general rules in the very process of their production, i.e., to overcome the "inductiveness" while preserving the unity in the study of the general and particular. In turn, all of this required a profound change in the existing methods of organization and presentation of educational materials. "Such a reworking of the educational subject", writes Gal'perin, "was the main difficulty in realizing the third type" [of orientation], but presentation of material according to this type of orientation "most closely approximates the properly scientific and contemporary understanding of it"[55].

The characteristics of the "limit" or "basic units", as contained in Gal'perin's works, describe in a logically undeveloped and metaphorical form what we defined above as the real, contentful abstraction that is the initial "cell" of the system under study. Only a careful *logical* understanding of the peculiarities of the "units" can clarify their adequacy for scientific presentation of the subject. It is clear, too, that such a presentation requires special modes of constructing educational subjects —modes that differ significantly from the traditional ones. Mastery here will occur not through orientation "according to laws of association" of

the basic units (this term is purely metaphorical), but through an ascent from the abstract to the concrete. Mastery by students of the initial abstraction and its application in the process of ascent is inseparable from the "rational-genetic methods" which make possible a valid detection of the contents of the corresponding concepts.

Thus, it seems to us that an actual carrying out of the third type of orientation, as described by Gal'perin, requires the forming in the students of abstraction and generalizations of a *contentful* character, along with their mastery of *theoretical concepts.* By paying attention to these aspects, one can construct educational subjects, in a study of which the mastery of the concrete universal is basic and combines with the consequent acquisition of the various particular manifestations. Only in this way can one overcome the narrow "principle of induction" in the development of educational materials.

Use by the student of socially elaborated standards is an essential condition of the emergence in him of theoretical thought as a mediated one. The basic function of these standards is to help a child to *reproduce from the outset* in his activity the *universal* properties of things. It is precisely this contentful aspect that gives the child's mental activity its mediated character. This last aspect is as yet insufficiently developed in the works of Gal'perin.

In recent years our general psychology developed a study of thinking which has a great impact on discovery of the mechanisms of formation of contentful generalizations and concepts in the process of learning. Eminent in this respect are the works of S. L. Rubinštejn and his colleagues (cf. above). We should also mention the work of M. S. Šechter who asserts that the content of concepts, although it is non-empirical, still has traits of the *images.* Conceptual images arise on the basis of special activities, replicating the object of the concept not in the form of some set of its elements, but as a whole. Such images are formed by man through conceptual construction without immediate reference to the corresponding traits of the concrete things.[56]

In our view, what is important here is emphasis on the fact that the content of the concept is "not an empirical image" of reality (in the epistemological sense of the term "image"), and also the assertion of their holistic character. This is why the concept reflects very complex but internally coherent structures of objects. The wholeness is repro-

duced in a special activity, the *developed form* of which appears in "conceptual construction" but the ultimate roots of which lie in *concrete* activity.

Interesting data are to be found in O. K. Tichomirov's book that portrays conceptual acts as acts of exploration. He finds that such acts can establish an *interaction* among elements of the situation, so that traits are revealed that are not available in immediate reflection. It is also characteristic that verbal expression of problem-solving is preceded by a complex exploratory activity that establishes "mediated products in the form of non-verbal meanings".[57] In other words, verbal fixing of some "meaning" not given in sensation is just a special and final case, but not the sole form of its expression in thought.

In some educational-psychological works we find special study of how the degree of mastery of educational materials depends on the type of generalization that occurs. For example, in the works of E. I. Mašbic training in the solving of geometric tasks was carried out according to two methods.[58] In the first case, the students solved *separate* tasks with varying of concrete conditions and of the ways of expressing some mathematical relations. The generalization needed to solve these tasks was formed slowly and progressively, but remained incomplete and inflexible. In the second method, the students were shown models of how the separate cases were solved and the general structure of the proof was explained; they were then able to apply them to separate tasks quickly and surely. "The students", writes Mašbic, "master the mode of solution after the solution of three or four model tasks, following a path that the students in the first group discovered only when very well prepared."[59]

The works of V. A. Kruteckij and S. I. Šapiro[60] note the fact that gifted students of mathematics generalize the solution on the basis of the analysis of one or a few tasks, while the less gifted use a totally other form of generalization.[61] In Mašbic' study these different types of generalization — we think this is the difference between theoretical and empirical generalization — are used to reveal two methods of education, which have different degrees of efficacy. It is remarkable that the second method allows almost *all* students to generalize the solutions correctly, following the same path as that taken by the most talented and gifted students.

Interesting data on the formation of contentful generalization as special form of activity is to be found in the works of A. I. Meščerjakov, working on the development of thought in deaf-mutes.[62] Here one sees clearly that a basis of generalization lies not in a formal comparison of the external traits of objects, but in a *specific* concrete activity, revealing and reproducing a definite function of things within some real system.

The works of T. V. Kudrjavcev mention the advantage of such generalized forms of problem-solving, which can also serve as means for successful action in some particular situations.[63] The significance of studying the process of forming in students concepts as "stairs" of *ascent to concrete knowledge* is stressed by A. M. Zolotarev.[64] N. P. Erastov emphasizes that educational organization has to feature those processes of thought that are connected with the ascent from the abstract to the concrete.[65]

In this way, our psychological writings are tending more and more to reveal that contentful generalization is one of the possible bases of new means for constructing educational subjects.

Abroad, both general and educational psychology have been concentrating on what we have called *empirical generalization* (see, e.g., the description of the process of generalization and concept formation in one educational dictionary, and in the works of R. Brown, E. Holas, Al. Roška[66], and others). In almost all these works the discussion about concept formation centers on empirical concepts that serve for classifying and cataloguing objects (cf., e.g., A. Pinsent, G. Claus and H. Hiebsch, L. Kelemen[67], and others).

At the same time, some psychologists abroad depart from the traditional, formal-logical interpretation of the formation of generalization and concepts. Thus, W. Metzger notes that increase in the "precision" of the concept is linked to essential shifts in its content, with its "restriction" (*Einengung*) and simultaneous "expansion" (*Ausweitung*) occurring during the interaction of a concept with others.[68] Of special interest is the work of the American psychologist, Jerome Bruner, who is trying to find new ways of constructing educational subjects, practically rejecting some traditional logical ways of understanding the general and the particular.[69]

Bruner stresses above all the fact that the mental activity of students and scientists are cut from the same cloth (the difference is one of

degree not of type). Hence, the educational subjects should be laid out in accord with the methods of science itself. "The student studying physics *is* the physicist, and it is therefore easier to study science by acting like a scientist . . ."[70]. Originally, students have to master the basic concepts that make up the *theory* of a given object, to arrive at an understanding of the general principles which, in turn, make it possible to explain the separate phenomena. "To understand something as a special case of a more general law — and this is what one has in mind when one speaks of understanding basic principles or structures — means to possess not only some concrete content but also the means for understanding similar phenomena that we might meet."[71] It is precisely this "means for understanding" that has to be formed in the student through his mastery of educational materials. However, in the opinion of Bruner, educational psychology has only lately come to study this problem.[72]

These propositions show that the current method of presenting science is a movement from the general to the particular. Bruner introduces some data that tend to show the utility of a construction of educational subjects that would take account of such a method. He, however, joins the other psychologists and educators in failing to provide an adequate logical analysis of the relation between "general" and "particular"; he fails to show the limits of traditional formal logic.

In a collective work, Bruner, Goodnow and Austin assert that a "true concept" shows itself in a correct *recognition* of some particular cases.[73] Here the concept is seen in its traditional, formal-logical form. At the same time, Bruner tries to explain a sort of "symbolic concept", distinct from a simple discrimination of perceptual traits. The former establishes the *relations* among the existential conditions of things. Though such a concept is based on the interaction among the sense-perceptible traits, its content is not subject to direct sensory grasping — as, e.g., in the establishment of the "notion of proportion".[74] Bruner is here departing from the traditional absolutization of empirical concepts and acknowledges the need for a special logical interpretation of concepts that reflects relations (more exactly, correlations) among sense-perceptible properties. But, such an approach requires a conscious and explicit use of the dialectical characterization of theoretical concepts, that is lacking in Bruner's account.

We should remember that Bruner's ideas have found some resonance among American and English educators (cf., e.g., W. Wall, A. Golett and J. E. Salder[75], and others). Some of them stress that students have mainly to acquire the "simple unitary form" of a given science. On such a basis one then can develop the instructions enabling the student to touch the essences of subjects.[76]

We turn now to another important question. Appearing before the XVIIIth International Congress of Psychology (1966), B. Inhelder declared that Soviet psychologists (A. N. Leont'ev and P. Ja. Gal'perin) "understand the process of knowledge through models that rather imitate reality than change it".[77] It would seem, then, that "any knowledge is an image or reflection of reality". According to Inhelder, the conception of knowledge that "continues to consider knowledge exclusively as a reflection of reality" is close to the empiricism of the 19th century.[78] She compares this position with that of Piaget, for whom the concept is the "result of a transforming of reality, and of the assimilatory activity of the subject".[79] She goes on to summarize Marx as saying: "Knowledge is the result of the active involvement of the subject in the process of changing reality."[80]

Let us look at the validity of such a "reproach". It first has to be stressed that the true foundation of Soviet psychology in general and of Vygotsky's school in particular is the dialectical-materialist epistemology, according to which thought is based on material activity which *transforms reality*. The appropriate ideas of Marx, Engels and Lenin have been adequately and deeply developed by Soviet psychologists (cf. the previous chapters on Vygotsky, Rubinštejn and others). In his address to the same Congress, Leont'ev showed that one of the central problems of Soviet psychology is the "problem of understanding the internal, ideal conceptual activity as a derivate of external, practical activity".[81] One can only welcome the fact that, in some of its basic premisses, the Piaget school also attends to the importance of transformatory activity in the formation of thought.

However, in Soviet psychology the principle of activity exists not all by itself but in conjunction with the principle of *reflection*. The external and internal characteristics of objects are detected and reflected in the sensible and conceptual *images* through various forms of activity and not just "contemplation" (cf. Ch. VII above). Explaining the nature of

reflection, Leont'ev says that "it is the result of an active process" and that its emergence requires "activity of the subject in relation to the reality reflected". He refers directly to the fact that "this assertion is in contradiction with the old sensualist ideas and with some more recent [similar] notions".[82] As is clear, the old sensualism did not contain a principle of activity, and some recent absolutizations of this principle separate it from reflection, and cannot internally link the two.

Inhelder's position manifests one of the "recent notions", according to which knowledge understood "only" as reflection is supposedly an anachronism. "Reflection" and "image" are *in advance* taken here in their traditional sensualist meaning, which ignores the historically accumulating transformatory activity of social man. However, recognition of an abstract principle of activity without simultaneous understanding of the fact — as Leont'ev so adequately expresses it — that "activity itself is a subject of the influence of autonomous properties of the objects"[83] necessarily leads to operationalism and ultimately to idealism.[84]

All the same, Inhelder's "reproach" has some foundation. The fact of the matter is that in our (especially educational) psychology the principle of activity and its links with that of reflection are often given in a sketchy way. The description of the process of concept formation often factually follows the classical sensualistic schemata. We see this when the "adepts" of the theory of activity, in polemics with other psychologists, do not carefully delineate the specific traits of the concept both as image and as activity.

The current elaboration of new methods for constructing educational subjects could be based on logical-psychological ideas but also on suggestions coming from educational experts who are close to the dialectical interpretation of the nature of the concept. In this context we should mention the work of N. Izvol'skij who sees man as having a real concept only when he is able to understand the *emergence* of the corresponding object and can construct it.[85] "Only then", he writes, "when the emergence of the object is clear to the student, can we say that the desired degree of clarity has been attained and that the student has the concept of this object."[86]

When there is coincidence of the method of construction of a thing and the understanding of its essence one should be able to produce it

surely and inevitably. For instance, for the proper formation of the concept of the square one has to establish the "process (or construction) which illuminates the question on the angles of the square, so that it becomes immediately clear that it is inevitable (and not just for the square before me) that the angles of the square be right angles". To study the triangle "it is important to find a process for forming the triangle that necessarily generates its properties".[87] Following this approach, Izvol'skij has come up with an original method for teaching geometry which still retains its importance if approached from a dialectical viewpoint on the process of concept formation.

M. V. Potockij's interesting book on the teaching of mathematics is permeated by the important idea that "*correct understanding of mathematical ideas is possible only on the basis of their emergence, of their real causes, and of their problematic character which, through abstraction, leads to the corresponding mathematical theories.*"[88] In the process of teaching with the help of this principle we clearly see the psychological complexity of questions that are simple from a mathematical viewpoint.[89]

Using a series of examples, Potockij shows the great possibilities that open up before a student who masters the *general methods* of solving problems or proving theorems. What needs, e.g., three different and unrelated proofs in elementary geometry can be proved with one in projective geometry.[90] It is clear that possession of such a [general] method facilitates proof of "special" theorems; but, for this, one needs other methods of the formation of educational subjects, than the traditional ones.

Currently, such new methods are being developed by many experts and teachers. For example, A. M. Myšljaev has been doing interesting work on the teaching of mechanics.[91] Similar forays into use of the notion of "from general to particular" are to be found in P. F. Atutov, V. Fedorova, D. Kirjuškin and I. I. Logvinov, P. Ivanov, F. Klement, M. Andrušenko[92], and others. In this way, the materials of many logical, psychological and educational investigations allow us to formulate the following two propositions:

First, the formation in students of contentful generalization is an important means for bringing teaching methods up to the level of contemporary science; and

Second, in the practice of teaching, the presentation of knowledge according to the principle "from general to particular" (from the *contentful general* to the *conceptually inferred* particulars) is proved to be feasible. The task that remains is an all-round development of concrete means of constructing the appropriate educational subjects.

3. SPECIAL CHARACTERISTICS OF REALIZING CONTENTFUL GENERALIZATION IN LEARNING

Many complex scientific problems have to be worked on in order to arrive at an application of dialectical logic to the education of students and to forming their theoretical thought. We suggest that now one can put forward the *hypothesis* that the mastery by students of a certain content of educational subjects can serve as foundation for forming theoretical thought, as above, through: *first* establishing contentful abstractions and generalizations that would serve as "cells" of the system, and *second*, the ascent from the abstract to the concrete.

In the first stages of grounding and confirming this hypothesis, special importance belongs to the question on the means for constructing *contentful generalization* in the process of the student's appropriation of the educational materials.

We looked at the main traits of such a generalization above, and we saw that its essence lies in the *construction* of universal, unitary forms of the particular occurrences, by *explaining* the emergence of the content of the concept.[93] The actualization of this principle in *education* requires that the child represent in specific concrete actions and fix in models such relations among things as are the universal ground for the particular phenomena in the system studied. Distinguishing and concretizing the initial relations in a certain way, the students have to follow these links of the universal with the particular, i.e., they have to work with the concept. Mastery of the educational material containing the concept in question will occur in the process of transition from universal to particular.

The formation of students' generalizations and the corresponding concepts exceeds the capacities of traditional epistemology and psychology. Since at the basis of every concept there is a *specific activity*, which from the very beginning reproduces some universality, this

excludes the sort of education that is based on conceptual schematization of the formation of the concept. Exposure of the *links* among universal, particular and singular reveals the content existent only in the concept and unavailable in sense data.[94] Narrow sensualism is thereby excluded and associationism as "accumulation of images" disappears as soon as it is clear that revealing of the universal through *action* underlies the mastery of the particular.[95]

Toward the experimental confirmation of our hypothesis, we must attend to the fact that contemporary education has to be oriented to the traits of culture and of science that characterize it as a whole system, where the basic achievements of the past are "summarized" and "superseded" (*snjatie, Aufgehoben*), including all the cognitive modes that belong to the period of accumulation of data. To "supersede" here means to *preserve* in a form that is specific for a higher level of development. This means that what is "superseded" has more importance within a developed system than when it was first formed.

This circumstance is simply not attended to in the content and methods of education that are in use today. Ja. A. Komenskij once summoned teachers to teach their disciples "from Heaven and earth, from oak and beech". Knowledge of the natural environment as developed by empirical naturalism has to be directly imparted to the students. The separation between ordinary knowledge and the scientific knowledge was not felt at that time, at least not to the degree of causing counterposing of these two modes of thinking. Pestalozzi asserted that "intuition by man of nature is the sole true foundation of education" (note the "sole true"!). In the previous chapters we showed that these views are very alive in educational-psychological theories, even though scientific knowledge has acquired its own specificity and has created its own version of "reality".

The individual who masters contemporary science does not have directly accessible nature before him.[96] As M. K. Mamardašvili writes, now "the object of knowledge is mediated by science, as by social institutions, by its history and experience . . . — certain aspects are selected, and given to the individual who enters science in the form of already *generalized, abstract content* of his thought".[97] If the school wants to introduce the student into the field of science, then it not only should not conceal its generalized and abstracted character, but it has

also to provide these abstractions and generalizations on the fully *contemporary* level, described by dialectical logic.

In other words, psychologists and educators can no longer speak of "knowledge" in general. In order to free themselves from *naturalism* in the understanding of the object of appropriation, they must pay attention to the specificity of the scientific *forms* of knowing and scientific approach to reality. The scientific character of educational materials is defined by the methods whereby imparted knowledge becomes the content of theoretical thought. Therefore, from the beginning, students have to be provided with materials, the mastery of which forms in them *contentful* abstractions, generalizations and concepts. One should not, of course, infringe on the role of experimental and factual data ("empirical information"). They do not have, however, an independent significance, because from the very beginning they are taken in the function that gives them general character, in the form of contentful abstraction and generality.

Of course, even in traditional education most information is mediated — through books or experimental procedures. But, as we saw above, such mediation often remains at the level of pure description and formal generalization, not the real abstractions that are the source of *development* of some system of phenomena and not those contradictions that are resolved in the ascent to the concrete.

The good intentions of traditional psychology and educational theory to distinguish education from the process of general human knowledge and the logic inherent in it, led to the opposite result — to the ignoring of the specific possibilities of education as the special and sole path of initiating the students to *contemporary* methods of theoretical thought.[98] In the practical activity of teaching there remains a tendency to naturalization of the objects and reinforcement of the empirical generalization that marked the previous epoch in knowledge. The corresponding ways of constructing educational subjects have become ridiculous.

The process of appropriation of scientific knowledge by students (education) is not identical with the cognitive activity of scientists, and the content of educational materials is not identical with the set of accumulated results of science. At the same time, many facts speak in favor of a *coincidence* between the processes of reasoning of the

student and that of the scientist.[99] The concrete forms and stages have to be researched since they are not at all clear. We think that one cannot forget the distinction of scientific activities suggested by Marx.[100]

Thus, [scientific] *research* moves from the sensible-concrete variety of particular cases to their universal, essential bases. *Presentation* of the same objective content, *begins* with this universal form which is already acquired historically and logically as a universal form of the mental reproduction of the particular. To our mind, the content and modes of developing of *educational materials* have to be similar to a *presentation* of the results of research; i.e., it must show the student the real movement that begins with some simple universal form.[101] Discovery of this form enables the student immediately to follow in "pure" form the development of the material in its particularities.

Educational subjects that are constructed in accord with the scientific elaboration of the material should guarantee the formation in the student of the contentful abstractions, generalizations and concepts. Only thus will there arise in student's *own* thought the premisses for a theoretical relationship to reality.

Existing educational subjects also contain the *results* of science. But the question lies rather in which results and how they are presented. In schools (especially at the elementary level) the students are *mainly* supplied with the results of the empirical, classificatory stage of science. At the same time, the educational subjects of high school contain a lot of information on the laws of one or another field of knowledge (physics, chemistry, biology, etc.). However, formal identity is the only principle needed to master this information. Using only *understanding*, the student is able to establish 'genus-species' dependencies of things. Such thinking consists mainly in *abstracting* and *distinguishing* one from the other the essential and accidental, as well as the particular and the universal.

Educational materials for mere understanding present no problem for defining the internal links between content and the forms of thought. But, such thought is *abstract*; it separates the essential from the accidental and gives it an appearance of formal universality — but this is only the *appearance* of the theoretical character of learning. This is why traditional psychology and educational theory identified "theoreti-

cal" as a synonym of "abstract", and the development of abstract thought (in the form of *understanding*) was advanced as the main task of education.

The existent modes of constructing educational subjects did not reproduce the "real movement" of the material for two basic reasons. First of all, these methods failed to take as basis the ascent from the abstract to concrete, within which the universal and particular are identified. So, even if these educators and methodologists had been given scientific materials, that follow the "real movement" of the object, they would not have known how to transform them into an educational subject.

The second reason is bound up with the fact that traditional methods ignore the fundamental role of concrete activity in education. The "real movement" of the material is reproduced in the higher theoretical form of the *ideal.* Such an ideal representation of the object absorbs complex forms of supra-individual human activity. Mastery of these representations requires from the individual a reproduction of adequate forms of reality. "The ideal as a form of subjective activity", writes E. V. Il'enkov, "is mastered only through object-oriented activity and its products . . ."[102]

According to the one-sided, sensualist, naturalist notion, the ideal is the "natural" result of the *influence* of the object on man who forms the corresponding images. This approach ignores the *specific* nature of the activity of the subject that transforms and reproduces the object on the ideal plane (this ignorance of the activity is a result of conceptualism). On the basis of such ideas, it is *impossible* effectively to direct the students' mastery of the ideal-theoretical picture of the world. In turn, a positive mastery of this theoretical picture presupposes the pre-formation in a student of such forms of his own activity which are relevant to the production of the elements of the conceptual construction of the concrete.[103] Thus, on the logical-psychological plane, the content of educational materials must be presented to the student in the form of the structure of their activity.[104]

The emergence of the elements of concreteness occurs in *investigations* and it looks as if we must include it into the educational subject. However, we think things are somewhat different. While the scientist carries out research in order to have data for a corresponding presenta-

tion that has not yet taken place, the student is in a totally different situation. Thanks to previous scientific work, he is faced with complete and fully presented descriptions of the "real movement" of the material. When he begins to appropriate this knowledge, he is guided by the content and by the disposition of elements given in descriptions which the student should have established by certain sorts of activity. The accomplishment of this activity is not real research but an *educational model* ("quasi-investigation"). Here in abbreviated and condensed form the student experiences those activities which led, for example, to the isolation of the abstract source of the system being studied. One of the tasks of contemporary psychology and educational theory lies, according to us, in the study of peculiarities and structural laws of students' activities which in their own way "repeat" in the form of recurrent models and reproduce real activities of research and investigation.

Accordingly, educational subjects have to be constructed in accord with the mode of scientific *presentation of the material.* At the same time, when the student is introduced into activity, reproducing the movement of this material, the educational material should preserve those situations and actions, which were present in the original investigation of the object.

In the developed theoretical thought of the scientist these activities are carried out on the mental plane. But, in the student the educational variants of these acts must initially take an objectified form.[105] "Grasping in conceptual activities", writes Leont'ev, "which underlie the appropriation — the 'inheriting' by the individual of knowledge, etc. developed by mankind — requires the passage of the subject from external acts to acts on the level of words, and then to interiorization of the latter, whereupon they take on the character of mental operations".[106]

Execution of concrete actions has a *specific meaning* in that it uncovers the material content of concepts. Only special concrete activities make it possible so to transform the object or situation that a man can immediately detect in them universal relations.[107] One of the basic difficulties for a corresponding construction of any educational subject (of mathematics, physics, etc.) lies in the fact that one has to carry out lengthy psychological research in order to find those "special actions" that reveal to the child the content of those abstractions,

generalizations and concepts which constitute a given field of knowledge or any of its branches.

NOTES

* This is Chapter VIII of *Vidy obobščenija v obučenii* (Types of Generalization in Learning), published in Moscow by the publishing House "Pedagogika" in 1972. Translated by Thomas J. Blakeley (Boston College) with the editorial assistance of Alex Kozulin (Boston University).

[1] P. Ja. Gal'perin, 'Psichologija myšlenija i učenie o poetapnom formirovanii umstvennych dejstvij' (Psychology of Thought and the Doctrine of Stepwise Formation of Mental Activities), in *Issledovanija myšlenija v sovetskoj psichologii* (The Investigation of Thought in Soviet Psychology), M., Nauka, 1966. str. 239.

[2] *Ibid.* str. 140.

[3] V. I. Lenin, *Soč.* t. 29, str. 156.

[4] The process of acquisition as a whole is investigated by the whole gamut of *pedagogical* sciences. Psychology isolates and studies certain aspects of this process, which are bound up with the emergence of the properly psychic (including the mental) functions of man, the basic function of which is to orient him via images in his environment.

[5] Gal'perin, *op. cit.* str. 238.

[6] K. Bühler introduced the notion of "anticipatory schema". Gal'perin quite rightly points out that this is basically logical and not psychological (*op. cit.* str. 238).

[7] I. M. Sečenov, *Izbrannye filosofskie i psichologičeskie proizvedenija* (Collected Philosophic and Psychological Works), M., Gt., 1947. str. 256.

[8] Cf. V. A. Kruteckij, *Psichologija matematičeskich sposobnostej škol'nikov* (The Psychology of Students' Mathematical Capabilities), M., Prosveščenie, 1968.

[9] Cf. V. S. Bibler, 'Tvorčeskoe myšlenie kak predmet logiki (problemy i perspektivy)' (Creative Thought as Object of Logic (Problems and Perspectives)), in *Naučnoe tvorčestvo* (Scientific Creativity), M., Nauka, 1969.

[10] Lenin, *op. cit.* str. 314.

[11] Cf. Gal'perin, *op. cit.*

[12] *Ibid.* str. 239.

[13] *Ibid.* str. 244.

[14] *Ibid.* str. 249.

[15] *Ibid.* str. 259.

[16] *Ibid.* str. 249.

[17] Cf. P. Ja. Gal'perin, N. F. Talyzina, *Zavisimost' obučenija ot tipa orientirovočnoj dejatel'nosti* (The Dependence of Education on the Type of Orientational Activity), MGU, 1968; and *Formirovanie znaniji umenij na osnove teorii poetapnogo usvoenija umstvennych dejstvij* (Formation of Knowledge and Ability on the Basis of the Theory of Stepwise Mastery of Mental Activities), MGU, 1968.

[18] Cf. P. Ja. Gal'perin, 'Fakty i teorii v psichologii formirovanija umstvennych dejstvij i ponjatij' (Facts and Theories in the Psychology of the Formation of Mental Activities and Concepts), in *XVIII Meždunarodnyj psichologičeskij kongress* (XVIIIth International Congress of Psychology), M., 1966.

[19] Cf. P. Ja. Gal'perin, D. B. El'konin, 'K analizu teorii Ž. Piaže o razvitii detskogo myšlenija' (Analysis of Piaget's Theory on the Development of Children's Thought), Preface to John Flavell's *Genetičeskaja psichologija Žana Piaže* (The Genetic Psychology of Jean Piaget), M., Prosveščenie, 1967.

[20] *Ibid.* str. 600.

[21] *Loc. cit.*

[22] D. Lokk (John Locke), *Izbrannye filosofskie proizvedenija v dvuch tomach* (Collected Philosophic Works in two volumes), M., Soc., 1960. str. 95.

[23] Cf. V. V. Davydov, 'Logiko-psichologičeskie problemy načal'noj matematiki kak učebnogo predmeta' (Logical-Psychological Problems of Mathematical Principles as an Educational Subject), in D. B. El'konin, V. V. Davydov (red.), *Vozrastnye vozmožnosti usvoenija znanij* (Developing Possibilities for Mastering Knowledge), M., Prosveščenie, 1966; and V. V. Davydov, 'Psichologičeskij analiz dejstvija umnoženija' (Psychological Analysis of the Activity of Counting), in V. V. Davydov (red.), *Psichologičeskie vozmožnostei mladšich škol'nikov v usvoenii matematiki* (The Psychological Capabilities of Young Students in Mastering Mathematics), M., Prosveščenie, 1969; and V. V. Davydov, Ž. Cvetkovič, 'O predmetnych istočnikach ponjatija drobi' (On the Empirical Sources of the Concept of Fractions), in *ibid.*

[24] Logical analysis deals with characteristics of categories and their relations, and also with the definition of the types of thought associated with one or another "choice" of categories. To the extent that it pursues the study of the concrete acts of the individual that are involved in certain cognitive categories, we see it as *logical-psychological* activity.

[25] Gegel' (Hegel), *Soč.* t. VI. M., Soc., 1939. str. 269.

[26] Gegel', *Soč.*, t. III. M., Gt., 1956. str. 92.

[27] *Ibid.* str. 93.

[28] Gegel', t. VI. str. 270.

[29] Gegel', *Soč.* T. X. M., Partizdat, 1932. str. 284.

[30] Cf. V. Ekkerman, 'Ob osuščestvlenii edinstva konkretnogo i abstraktnogo v obučenii' (On Accomplishing the Unity of Concrete and Abstract in Education), *Sovetskaja Pedagogika* 1958, 2.

[31] M. A. Danilov, B. P. Esipov, *Didaktika* (Teaching), M., APN, 1957. str. 74; and B. P. Esipov (red.), *Osnovy didaktiki* (Bases of Teaching), M., Prosveščenie, 1967. str. 91—92.

[32] Cf. E. V. Il'enkov, 'Škola dolžna učit' myslit" (School Should Teach how to Think), in *Narodnoe obrazovanie* (Popular Education), 1964, 1.

[33] A. Lichnerovič, 'Proniknovenie ducha sovremonnoj algebry v elementarnuju algebru i geometriju' (The Penetration of the Spirit of Contemporary Algebra into Elementary Algebra and Geometry), in *Prepodavanie matematiki* (The Teaching of Mathematics, translated from the French), M., Učpedgiz, 1960. str. 55.

[34] Il'enkov, *op. cit.* str. 9.

[35] *Ibid.* str. 13.

[36] E. V. Il'enkov, 'Ob estetičeskoj prirode fantazii' (On the Esthetic Nature of Imagination), in *Voprosy estetiki* (Questions of Esthetics), Vyp. 6, M., Iskusstvo, 1964. str. 141.

[37] A. N. Šimina, 'Marksistsko-leninskoe ponimanie konkretnogo i ego značenie dlja didaktiki' (The Marxist-Leninist Understanding of the Concrete and its Importance for Teaching), in *Učenie zapiski Gor'kov.Pg.In-t*, Vyp. 53. 1965. str. 4—12.

[38] Šimina, *op. cit.* str. 94.

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Institute of Pre-School Education,
Moscow,
U.S.S.R.