TEACHING, LEARNING, AND DEVELOPMENT: A POST-VYGOTSKIAN PERSPECTIVE

Anna Stetsenko and Igor Arievitch

Learning is not development; however, properly organized learning results in mental development and sets in motion a variety of developmental processes that would be impossible apart from learning.


These words by Lev Vygotsky address one of the most fundamental concerns for anyone dealing with children - parents, teachers, developmental psychologists and others. How are teaching, learning, and the development of children's minds related? Are these processes independent, or do they influence each other, and if the latter, then in what way and by what means? For example, can qualitatively new levels of intelligence or critical thinking be achieved as a result of learning? If so, what kind of learning can lead to such results and how should teaching be organized to ensure that this kind of learning takes place? The way we answer these questions depends on what we believe about such basic theoretical matters as the very nature of mind and its development. These answers also crucially affect the ways we organize the processes of teaching-and-learning. For example, if we believe that children's minds develop according to 'internally-driven' laws, then we will be mostly concerned with detecting these laws so that we can tailor teaching processes to students' naturally unfolding mental capacities. If, on the contrary, we believe that children's minds can be developed through properly organized teaching-and-learning, then our primary concern should be to construct those forms of teaching-and-learning that do have a developmental impact on the minds of our students.

Of course, learning always results in some change, for example, in increased knowledge or the acquisition of a new skill. However, the Vygotskian position is more radical than this simple statement, differing drastically from most currently dominant views in psychology and education. According to Vygotsky, teaching-and-learning is the very pathway through which cognitive, social, and affective development takes place. The aim of this chapter is to explore this radical position, its complex layers, and its practical implications for our educational practices and our conceptions of development. In particular, we shall show how the basic Vygotskian position has been elaborated by one of his followers, Piotr Gal'perin. We hope to demonstrate that Gal'perin's analyses of the links between these processes leads to important insights into how children's minds develop as well as into some of the psychological regularities in the processes of learning-and-teaching.

We first take a brief look at how the relationships between teaching, learning, and development have been approached in several historically prominent theories in psychology. Then we focus on how this issue has been conceptualized in sociocultural theory. After that, in the major part of this chapter, we focus on how these theoretical
formulations were elaborated and empirically tested by Gal'perin and his colleagues. In particular, we demonstrate how their research helps us to understand why and how developmental processes are fundamentally dependent upon educational practices and associated learning. Finally, we argue that, by breaking the vicious circle that prevails in traditional thinking about learning, teaching and development, this approach suggests how to arrange teaching-and-learning processes in such a way that they indeed lead to a profound developmental change in children's minds.

Research on Teaching, Learning, and Development: Traditional Gaps and Persisting Controversies
The relationship between teaching, learning, and development has an interesting history in psychology, characterized more by a shifting of attention and prioritization between these processes than by a focus on their inter-relationships. With some notable exceptions, such as the work of John Dewey, these relationships were largely ignored in psychological theories at the beginning of the last century. The role of learning in development came to the fore with the rise of behaviorism, which attempted to specify the learning mechanisms that underpinned changes in behavior. Behaviorists, however, excluded mental processes from the scope of their analyses, and therefore could have nothing to say about the development of these processes. Besides, behaviorist theories were grounded in research on how animals learn to perform behaviors. Children's learning, particularly at school, was not the direct focus. Although some inferences were drawn from animal studies about the teaching and upbringing of children, this approach could not and did not offer much insight into how teaching-and-learning affects the development of mind.

However, by the mid-1970s, with the waning influence of behaviorism and the rise of the new cognitivist theory, learning itself ceased to attract attention (cf., Stevenson, 1983). Discussion of learning was replaced by an interest in the discovery of deep universal laws of "mental machinery" that were presumed to be hardly affected by any external influences. Cognitivist theories primarily aimed, and continue to aim, at describing context-independent rules and structures common to all humans, regardless of the culturally specific activities in which they engage. For example, from a cognitivist position, what matters in the analysis of human memory is not how children learn to memorize certain kinds of material, nor how their learning depends on the ways they are taught. All that matters are the characteristics of a predetermined and virtually unchangeable general storage capacity that are thought to be best revealed through research on the memorization of meaningless information (e.g. strings of letters or numbers) outside schooling experiences or any other learning practices in which the child is engaged.

Nevertheless, the issue of how it is that cognitive developmental change does come about has been central in another landmark theory in the history of psychology -- Jean Piaget's 'genetic epistemology'. Piaget can be credited with the discovery of many important regularities in how the human mind develops through the individual's active engagement with the world. However, this theory largely attributes children's progress in developing mental capacities, such as conceptual understanding or logical reasoning, to their own
independent experiences and discoveries. Whether and how cognitive development in its principal sequence and basic pace is affected by what children are taught and what they learn at school has not been at the focus of the Piagetian research framework.

Thus the complex role of teaching-and-learning in mental development has essentially been ignored in most of the prominent approaches in psychology. How specific activities in which learners engage, and the mental tools that they learn to use, affect the development of their minds is a question that has rarely been clearly formulated, let alone satisfactorily resolved. Today, teaching, learning and development continue to be viewed by many as processes that are essentially different from each other or only superficially related. For example, despite growing evidence that intelligence can be learned and taught (see e.g. Ceci, 1991; Perkins, 1997), there is practically no debate about the mechanisms that make this possible. Even when links between learning and development are highlighted (e.g., Human Development, 1995, special issue), learning tends to be restricted to individual experiences rather than seen in relation to schooling. In other words, large gaps remain in the study of the mechanisms that underlie and possibly link all three processes - teaching, learning, and cognitive development.

As a result of these gaps, the domains of psychological and educational research have not, in our view, profited from each other as much as they could. On the one hand, discoveries about learning processes contribute only very little to our understanding of how and why children's minds develop. For example, new teaching methods are not regarded in terms of what they mean for a general theory of development. On the other hand, psychological theories of development do not have a large impact on the practice of teaching and learning (cf. Strauss, 1998). Although some ideas from cognitive psychology have influenced educational practice (e.g., the recent emphasis on higher-order thinking and metacognition), too often these ideas have not been supported by explicit strategies for implementing them in school. For example, it is somewhat ironic that arguably the greatest contribution of cognitive psychology to education has been summed up in the following principle: "Think less about teaching and more about learning" (Romig, 1999). However, we believe that the building of new walls between teaching and learning that cognitivism inadvertently encourages can hardly benefit our understanding of either of these processes.

The reason why researchers concerned with teaching, learning, and development are still searching for common ground as a basis on which their findings could be integrated, we believe, is that there has been a dearth of conceptual space where the relationship between these processes could be conceived. Indeed, when learning is regarded only as the forming of links between stimuli and responses (as in behaviorism), or when the developing mind is viewed as governed merely by internal regularities (as in cognitivism), or when the impact of teaching on development is ignored (as in most of developmental psychology), there is simply no room for the three processes to be conceptually brought together and the links between them examined.

It took a whole new approach to mind and human development-- sociocultural, or 'cultural-historical activity' theory -- to make the analysis of links between teaching,
learning and development both possible and necessary. In fact, conceptualizing this relationship has been a pivotal element in this approach.

**A Sociocultural Framework for the Study of Teaching, Learning, and Development**

Sociocultural theory (or CHAT, for reviews, see Rogoff & Chavajay, 1995, and several chapters in the present volume), largely inspired by the seminal works of Lev Vygotsky, can be characterized by its central claim that children's minds do not develop by virtue of some predetermined structures that unfold through time according to their own inherent programs or sets of rules. Rather, this theory posits that children's minds develop as a result of constant interactions with the social world -- the world of people who do things with and for each other, who learn from each other and use the experiences of previous generations to successfully meet the demands of life in the present. These experiences are crystallized in 'cultural tools', and children have to master such tools in order to develop specifically human ways of doing things and, in the process, become competent members of a human community. These tools can be material objects (e.g., an item of kitchenware that crystallizes one specifically human way of eating and cooking), or patterns of behavior specifically organized in space and time (for example, children's bedtime rituals). Most often however, such tools are combinations of elements of different orders, and human language is the multi-level tool par excellence, combining culturally evolved arrangements of meanings, sounds, melody, rules of communication, and so forth.

Learning such tools is not something that simply helps the mind to develop. Rather, this kind of learning leads to new, more elaborated forms of mental functioning. For example, when children master such a complex cultural tool as human language, this results not only in their ability to talk but leads to completely new levels of thinking, self-regulation and mentality in general. It is the specific organization of this tool (e.g., the semantic, pragmatic and syntactic structures of language) that calls into being -- and in effect shapes and forms -- new facets of the child's mind.

Importantly, cultural tools are not merely static 'things' but embodiments of certain ways of acting in human communities. In other words, they represent the functions and meanings of things, as discovered in cultural practices: they are "objects-that-can-be-used-for-certain-purposes" in human societies. As such, they can be appropriated by a child only through acting upon and with them, that is, only in the course of actively reconstructing their meaning and function. And such reconstruction of cultural tools is initially possible only in the process of cooperating and interacting with other people who already possess the knowledge (i.e. the meaning) of a given cultural tool.

This short account is presented here to illustrate the fact that the sociocultural approach, unlike those we have previously discussed, not only allows for a synthesis of teaching, learning, and development; it actively calls for it. As other chapters in this volume emphasize, teaching leads development because it allows children to learn to use new cultural tools, and such mastery constitutes the very cornerstone of mental development. Children's development is thus inherently linked to teaching-and-learning. Moreover, the relationship between them is made explicit in this approach: it is conceptualized as a three-fold process in which cultural tools are provided, learned and transformed into the
building blocks of the mind, all within the space of active interaction and cooperation in the 'zone of proximal development'.

We now turn to how the relationship between development and teaching-and-learning has been further explored and elaborated in more recent theories within the CHAT perspective.

**Gal'perin's Perspective on Teaching, Learning, and Development**

Because such a central role is accorded in the Vygotskian approach to the role of teaching-and-learning in development, it is no wonder that much of the research conducted in this tradition has focused on exactly this issue (for a review, see Wells, 1999). Many innovative ideas with vast theoretical and practical implications for education have issued from this research, and continue to do so. However, one of the most radical approaches to teaching, learning, and development can be found in works by Piotr Gal'perin, who started his career as Vygotsky's close colleague and went on to establish his own theory of human development that continued and in many ways expanded Vygotsky's framework.

At the center of Gal'perin's theory is the issue of the origins of mind and the nature of developmental cognitive change. Extending Vygotsky's ideas about human development, Gal'perin contended that mental processes should be understood as transformed and internalized material actions that involve cultural tools. He postulated three stages in the process by which such transformation occurs, progressing from physical action to audible verbalization and, finally, to 'internal speech' and other mental operations (e.g., Gal'perin, 1989a,b,c). Such internalized actions become "the very stuff" of the mind, that is, they give the mind its structure and content.

For example, according to Gal'perin (1989c), voluntary attention is not an inherent mental capacity which focuses a mysterious 'mind's eye' on a desired content but, rather, a transformed, initially material, process of monitoring one's own activities. Take the case of a child's ability to pay attention while writing down words. To be sure, many children come to form this ability without being fully aware of all the stumbling blocks they overcome along the way and all the complexities involved in this process. However, as most teachers and less fortunate parents know, a large number of children experience tremendous difficulties in learning how to be attentive while writing. For this ability to emerge, it is not enough to encourage the child to pay attention, because children might simply not know what it takes 'to pay attention'. Instead, children have to be taught how to monitor their writing activity, namely, how to notice and correct mistakes in written sentences. This learning, in the early stages, involves various material 'supports' such as breaking down words into parts by making pencil marks between syllables, following a certain order provided by the teacher. Later, these material supports can be abandoned and children proceed to perform monitoring in detailed overt speech. In the final stages, the whole monitoring activity can be performed without overt verbalization, that is, 'in mind' and at the same time as the main activity of writing.
Importantly, as seen from the example just described, the transformation of material actions into internalized 'mental processes', especially those that are important for children to function as competent members of a human community, is a complex process that always involves mastery of cultural tools -- in this case, knowledge of how to distinguish syllables. Therefore, exploring the process by which cultural tools are acquired (or learned) by children becomes a pivotal element in studying cognitive development (for details, see Arievitch & Stetsenko, 2000).

Based on these theoretical claims, Gal'perin explored concrete regularities in how actions are transformed from material to mental forms in the course of learning cultural tools of various kinds. It is in these studies that Gal'perin arrived at what became the cornerstone of his approach -- the innovative analysis of instructional practices based on different types of cultural tools, and the spelling out of the developmental potential of different kinds of instruction. Although Gal'perin was primarily interested in the basic regularities of cognitive development, his whole research program took the form of studying how the teaching and learning of specific cultural tools impacts on children's development.

**Traditional instruction and its impact on development**

While examining existing instructional practices, Gal'perin came to the conclusion that, in all their great variety, such practices far too often fail to provide children with the cultural tools that are most beneficial for the development of their minds. That is, children are not given tools that enable them to construct their actions in a form that is most conducive to the efficient transformation of these actions into the instruments of mind. Instead, school children are often faced with fragmented, poorly generalized phenomena that are supposed to be learned by simply memorizing them.

Typically, instruction in its traditional form is based on: (a) the teacher's presentation of the task, (b) the explanation of a rule to solve the problem as presented in a particular example, (c) learner's memorization of this rule, and finally (d) practice in solving typical tasks. However, many of the implicit rules and regularities that an expert "automatically" takes into account may well remain hidden from the learner. Each child has to figure out by herself a substantial body of such rules for acting correctly while trying (often unsuccessfully) to solve a given task.

The basic feature of this type of instruction (and, at the same time, its main deficiency) is that it does not allow or encourage the child to build the actions in a way that would allow him or her to meaningfully generalize these actions, and hence to internalize them. Trial-and-error is inevitable in this case, allowing only a slow, gradual selection of the "correct" form of action necessary to solve the task. As a result, children's actions cannot be efficiently transformed into the building blocks, or tools, of their minds.

For example, when learning the grammar of a foreign language, students typically have to memorize by rote dozens of rules. The rules are presented and studied one by one in a way that does not show how they might be interconnected. The explanation of each rule is usually reduced to providing an example. The implicit basic relationship underlying different rules that does actually exist in each system of grammar, for example, the
relationship between aspects of the word's meaning and the word's structural elements - is not revealed to students. In other words, students are not provided with the tools for a meaningful orientation in the implicit rules that govern the language domain. As a result, the systems of grammar are perceived by children as a formal and meaningless collection of isolated rules rather than as a coherent system of relationships based on general regularities. Thus, if students are to begin to discover these relationships, they can do so only in a lengthy, trial-and-error, intuitive kind of way. It usually takes a lot of painful effort and several years of study to ultimately master (or fail to master) the skills of correct spelling and writing in a foreign language.

This insufficiency in revealing the set of conditions necessary to solve the task is not a minor detail of the instruction process. In fact, it directly affects the quality of a learner's actions and hence the resulting mental processes. Under these conditions, actions often remain unstable, poorly generalized, and dependent on incidental variations in the instructional situation (e.g., the teacher's individual style). This inevitably results in large inter-individual differences in children's performance. In this type of instruction, it is practically impossible to establish causal connections between any developmental changes that do occur and the instructional milieu. As a consequence, it can appear more plausible or more fruitful for teachers and psychologists to explain development in terms of age-related regularities or inborn inter-individual differences in mental abilities, rather than in terms of the impact of instruction and associated learning on development (Gal'perin, 1989c).

**Systemic-theoretical instruction**

Having analyzed and described the features of typical traditional instruction, Gal'perin concentrated his efforts on developing an alternative type of instruction that would provide children with more psychologically efficient and developmentally beneficial cultural tools. Based on theoretical assumptions about the nature of mental development, Gal'perin's empirical studies led him to define the main criteria for the selection of such cultural tools. In brief, efficient cultural tools are learning materials (i.e., concepts, theories, ideas) that present in a generalized or schematic form the essential features of a given problem domain or class of phenomena. Typically, these features pertain to general regularities in how phenomena evolve and relate to each other in human sociocultural practices. Accordingly, efficient cultural tools are typically found in historically evolved knowledge that captures the lengthy evolution of previous generations' practices in dealing with a particular problem domain or class of phenomena.

A simplified but illustrative example of what constitutes an essential feature is the following. There are many features that describe a circle. Most obviously, a circle is simply a flat round area. In the classical scientific definition, however, a circle is a curved line on which every point is equally distant from one fixed point inside the curve. Yet another definition reflects the procedure by which a circle is produced: A circle is produced by two sticks with one fixed end, or by a pair of compasses. In the latter definition, the initial operation underlying the concept of a circle (and thus its genesis) is revealed, thereby making it clear why all the radii of a circle are and have to be equal -- namely, because it is actually generated by the same radius revolving around one fixed
point (cf. Davydov, 1988). This latter kind of definition is effective because it describes
the circle as a product of a specific operation discovered in sociocultural practices and
thus represents its generic essential feature. Gal'perin suggested that providing learners
with cultural tools that reflect generic, essential features of phenomena or classes of
problems, would greatly enhance their cognitive development. Accordingly, a whole
new type of instruction, based on such cultural tools was developed by Gal'perin and his
colleagues.

This instruction, termed systemic-theoretical, arms children with a general method to
solve any specific class of problems in a given subject domain by exposing the relevant
essential features, that is, by showing their origins in particular practices. In such
analyses, students learn to distinguish these essential features and to base their further
actions and thinking on them. Specifically, this form of analysis includes a)
discriminating between different properties of an object or phenomenon, b) establishing
the basic units to analyze a particular property, and c) revealing the general rules
(common to all objects in the studied area) whereby those units are combined into
concrete phenomena. The method makes extensive use of symbolic and graphic models
to represent basic relations between different properties of the object.

The principles of systemic-theoretical instruction were implemented by Gal'perin and his
colleagues in a number of experimental programs in a variety of subjects, including
mathematics, physics, language, and history. Perhaps the most illustrative in terms of its
effects on cognitive development is the program of elementary mathematics for 5-6-year-
old children (see Gal'perin & Georgiev, 1960). Within this program children are taught
such fundamental concepts as that of number. Traditional instruction often fails to enable
children to form genuine mathematical concepts. For example, numbers are often
empirically introduced as single discrete objects (i.e., one stands for 'one pen', two for
'two apples' etc.) without any further explanation. Children are taught that 'one' (object) is
one, not two or more, and this is something to memorize, accept, and follow. The logic
and function of the concept of number -- that is, how and why numbers have evolved in
human practices -- is not revealed. As a result, children tend to confuse mathematical
numbers with discrete objects.

In contrast, within systemic-theoretical instruction, children learn the logic and history of
how numbers came about -- that is, their origin in specific sociocultural practices.
Because all the basic types of numbers emerged as a result of measurement (e.g.
Lebesgue, 1958), the idea of measurement is systematically introduced to the children.
First, children are shown how important measurement is in various everyday situations,
for example, in stores to establish the correct amount of goods. Then they learn to use
measurement as an analytical tool with which to derive fundamental concepts in
elementary mathematics.

Specifically, children are first taught to choose appropriate measures (e.g., cups for the
volume of water, strips of paper for length) in order to compare objects in terms of their
particular properties (volume, length). In the process of measurement, children learn to
use some material tokens (e.g., chips or buttons) to record the results of every step of
measurement. For example, a child checks how many cups of water fit into a given container and sets aside a chip for each cup. The resulting collection of chips then comes to represent in a very visible and easy-to-grasp manner, quantified in a material form, the volume of water in a given container. This helps children to realize how the properties of objects can be transformed into quantities as a result of measurement. As a next step, children learn how to compare two objects by putting two sets of markers (each recording the result of measuring one object) next to each other, in one-to-one correspondence. For example, the amount of water in one container gets represented by 3 chips (each representing one cup of water), whereas the amount of water in another container is represented by 2 chips, with the two sets of chips now being directly and immediately comparable. Thus, concepts such as 'larger', 'smaller', 'equal to', 'larger (smaller) by so much' become operationally clear to children.

It is only after such practical-analytical work that the concept of number is introduced. For example, 'one' is explained as the result of measurement when the measured quantity is represented by one chip (i.e., where one chip stands for one cup of water). Other numbers can then be constructed by children themselves according to the rule "smaller by 1 or greater by 1". The material markers are soon replaced by more abstract symbols, thus gradually transforming practical comparisons into mental operations. In sum, the fundamental concept of number is introduced to children not through separate objects but as a ratio of some quantity to a chosen measure, that is, generically (i.e., by reconstructing the genuine problem and practice that served as the source from which this concept emerged). The final stages of the program include other important elements. Children go on constructing numbers up to 10 000 in the same fashion, at the same time learning what each number is called and how it can be written. This is followed by similar work aimed at the children gaining mastery of the four arithmetic operations, decimal fractions, and so on (Gal'perin & Georgiev, 1960).

The general result of the program is that genuine mathematical concepts are formed in children a whole age period earlier -- in 5- and 6-year-olds rather than in 10-12 year-olds, when it has usually been found to occur. Even more importantly, however, the children's entire view of material objects changes: they come to understand that things need not be judged solely by their appearance. In other words, children set themselves free from apparent but often misleading impressions and thus advance from immediate (naive-egocentric) thinking to thinking mediated by the concept of measure. For example, children who were initially identified as non-conservers on Piagetian tasks now display a very different understanding in a conservation task. That is, children who previously thought that the amount of water poured from a tall container into a shorter one decreased as a result of this operation -- irrespective of the container's width -- now refuse to give an immediate answer and say instead: 'Let's first measure!' These children then proceed to conclude that the amount of water did not change as a result of transfer from one container to the other and thus demonstrate the conservation effect, even though this concept was not directly taught to them.

Another program illustrating principles of systemic-theoretical instruction aims at teaching foreign languages such as German (e.g., see Kabanova, 1976). The students in
this program are provided with generalized schemes that help them understand and systematically track down the sources of grammatical forms in the contexts of human activities and practices. For example, the complex rules of how to use German modal verbs, instead of being presented as a collection of unrelated cases that have to be simply memorized, are explained in a systematic way based on revealing the implicit functions of these verbs. In the process, students learn how verbs function in human language to reflect intricacies both of the reality they describe and the human communication they serve to accomplish. Thus, subtle linguistic differences become apparent to students even if their native language does not have a similar system of verbs (e.g., as in Russian). The analysis occurs under the guidance of a teacher who provides students with the basic rules for linguistic exploration, in this case, how to grasp the function of a verb by looking at practical situations in which it is used.

Importantly, students are not just 'trained' in how to apply linguistic rules, but are given cultural tools -- in this case represented in the generalized schemes of analysis -- that enable them to discover implicit linguistic regularities. After these generalized schemes are internalized, students use them as powerful tools of orientation in discovering the implicit regularities of language. For example, students are able to transfer the acquired analytical method to other domains, specifically, from grammar to other aspects of the German language, and then to other linguistic activities such as creating their own 'languages' according to systems of linguistic rules.

In general, as in the teaching of elementary mathematics, this program has resulted in a spectacular cognitive-developmental change, in that children advance from a naive-empirical way of thinking (i.e., based on apparent but often non-significant perceptual features of phenomena) to one that is theoretical (i.e., based on essential characteristics of phenomena). Importantly, the systemic-theoretical teaching in these and many similar programs leads to substantial progress not just in children's knowledge but also in their wider cognitive functioning. In particular, significant improvements occur in children's abilities to analyze, plan, and reflect upon their actions, to set goals and systematically control how they are attained, as well as in their memory and even in their imagination. No less significant is that trial-and-error learning, so typical of traditional instruction, becomes rare and incidental, and also that the time it takes children to learn new knowledge or skills significantly decreases. In addition, impressive changes occur in children's learning motivation. That is, in contrast to children in classes with traditional instruction, whose motives for learning remain by and large pragmatically oriented (e.g., to get a good grade, to do better than others), children in experimental classes gradually develop a genuine learning motivation -- a strong and stable interest in the exciting process of discovering the hidden regularities in the world and general ways of solving problems.

Teaching experiments based on Gal'perin's principles were mostly carried out from the 1960s to the 1980s in different cities of the Soviet Union; the full list exceeds eight hundred. These experiments were carried out in laboratories, schools, and in settings ranging from programs on limited topics, such as described above, to long-term programs both for adults and children, for example, a full elementary school course in mathematics.
Furthermore, Gal'perin's approach has had a direct impact on large-scale teaching experiments, also initiated in the 60's, by El'konin and Davydov and continuing until the present in many different parts of the world. Overviews of some of these studies can be found in Carpay (1974), Davydov (1988), Haenen (1996), Karpov and Bransford (1995), and Lompscher (1984). However, given the fundamental nature of implications from Gal'perin's approach, broader replications and further analyses of its methodology are certainly still needed, employing more advanced techniques of research design and validation. In addition, the theoretical approach based on Gal'perin's principles could greatly benefit from the incorporation of recent developments in research on socio-interactional contexts of teaching-and-learning, such as situated learning and children's participation in communities of learning (for review, see Rogoff & Chavajay, 1995, and the present volume). We shall conclude this chapter, however, by considering some of the implications of Gal'perin's research in more detail.

Implications for Developmental Psychology and Education

Gal'perin's approach integrates the analysis of teaching-learning and development in a systemic way by capitalizing on an element central to all three of these processes. This element concerns the 'cultural tools' provided by teachers and learned by children in the course of instruction, thereby inducing activities that can be transformed and internalized into powerful instruments of mind. These new instruments provoke development, in the full sense, as they empower learners to become active explorers and thinkers. Thus, the development of the human mind is seen not as a process separate from teaching and learning, but as part of a system that encompasses all three activities. In this sense, Gal'perin's approach fills the gaps so typical of previous frameworks in both psychology and education. It also allows us to understand what lies behind developmental change and thus adds greater specificity to Vygotsky's insight that development is driven by teaching-and-learning. Ultimately, it is in this sense that Gal'perin's theory is a contribution simultaneously to developmental psychology and to education.

Importantly, in contrast to traditional theories, which often ignore how development is contingent on teaching-and-learning practices and thus confuse developmental outcomes achieved within particular educational systems with universal developmental regularities, Gal'perin's approach draws attention to a self-perpetuating 'vicious circle', namely

\[
\text{inadequate theories of development} \rightarrow \text{poor educational practices} \rightarrow \text{poor development outcomes} \rightarrow \text{inadequate theories of development}
\]

For example, many traditional theories posit that children lack the ability to reason in a reflective way with abstract categories. Given this view, many educators think that children need to be taught in a fashion that best accommodates the allegedly fixed age-related features of their minds. Thus, traditional instruction typically includes the requirement to teach young children in a "piece-meal" fashion whereby they are exposed to small bits of information supported by concrete illustrative examples, with no attempt to reveal the general rules and connections that lie behind these examples. As a result, children indeed do not develop the ability to operate with abstract (i.e., generalized, systematic) concepts and ideas. In contrast, research findings by Gal'perin and his
colleagues demonstrate that, when children are taught in a systemic-theoretical fashion, as described above, there are spectacular developmental changes, including progress in abstract reflective thinking. In this sense, then, it is the traditional instructional restrictions thought to be grounded in inherent limitations of children's minds that, in fact, themselves produce these limitations!

Gal'perin's research, we would argue, represents a key development in the educational approach originally envisioned by Vygotsky and currently pursued by many working in sociocultural and CHAT traditions. For example, Gal'perin's theory provides essential support for theories striving to dispel the old stereotypes that still underlie many educational practices. Specifically, Gal'perin's work helps to undermine the "seed metaphor" that describes cognitive development as a process driven by inner regularities that can be only slightly (if at all) altered by learning. His studies show that children have a vast developmental potential that can and should be realized within specially designed teaching-learning practices that are based on sociocultural principles of development.

Gal'perin's approach is also consistent with theoretical viewpoints that emphasize that children need to acquire not only rules and facts (i.e., declarative knowledge) but also procedures of how and where to apply knowledge (i.e., procedural knowledge) (e.g., Bruer, 1993). Gal'perin specifies ways to enable students to grasp not just the surface of things but the regularities of how various phenomena evolve, develop, and systematically relate to one another in contexts of human sociocultural practices. Understanding these essential features entails understanding how knowledge can be applied in various practical domains. For example, and turning again to the program in mathematics described above, learning the concept of number as part (and product!) of a broader activity of measuring entails understanding how to use numbers for real life practical tasks that necessitate measuring and otherwise quantifying various aspects of reality. Thus, it becomes possible to bridge the traditional gap between practical and theoretical knowledge. This is achieved not by simply giving students additional 'practice' in applying initially inert knowledge, but by introducing phenomena, right from the beginning, as essential instruments and products of historically evolved human practices.

Furthermore, Gal'perin's principles are in agreement with theories of situated learning (e.g., Lave & Wenger, 1991; Rogoff, 1990) and distributed cognition (e.g., Cobb, 1998), which emphasize that knowledge and learning are ultimately embedded in cultural practices and distributed among the participants in these practices and enshrined in the technological and cultural tools that are being employed. However, Gal'perin's theory goes further in that it emphasizes the following. To understand and promote the development of mind one needs not only to observe how children participate in community practices and make use of cultural tools, but also actively to construct instructional procedures that specifically provide children with experiences of tool use, in which the evolving histories and functions of the tools are made explicit. Finally, Gal'perin's approach gives an instructive -- albeit a counter-intuitive -- answer to what is perhaps the most pressing issue concerning education today: Why is school learning so abstract and removed from real life? From Gal'perin's perspective, the remedy for the schools' failure to produce useful knowledge and know-how should be sought not by
substituting the teaching of abstract knowledge by rich and specific hands-on experience. Instead, the demarcating line should be drawn between inert knowledge, regardless of its level of generality, and knowledge also of varying degree of generality as an instrument of meaningful, historically evolved cultural practices. It is this latter knowledge, unlike inert facts or knowledge gained in a hands-on and vivid, but too often fortuitous and unsystematic experiences that empowers children with methods for constructing new knowledge. (For a similar argument, see Chaiklin, this volume.) Therefore, it is also this kind of knowledge that can be actively used by the learners in virtually unlimited and never-ending expansive cycles of exploration and discovery (cf. Engeström, 1991; Karpov & Haywood, 1998). Arguably, there is nothing more practical and nothing closer to the demands of real-life situations than such knowledge, especially in the 21st century in which increasing value is likely to be put on life-long learning.

Endnotes

1. The contribution of the authors was equal.
2. Although the ZPD is not the focus of this chapter, it should be noted that this concept is inextricably linked to that of the cultural tools (for details, see Stetsenko, 1999). According to Vygotsky, it is because adults provide children with new cultural tools, that children are enabled to solve problems on a more advanced level in collaboration than when acting alone. Therefore, the concept of ZPD is a concrete expression of Vygotsky's idea that mediation by cultural tools is a unique feature of human development.
3. There is a certain affinity between some of Gal'perin's instructional programs and innovative teaching programs developed recently in different theoretical frameworks. For example, a number of recent studies point to the pivotal role of (a) the means involved in distributed cognition (e.g., Cobb, 1998; Salomon, 1993; McTighe & Lyman, 1988), (b) activation of the monitoring and reflective function of metacognition (e.g., Marshall, 1995; Scardamalia & Bereiter, 1985), and other methods of cognitive reorganization for successful teaching-and-learning. Analyses of differences and similarities between these specific programs is beyond the scope of this chapter which focuses primarily on a much more general question -- namely, how the relationship between teaching-learning and development can be explicated from a CHAT perspective.