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Connecting Sociocultural Theory and Educational Practice:

Galperin's Approach

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Abstract

Learning and instruction have always been important topics in the sociocultural school of thought founded by Vygotsky and further developed by his followers. Taking sociocultural ideas as a starting point, Piotr Galperin developed an original conceptual system and a new method of investigation that made teaching and learning a central part of psychological research. We analyze Galperin's theory and discuss its direct relevance for educational practice. The analysis is based on a spiral model which, we suggest, most adequately represents Galperin's procedure of the formation of mental actions. This model helps to clarify the relevance of Galperin's approach to current issues in psychology and education.

Connecting Sociocultural Theory and Educational Practice: Galperin's Approach

In this article, we discuss how teaching and learning have been integrated in psychological theory and research by Piotr Galperin (1902-1988), one of the major figures (along with Leontiev, Luria, Elkonin, Davydov, and others) in the sociocultural school of thought that originated in the work of Lev Vygotsky. Vygotsky's theory emerged out of the social and political context of the first decades of the 20th century and represented a new approach to psychology with tremendous promise. However, it remained unfinished and in need of reexamination and elaboration. The present analysis of Galperin's approach can be considered as a step in this direction. We argue that Galperin's original synthesis of theoretical ideas about the development of mental actions and teaching strategies for efficient formation of new actions in the laboratory and classroom contexts was a novel and necessary extension of Vygotsky's ideas.

Specifically, Galperin's research strategy was to analyze how new mental processes emerge in the context of meaningful, goal-oriented activities of teaching and learning, through gradual internalization of actions by learners. This approach was based in the system of interrelated sociocultural ideas about (a) the leading role of teaching and learning in development, (b) the internalization of material actions as the pathway of cognitive development, and (c) the centrality of cultural tools and social interaction in development. The hallmark of Galperin's approach is that he creatively elaborated these ideas and used a method of systematic construction of mental actions in specially organized teaching and learning activities to reveal the necessary steps that mental actions undergo in their genesis, as they originate from material actions. We discuss the foundational core in Galperin's procedures, presenting it as a *spiral model*, and drawing attention to the reciprocal links and regularities in the processes of teaching, learning, and cognitive development.

In line with this general contribution, Galperin's contemporary relevance is noteworthy. As we discuss in the concluding section of this article, Galperin's approach resonates with the recent revival of interest in overcoming the limitations of theories that ignore the fundamental role of learning in children's development. For researchers in educational psychology who turn to direct study of the impact of learning on development, Galperin's approach can serve as a useful source of ideas and methodology.

In addition, Galperin's perspective opens up ways to address links between today's sociocultural theories that take root in Vygotsky's works, and cognitively oriented studies on learning and development. Linking sociocultural and cognitive theories is a necessary prerequisite for developing a framework in which the many now disconnected findings about teaching, learning, and development can be integrated to meet the growing demands of today's education. Galperin's understanding of learning as a meaningful activity that takes place in social interactions, echoes Vygotsky's (1987, p. 212) maxim that teaching "is only useful when it moves ahead of development."

Early Studies

Galperin's career began in the 1930s, when he joined (a few years after receiving his first degree in medicine) the so-called Kharkov group of psychologists. This group included a number of Vygotsky's co-workers (Luria, Leontiev, and others), who embarked upon the development of sociocultural theory with a specific emphasis on the concept of activity. Conducted within this group project was Galperin's first study on the differences in tool use between humans and animals (Galperin, 1998), a study that was pivotal for the development of his research agenda.

In this study, Galperin followed Vygotsky (1978), who had articulated differences in the use of tools between children and apes, and attributed an important role to speech, signs and symbols as uniquely human. Galperin studied the development of simple tool-mediated actions in

5 groups of children (10 children in each group; the children were grouped according to their age, starting from 2-year-olds in the first group and to 6-7 year-olds in the fifth group). In this experiment, children were asked to retrieve various attractive toys from the bottom of a deep box using a specially designed spade-like tool, with a blade attached at the right angle to the handle. By observing children engaged in such a task in a play situation (children were told that the toys were lying on the bottom of a "well"), Galperin examined how initial inexperienced use of tool by younger children, who did not yet grasp the meaning of the tool, looked very different in observations of older students, whose tool use gradually evolved into genuine instrumental (tool-mediated) operations.

These operations complied with the culturally established mode of acting assigned to a given tool. For example, eating with a spoon is an operation in which the hand (and the whole body) has to perform an established sequence of "unnatural" movements (i.e., sharply contrasting with the movements performed while eating with bare hands) in accord with the culturally developed design of the spoon. In Galperin's experiment, children displayed gradual progress from unspecific, "manual" use of the spade to a specific, instrumental use. Younger (2-year old) children used the spade just as an extension of their hand, paying no attention to the implicit, though fundamental, condition dictated by design of the spade – that the blade with a toy on it should be kept in a horizontal position and the handle should be lifted up vertically. Naturally, the toy immediately slipped off the blade. In contrast, older (6-7 year old) children fully concentrated on keeping the spade in a proper position, therefore adjusting every movement of the hand and body to the objective logic of operation "crystallized" in the design of the spade.

Galperin's early studies were on a small-scale and his analyses of clinical cases, therefore lacking the rigor of contemporary research requirements. However, as we described, he managed to discern some critical stages in children's mastery of specifically human tool-mediated

operations. Galperin speculated that mastery of such instrumental operations, in which the meaning and the function of cultural tools are integrated, underlies the development of sensory-motor thinking and is crucial for further cognitive development (for details, see Haenen, 1996).

In 1943, during the WWII, Galperin joined Leontiev to conduct research on veterans with various impairments of arm movements (i.e., of shoulder or elbow joints). The patients were asked to perform simple movements; a special device was used to assess their performance by measuring the amplitude of arm movements. Each patient was given a sequence of tasks, such as "raise your arm as high as possible", "raise your arm up to a certain height", "reach an object… (held by experimenter up at a certain height)". These tasks were basically identical in their overt motor pattern, but differed in their meaning and content, ranging from aimless movements to meaningful actions. Measuring changes in the movements' amplitude depending on the nature of the task in 41 patients, Galperin and Ginevskaia (1947) reported considerable amount of variability in performance. Specifically, while veterans were apparently unable to perform a movement upon the request to simply raise a hand, they were successful in carrying out a meaningful, object-related action, such as combing one's hair. On the basis of these experiments, Galperin and Ginevskaia developed a rehabilitation program, employing meaningful tasks in order to restore the damaged motor coordination. According to the authors, they achieved up to 30% improvement in the experimental group as compared to the control group.[1]

Thus, in his early research, Galperin formulated the general idea that the development of a sociocultural and meaningful (i.e., tool-mediated) activity, initially practical and shared between child and adult, constitutes both the source and the context of cognitive development. This idea became the cornerstone of Galperin's own research agenda. Cognitive processes as orienting and regulating individual's performance in relation to the learning task, the role of cultural tools and

the importance of meaningful learning – these are the themes that were continued and elaborated in Galperin's further research.

Galperin's Methodology

The central part of Galperin's theory concerns the question of how human mental activity is formed out of the transformation of "external" activity. Galperin sought evidence to illustrate the process by which individuals internalize external activity using a procedure he created and called the "stepwise formation of mental actions." Rather than passively observe the emergence of a new psychological process, Galperin sought to expose and actively guide the internalization of a new activity by an individual in carefully designed experimental procedures. Galperin created his methodology in a long lasting "dialogue" with Piaget. Although Galperin admired Piaget's contributions to psychology, he sharply disagreed with Piaget on the relevance of the observation method (Galperin, 1989; Galperin & Elkonin, 1972).

Galperin noted that, when some activity is performed on the mental plane, "in the mind," the researcher does not have access to its content and structure. Researchers do not deal with the activity itself but only with what "remains of activity" on the surface – some mental images (established in introspection, i.e. "internal observation") and the outcomes of that activity (established in external observation, i.e., "horizontal cross-sections", such as tests or various forms of interview). Historically, Galperin argued, this inaccessibility of mental processes through internal or external observation confined associationist psychology and behaviorism to studying the phenomena of consciousness or the phenomena of behavior, instead of revealing the underlying mechanisms of those phenomena.

The same constraints, Galperin maintained, were characteristic of studies by Piaget. On the one hand, there was an amazing wealth of fascinating empirical facts obtained in Piaget's clinical interviews and observations. On the other hand, the method of horizontal cross-sections

did not permit going beyond the phenomena of the child's thinking or, more precisely, made Piaget take these phenomena (e.g., egocentrism) for real mechanisms of child's cognition. According to Galperin, this methodological stance led Piaget to a virtual denial of psychology's own subject matter – hence, Piaget's claims that explanations of mental processes could be found in physiology or logic (Piaget, 1963).[2]

Galperin also argued that in Vygotsky's work there was a substantial contradiction between ideas and the research methodology. Vygotsky made an important claim that co-operation with the adult increases the child's abilities, inducing a transition to the next stage of cognitive development. This and related ideas (i.e., on the zone of proximal development) distinguished Vygotskian views of child development from those of Piaget. Why then, asked Galperin, did Vygotsky's description of the main periods of mental development paradoxically coincide with the Piagetian model? For example, Vygotsky's experimental data supported Piaget's contention that the child comes to be able to master the genuine (scientific) concepts only by the age of 11 or 12.

In Galperin's (1998) view, the reason for such coincidence was because Vygotsky's methodology never allowed him to clarify the specific function of the adult who interacts with the child within the ZPD. Although Vygotsky called for an instructional intervention in developmental research, in his experimental studies (e.g., of concept formation), he actually was tracing the "natural" process in very much the same fashion as Piaget. For example, Vygotsky's method of double stimulation (used in the study on concept formation, in which the gradually changing relation between the two types of stimuli – words and objects – had been examined; see Vygotsky, 1987) was just a modification of cross-sectional methodology. Again, Galperin saw that the methodology limited the research to ascertaining an achieved level of development at a particular stage (e.g., characteristics of pre-conceptual complexes, pseudoconcepts, etc.).

After Vygotsky stated the leading role of instruction, it seemed logical for him to make the next proximal step: To investigate the type of instruction and the specific character of the child-adult interaction that can actually lead mental development. However, according to Galperin, the unresolved contradiction between the idea of the child-adult interaction as the driving force of development on the one hand, and the methodology of tracing down the "natural" course of development on the other, didn't allow Vygotsky's research to live up to its own promise – to demonstrate how exactly instruction can advance development. This is why Vygotsky's experimental data coincided with Piaget's descriptions of conceptual changes in children.

Galperin came to the conclusion that to conduct an objective psychological study it was necessary to abandon mere observation in favor of active construction of actions in the external form and guided transformation of those actions into mental processes. This was a significant step in creating a new methodological paradigm for studying the mind. For Galperin, this was also an important advance in linking psychological research to teaching and learning. The orientation of research towards active construction and guided formation of mental actions made instructional procedures an integral and pivotal part of Galperin's approach.

Galperin analyzed two main aspects in the process of mental actions formation. From the developmental standpoint, Galperin conceptualized the process as a gradual internalization of the initially external forms of the individual's activity. From a psychological-educational perspective, this process appeared as systematic mastery by the learner of new forms of problem solving that resulted in the formation of new mental abilities. Below we discuss these two aspects of Galperin's approach as Internalization and the Formation of Mental Actions, which in turn bring us to direct links between this system and educational practice.

Internalization

The concept of internalization was a cornerstone of Vygotsky's approach and in contemporary presentations of his views this issue is given much attention (e.g., Arievitch & Van der Veer, 1995; Haenen, 1996; Kozulin, Gindis, Ageev, & Miller, 2003; Van der Veer & Valsiner, 1991; Wertsch, 1991). Galperin's notion of *systematic formation* of mental actions represented an extension of Vygotsky's core principle of internalization.

Galperin operationalized the concept of internalization by drawing on the qualitative difference between types of actions in animals and humans. This view posits that humans differ from animals largely in their specifically human "internal" plane of action – the ability to act with symbolic substitutes of objects without those objects being physically present. It is exactly this fundamental human ability that is reflected in Galperin's conceptualization of internalization, and that underlies a wide variety of seemingly different phenomena, like the mental models studied in cognitive psychology, or the inner speech studied by Vygotsky (for details, see Arievitch, 2004a; Arievitch & Van der Veer, 1995).

Importantly, actions performed in abstraction from the physical situation, although termed "mental actions" are, in Galperin's interpretation, not internal, mental faculties, nor are they a reflection of brain processes. They are object-related actions, as are all other human actions, the only difference being that mental actions are carried out in a special form; that is, without physical execution. Conceptualizing mental activity itself as an object-related activity implies that it occurs in the objective, outer world. It is carried out not according to any internal "mental" laws but rather according to the laws of the external world; that is, in compliance with particular characteristics of external objects and processes. Therefore, in Galperin's view, mental actions have the same object-related content as the material actions in a corresponding field.

To test this assertion, Galperin studied regularities in how actions with a given objective content are transformed by individuals from the material form into a psychological form with the

same objective content. As we describe in the Teaching Experiments section of this article, Galperin conducted studies in such different areas as conceptual thinking, attention, motor skills, and language development (Galperin, 1965). From this evidence, Galperin conceptualized internalization as a transformation of certain (material) forms of individual external activity into other (mental) forms of that same external activity, and as a specifically human form of appropriation of new knowledge and skills.

Based on this conceptual framework, Galperin developed detailed hypotheses and a theory of the stepwise formation of mental actions – a culminating point of his research with important educational implications (see Galperin, 1992 for a full explication of his theory).

The Formation of Mental Actions

Within the framework of activity theory, actions are broadly conceptualized as conscious attempts to change objects according to some intended result (Galperin, 1992). This refers to sawing a branch, decorating a room, computing a sum, using a concept correctly, and so on. Any of these examples can be used to show how an action can be executed on several levels of abstraction. Galperin classified each concrete form of an action into three basic levels of abstraction which he called the material, the verbal, and the mental levels. He then characterized each of these levels according to one dominant way of thinking (Table 1).

Insert Table 1 about here

At the material level, the action is often performed by actual hands-on manipulation with the aid of physical objects or their material representations – models, pictures, diagrams, and displays. In terms of thinking, this could be called operative thinking. However, at this level the action can also be performed without the actual hands-on manipulation of the physical objects

(e.g., refurbishing one's room by looking around and "moving" the furniture visually; this could be called figurative thinking). At the verbal level, the action is performed by means of "speaking aloud" (communicative thinking) or "speech minus sound" (dialogical thinking); at this level the external objects are no longer needed. At the mental level, the action is exclusively performed internally ("in the mind") and both external objects and audible speech are no longer necessary (conceptual thinking).

According to Galperin, these fundamental levels of abstraction and their associated ways of thinking are equally important and each should have its place in the teaching-learning process. When actions pass through these three levels, there is a reasonable guarantee that a fully-fledged mental action will be formed. This assertion can be supported with reference to principles of *generalization* and *abbreviation*.

First, passing through all the levels requires that several different representations of the materials involved have to be used in order to draw the students' attention to both the essential and non-essential properties of objects. This contributes to the generalization of an action representing the degree to which those properties of objects that are constant and essential for action are isolated and distinguished from the non-essential and varying ones. Such a generalization helps to ensure that a student is fully familiar with the distinctive features of the learning task. Second, as the action passes through the three basic levels, the number of operations that originally are part of the action is reduced and the action becomes abbreviated. Initially, at the material level, the action is executed in its most extended form. Then, some of its operations are joined together. Thus, the abbreviation of the action contributes to its mastery, that is, the ease and speed, with which the action is carried out.

To summarize, Galperin developed ideas about how to form mental actions based on three levels of abstraction. Apart from theorizing, he also conducted research into how to implement

this approach in educational situations. Galperin and his students and co-workers collected rich empirical evidence during several decades, from the 1950s through the 1980s. Their methodology varied from small scale, laboratory-based experiments to long-term curriculum implementation in classrooms. The common format, however, was called a 'teaching experiment' based in elaborating the support material and procedures needed to perform a specific task, providing the students with this material, guiding them through learning, and then documenting their progress in solving the tasks. In some studies the researchers compared students' performance on the same tasks with that of control groups not exposed to the specially organized teaching. The outcome data on the efficiency of teaching was reflected in students' progress on a given task. Experiments included both limited topics such as teaching selected geometric concepts and skills (i.e., perception of three-dimensional figures on the basis of two-dimensional projections) and long-term programs such as entire courses in elementary mathematics, history, grammar, and foreign languages (for details, see Arievitch & Stetsenko, 2000; Haenen, 1996, 2000, 2001; Karpov & Haywood, 1998). We will provide brief examples of these studies in the section on Teaching Experiments. At the core of these teaching experiments was the idea about the necessary sequence of steps to internalization of activity and gradual formation of mental actions. Below we analyze this idea by presenting Galperin's position as a spiral model of teaching-learning.

The Spiral Model

Galperin developed his teaching strategy on the assumption that learning any kind of knowledge is, in essence, mastery of different kinds of actions (activities). The stepwise teaching procedure was meant to ensure the high "quality" of such actions. In particular, the procedure was structured in such a way that already at the first stages the learner's action became meaningful, then it became generalized, and at the final stages of learning the action was

internalized and performed mentally, thus beginning to orient other actions. This was achieved by first having the learner solve the problem materially in a most detailed form, so that all the substantial aspects of the action became clear to the learner, then by having the learner perform the task verbally, and, at the final stages, by the utmost abbreviation and automation of the action. Importantly, Galperin considered the complete sequence of steps (acting at the material level, acting at the verbal level, and acting at the mental level) in their most expanded form primarily as a theoretical model of mental actions formation under the analytic assumption that a given action is perfectly new to the learner. In real learning situations, however – depending on the action to be learned, the specifics of the learning task and, in particular, the learners' prior knowledge – the steps may be abbreviated, combined together, or some even skipped.

We suggest that the stepwise process of the formation of actions can be most adequately represented by a spiral model (Figure 1). The spiral indicates the students' increasing internalization of an action while it passes through the sequence of levels in mastering a given task. The learning process moves forward within the alternating levels of acting, as gradual improvements in the "quality" of action take place (in terms of its pace, "smoothness", generalization, etc.). These improvements can be observed in a steadily growing ability of the learner to orient oneself in the task – that is, to identify the conditions that are essential for carrying out a given action. This ability leads to a better understanding, execution and acquisition of action at a particular level. Performing the task at each level contributes to this orienting ability: Gradually ("stepwise"), the student becomes aware of the ins and outs of an action. According to Galperin, this is critical for the students to progress across an ever-widening zone of proximal development.

Galperin's position here is in essential agreement with recent research on self-regulation (e.g., Boekaerts & Corno, in press 2005). Improved orienting ability enhances, in current

educational parlance, students' self-regulation and autonomy, described as the students' capacity and willingness to skillfully monitor and evaluate one's own learning. The development of self-regulation (and of proper orienting activity in general) implies a powerful learning environment and supports. What are the elements of Galperin's design of such an environment?

Insert Figure 1 about here

Within one cycle of the spiral, one can distinguish five levels, of which level 5 is, at the same time, the first level of the next cycle. At the end of each cycle, students come to better understand the actions they have learned, because they have internalized verbal generalizations and formed mental images that allow for performing the actions in the abbreviated form. As a result of the activity at the preceding levels, the students become more knowledgeable and come to understand the actions' content in their operative, figurative, verbal and conceptual dimensions. The integration of the successive levels of performance results in the advanced forms of orienting activity that constitute the basic component of what Bruner called "a cognitive toolkit (…) that permits one to get to higher grounds mentally" (Bruner, 1986, p. 73). In the following section we take a closer look at these five levels.

Orienting in the Learning Task

In the beginning, the goal of action is explained to the learner by the teacher; the learner also receives an "advance organizer" for the action, which creates the initial motivation for learning. Although motivation is a long-term goal, this first step is meant to stimulate motivation and to maintain it during learning (for a similar view on the motivating role of advanced organizers, see Ausubel, 1968). According to Galperin, the learning contents should be presented as a meaningful whole from the very beginning of the teaching-learning process (as we illustrate below). Introducing knowledge as a meaningful whole implies presenting it as some kind of

"tomorrow's knowledge" that has to be understood conceptually from the very beginning. First (while orienting at a basic level), students have to understand and accept the motivational and cognitive value of the to-be-acquired knowledge, before the actual appropriation and ability to use it can take place. This can be considered as a way to implement Vygotsky's idea of "developmental teaching" i.e., that teaching should lead development in order to call to life those functions that are lying in the zone of proximal development (Vygotsky, 1987). Galperin's teaching procedure ensures that students engage with the learning task and make first steps within their ZPD based on a broad orientation in the object and conditions of action. This emphasis on meaningful learning resonates with ideas of many contemporary educational theorists (e.g., Bransford, Brown, and Cocking, 2000).

What is the main content of such a phase of orienting? Generally speaking, it provides the information (as complete as possible) about the execution of an action. According to Galperin (1989), the initial orientation includes the intended outcome, objects and means of the action, and the necessary steps and conditions of action. Galperin puts this information together in a summarized form on an "orienting chart." The chart provides a clear picture of the way the action can be performed. It presents the course of the action and its sequence and, therefore, serves as the main tool of learner's orientation in the conditions and "rules" of action.

In experiments Galperin conducted using orienting charts, he found that students can learn the content of the chart with an unusual ease (given their often complex content) and without deliberate memorization, while performing the learning tasks. Similar advantages to orienting charts have been verified by other researchers, including Carpay (1974), who designed a chart for choosing the correct aspect form of the Russian verb, and Mettes, Pilot and Roossink (1981), who designed a chart that students can use to orient themselves while solving problems in a thermodynamics course.

Acting at the Material Level

Working with orienting charts implies that the action is initially executed at the material level. After the initial orientation in the task, the learner makes next steps in learning new action by hands-on manipulations with material objects or their symbolic representations. For example, the child can carry out an arithmetical task while combining, moving around, and arranging objects into groups. However, for complex objects and actions, it is more convenient to present them using visual, graphic or schematic representations as substitutes for material objects. These representations, as part of an orienting chart, may take the form of models, displays, diagrams, maps, and drawings, which reflect the properties and relationships essential for the action.

At first glance, it might seem that the material form of an action are necessary only for young children at the initial stages of learning. However, a lot of studies have shown that even adults, when they are learning anything substantially new for them, often need at least partial materialization with the help of something like an orienting chart (e.g., Ausubel, 1968; Salmina, 1988; Talyzina, 1981).

Acting at the Verbal Level

When the action has been learned well enough to perform it with material supports (physical objects or their symbolic representations, such as orienting charts), it is necessary to separate the action from its materialized props and to "elevate" the action to the level of overt or social speech. In Galperin's procedure, learners are then instructed to talk about the action and to think aloud as they perform it without manipulating tangible objects or their material representations. What was previously a material or practical action now becomes a verbal one. Speech becomes the sole representation of both the action and its objects.

Galperin (1969) emphasized that the action in overt speech is no longer a material action, nor is it yet a mental action. The learner is not yet able to perform the action through "inner"

speech, i.e. "in the mind." Overt speech is a transitional phase between the material and the mental action. Galperin (1989) provided two arguments for emphasizing the necessity of overt speech. First, the action performed in the overt speech is already at this stage a "theoretical" action. The action is no longer dependent on material objects; these are replaced by words and reflected in speech in a generalized form. This means that the action itself becomes generalized. The second argument refers to the function of speech as a means of communication. The effect of overt speech is determined by the social role of speech. Learners must execute the action verbally so that it is comprehensible not only to themselves but to others as well. The execution of the action meets the requirements of social communication and, in particular, the requirements of communicating in the language of a given discipline, from which the curriculum subject has been drawn.

Due to its distinctive communicative feature, overt speech could be called "communicative thinking." This term links Galperin's reasoning with Vygotsky's claim that social speech becomes the source of thought. In sum, both the generalizing and communicative functions of speech make overt speech effective. Its favorable effects point to the importance of verbal interaction, either via small-group work or cooperative learning in classrooms. Working together, thinking-aloud, and elaborating explanations substantially promote students' progress in learning (e.g., see Cohen, 1994).

After performing the action in overt speech, the learner is encouraged to act in covert speech. This transition from overt speech into "speech minus sound" requires a transformation of the structure of speech itself into what Galperin (1989) called "the audible image of the word." According to Galperin, such an "audible image" can only evolve after the action has passed through the stage of overt speech. The psychological significance of an audible image rests on the fact that it is more stable and stronger than a perceptual image, which evolves on the basis of

mere materialized action without the subsequent overt speech. Though the action has gone "inward," the speech is still the bearer of both the action and its objects.

Galperin (1989, p. 53) called an audible image "external speech to oneself", because the execution of the action at this stage still meets the requirements of communication. The execution is based on an "inner dialogue" and reflects what Wertsch characterized as the "increasing dialogicality that characterizes intramental processes" (Wertsch, 1991, p. 90). This dialogical property of covert speech leads some theorists to generalize and refer to it as "dialogical thinking" in which an action gradually becomes more and more routine and abbreviated. When the action has been developed almost to the point of becoming automatic, there can be a transition to acting mentally, "in the mind."

Acting at the Mental Level

At the stage of covert speech, learners begin to execute all aspects of an action quickly and smoothly. The teacher abandons control of the intermediate outcomes and instead checks only the final outcome of the action. At this stage, the action gets abbreviated; the action is transformed into a mental phenomenon – a chain of images and concepts. Therefore, as a result of the successive levels of abstraction (material – verbal – mental) the action attains a new form: it becomes a "pure thought". This form, as Galperin (1989) argued, represents a qualitatively new level of psychological functioning: the mental action takes on the orienting function. That is, on the basis of these representations, an individual can foresee the effects of one's own actions, change the actions to fit the distinctive features of the situation, and anticipate options on the basis of previous experiences. Thus, the newly formed mental actions serve a key function in regulating the individual's activity. Again, according to Galperin, if we studied those actions only in their final, mental form (that is, when they are already abbreviated, automated, and performed "in the mind"), we would only be able to observe different manifestations and register the results

of those elusive "mental phenomena" (or of the phenomena of behavior). By contrast, Galperin argued, guided formation of actions, apart from its educational value, opens up broader possibilities to analyze the hidden structure of those phenomena (which is the structure of underlying actions) and their genesis.

Orienting at a more Advanced Level

At the end of each cycle, Galperin holds that students come to a better understanding of the actions they have learned, and are more knowledgeable about them as the result of prior activities at the preceding levels. This can be observed in newly acquired forms of orienting activity. Putting it somewhat differently, Galperin viewed the ability of looking ahead (orientation) as a precondition to and even a prime aspect of learning. In contemporary educational psychology, this ability is considered part of students' self-regulation, because looking ahead leads to cognitive planning and monitoring. Pintrich and De Groot (1990) provided empirical evidence that such components of self-regulation foster academic performance.

Galperin's emphasis on orienting activity and its specific qualities as a core component of the student's potential to make further progress also resonates with Snow's reshaping of the concept of aptitude as readiness for learning (Snow, 1992). Synergistic interaction between the learning task and the student's aptitude occurs within a limited range, comparable to Vygotsky's ZPD (for this argument, see Stanford Aptitude Seminar, 2002). To enhance students' potential to learn in the ZPD, Galperin focused on improving the qualities of their orienting activity within the stepwise teaching-learning procedure. Below, we illustrate this type of instruction with teaching experiments in different subject areas.

Teaching Experiments

From the 1950s on, Galperin and his co-workers developed experimental programs in teaching a variety of subjects, including mathematics, physics, language, and history. One of the

most transparent illustrations of Galperin's teaching strategy is in the domain of motor skill learning, namely, teaching handwriting to children (Pantina, 1957). The most basic factors in the development of handwriting writing skill are both the presence of the correct motor image and the shift as quickly as possible from visual to motor control strategies of writing. To achieve such a shift, Galperin developed a teaching method based on identifying the basic units of the shape (contour) of letters. In writing letters, where the learning task is to reproduce their shapes correctly, the unit of the shape can be found in a "segment of continuous movement." Where the line begins or changes direction, indices are added so that each unit is located between two such indices.

In Galperin's experiments with this procedure, children learned to establish the inventory of indices through analyzing the shapes of letters. The teacher offered a model of a letter, explained the purpose of the indices, and showed how one could isolate them. Instead of providing the inventory of indices, the teacher explained the principle of identifying them, namely, that they are placed where the line begins, or ends, or changes direction. Beginning with the second letter, the students isolated all the indices, while the teacher merely corrected the mistakes. Thus, the students established for themselves the inventory of indices and acquire a general principle, which was applicable to any particular letter. After establishing this general orientation basis, the learning process proceeded according to the spiral model. At the initial stages, children identified indices (dividing marks) by drawing the helping lines with the pencil on paper and gave those indices verbal characteristics. At the final stage, children identified indices mentally and with some automaticity", wrote letters quickly and correctly. In the post-test series it was established that the students were able to transfer the acquired method of analyzing shapes to a variety of tasks, such as reproducing Arabic writing, blueprints, and drawings. (for

details, see Haenen, 1996). To use Brainerd's (1975) term, this was an example of "near-far" transfer.

Another example of the spiral model is the study on attention by Galperin and Kabylnitskaia (1974). Its core assumption was that the activity of monitoring and checking one's performance is a material prototype and the source of psychological processes of attention. That the two processes – materially checking for errors in one's performance and 'mentally' paying attention to one's performance – are intrinsically linked, has to do with their basic kinship as forms of control. Namely, both processes serve the same essential function – to control and improve the quality of one's performance (such as in writing) by systematically monitoring its course and checking for errors. Therefore, Galperin reasoned, children could be taught to be attentive through organizing their material activity in such a way as to allow for a systematic control of performance.

Based on this assumption, Galperin and Kabylnitskaia designed a small-scale experiment to teach children to be attentive to spelling errors in the text. Twenty three children (9 year-old, 3d grade), were selected to participate because they all had been characterized by their teachers as "outstandingly inattentive" to spelling errors. For example, they made frequent mistakes while copying the text from the blackboard in class and routinely failed in checking for errors in their own text. At the preliminary phase of the experiment, children performed several different tasks designed in order to establish that the children indeed made mistakes in spelling because of their inattention, and not because they did not know the right spelling. For example, when asked to spell separate words, children made almost no errors (on average, 0.4 errors per task). In another task, the experimenter asked the children to copy a text containing errors (deliberately made in the text by the experimenter) and to correct all of them. The assumption was that if children did not know the spelling rules, they would repeat the same errors while copying the text. However,

children corrected all the spelling errors deliberately left in the text but, while copying the text, made other errors of their own. This outcome also served as an indicator that it was because of inattention, not because of lack of knowledge that those children did poorly on spelling checking.

In the main part of the experiment, the children were taught first to monitor and check for errors in spelling tasks in the material form. They broke the words in the text down into syllables with a pencil on paper and then checked the spelling syllable by syllable, following the order written on an orientation chart provided by the experimenter. After the activity of spelling checking had been mastered on the material level, children progressed to performing that same activity verbally; that is, they described their actions in detail out loud, without using a pencil or the orientation chart anymore. After that, under the guidance of the experimenter, they gradually transitioned to talking to themselves, without overt speech, while carrying out the same activity. As children achieved this stage, their verbal descriptions of their own actions became increasingly abbreviated, thus accelerating the actual performance. In the end, children came to be able to carry out monitoring and checking of spelling entirely "in the mind," smoothly and with few mistakes, as evidenced by a comparison between the pre- and post-test. In the pre-test the mean was 6.4 errors per task (spelling checking in a given text) within a range of 3 to 12, while in the post-test the mean decreased to 0.2 errors per task within a range of 0 to 3. On this basis, the authors concluded that children who are extremely inattentive to spelling errors can learn to develop their ability to attend to spelling. (Galperin & Kabylnitskaia, 1974).

Yet another example is a program designed according to Galperin's principles by Volodarskaia (1972), who taught students to analyze elementary geometrical concepts, such as adjacent and right angles, perpendicular, symmetric figures, bisector, and some others. In this study, 50 sixth grade students (11-12 year-olds) were selected who were performing poorly in geometry in school. At pretest, the students correctly answered only 4-6% of 450 problems in

identifying and classifying geometrical figures and shapes. The instruction taught them to identify a concrete object as an instance of a concept; in this case, as a category sharing some distinctive features (shape, position, etc.). These features were listed on an orienting chart, also containing the identification procedure to be used in deciding if a given instance belonged to the concept. After the students solved several tasks aloud with the orienting chart at hand, the teacher encouraged the students to put the orienting chart aside, and carry out the action at the verbal level by speaking sub-vocally (covert speech). To ensure generalization at these levels, the students were also directed to identify items in the form of a concrete object, a picture or a description. If the answers were correct, the teacher encouraged the students to abbreviate the actions, thus working to transition the action to the mental level.

Results of the study showed that all participating students were able to identify items by looking them over quickly and providing an almost immediate and correct answer on the 450 item post-test. Ninety-three percent of students were able also to give conceptual explanations of their answers, while only seven percent could not (Volodarskaia, 1972).[3]

The above examples illustrate the use of Galperin's spiral model of teaching-learning in educational studies. In each case, the student's material activity of problem solving was gradually transformed into the ability to solve that particular kind of problem mentally. In addition, these examples illuminate the central property that, according to Galperin, defines the developmental potential of instruction – the quality of cognitive tools employed in problem solving (for a detailed discussion, see Arievitch & Stetsenko, 2000). Galperin's instruction seems to be a forerunner to today's "design science" in the sense that it is based on different learning systems at different moments in synergistic interaction (Salomon and Perkins, 1998). Galperin's model is an example of carefully designed instruction in which the learning process moves forward in a spiral fashion, providing students with advanced cognitive tools.

Although Galperin's model is similar in some ways to accounts by others who have discussed the formative role of education in minute detail (e.g., see Cronbach, 1967, on the role of experiences that communicate to learners what others have learned), we think that Galperin's work offers important elaborations. In particular, Galperin provided a detailed description of instructional procedures that bring together, "in synergistic interaction," the notions of cultural tools, internalization, and active problem solving.

Conclusion: Bringing Together Teaching, Learning, and Development

The relevance of Galperin's system of ideas for recently evolving trends in developmental and educational psychology can be revealed in light of the main orientation of his theory and research methodology. Galperin approached the fundamental questions about the nature of the human mind and development by studying the origins of mind in material, tool-mediated, and meaningful activity, initial forms of which exist as shared adult-child social interactions. In taking this approach, Galperin followed in the footsteps of Vygotsky and his co-workers, pursuing the profoundly sociocultural account of cognitive development. At the same time, Galperin departed from Vygotsky in that, instead of relying on observation methods, Galperin turned to the methodology of active construction of new mental processes by organizing teaching procedures and contexts to guide learners' cognitive growth and to systematically assess its path. In so doing, Galperin operationalized and implemented Vygotsky's early and rather general insights about the leading role of teaching and learning in development. He identified the sequence of stages that an activity passes through in its transformations from material to mental forms, and he devised instructional procedures that are most conducive to such transformations.

Galperin's approach -- revealing how development is driven by instruction and associated learning -- is thus a contribution to both developmental psychology and to education. Galperin's work anticipates the recently revived theme in psychology about the importance of learning in

development. Among developmental researchers from various backgrounds, including neo-Piagetian (e.g., Fischer & Bidell, 1998) and information processing (e.g., Siegler, 1996), are those now beginning to investigate the processes of learning and their impact on development, after many years when this topic was largely neglected (Siegler, 2000). Galperin's insights on how to organize students' learning by devising appropriate instructional procedures that promote cognitive growth complement this current direction in developmental psychology.

Galperin's works are also congruent with several research directions in educational psychology. Perhaps most prominently, his ideas of reciprocal relations between teaching, learning, and development are in line with the modern situated view of aptitude as resulting from a interaction in a particular educational situation, thus locating aptitude in the joint action of person and situation, and focusing on propensity-in-situation (Stanford Aptitude Seminar, 2002). This line of thinking generally upholds the view that students' general abilities are not fixed and that educational programs can affect the development of new abilities (see also e.g., Ceci, 1990).

In addition, Galperin's approach can be used to build conceptual bridges between the sociocultural theories of learning stemming from Vygotsky and previously disconnected theories that focus on cognitive growth of individual learners. In particular, Galperin viewed learning as a progression from socially shared to internalized knowledge, in which learners are provided with cultural tools by members of their communities in joint activities of teaching and learning. Therefore, while conceptualizing learning and development as sociocultural processes, Galperin at the same time acknowledged the important roles of individual learning and cognitive development in these processes. This position links his ideas to the theme of learning as social participation (e.g., Lave & Wenger, 1991; Rogoff, 1998), on the one hand, and that of knowledge acquisition and reciprocal cognitive growth (e.g., Bandura, 1978; Cronbach, 1967; Resnick, 1994; Salomon, 1993), on the other. In effect, Galperin's approach predates recent calls for

complementing, instead of contrasting, the metaphor of participation and that of acquisition (Sfard, 1998; Stetsenko & Arievitch, 2002).

At another level, a number of more specific ideas developed by Galperin can be valuable for today's research. For example, Galperin's approach addresses the problem that children need to acquire not only rules and facts (declarative knowledge) but also procedures for how to apply knowledge (procedural knowledge; e.g., Bruer, 1993). In fact, Galperin's teaching strategies can be used to reduce if not virtually eliminate the gap between declarative and procedural knowledge. Namely, in his stepwise teaching model, each action that students master can be comprehended conceptually because it is introduced, from the beginning, in its functional relation to a broader, meaningful task to be learned. At the same time, each concept students are learning is represented as a sequence of procedures (actions) that serve as a basis for solving certain problems. Therefore, declarative and procedural knowledge are essentially merged into an integrated whole. This can be achieved when teaching and learning are organized as meaningful activities, thus putting the acquisition of new knowledge to the service of orienting and guiding future actions.

These ideas can help to develop a framework in which the mutual influences among teaching, learning, and development are more fully appreciated than in much research today. Conceptualizing mental processes and abilities as originating in collaborative, meaningful activities, introducing children to such activities, providing them with necessary cognitive tools, and guiding their progress as the core of teaching and learning that leads development – these are the themes from Galperin's work that can be used as components in building an integrative framework for teaching and learning.

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Footnotes

[1]Leontiev and Zhaporozhets (1960) developed similar rehabilitation programs at approximately the same time, partly in collaboration with Galperin and Luria. This kind of research later became the hallmark of Luria's approach in neuropsychology (Luria, 1970).

[2]Today, dramatic advances in MRI-based research technologies stimulate similar claims that mental processes can be explained on the basis of brain mechanisms. Speculative as it sounds, we would take the risk to say that, probably, for Galperin, these claims would resemble hopes in psychology generated by the advent of the computer in 1950s – the hopes that mental functioning could be understood as analogous to computer information processing. However, the limitations of the "computer metaphor" have been recently acknowledged in contemporary cognitive psychology (e.g., see Hutchins, 1995). Many cognitive psychologists are now looking for explanations beyond the brain, in collaborative activities (for a detailed discussion, see Arievitch, 2004b).

[3]It must be mentioned again that further validation of Galperin and his colleagues' findings is needed, employing more advanced statistical procedures. However, the large number of these studies (the full list exceeds 800 works) and the consistency of their findings can be taken as a reasonable support for Galperin's theory.

Table 1.

Three basic levels of the action.

Level	Description	Examples
Acting at the material level	Acting on concrete, tangible, physical objects or their material representations (models, pictures, diagrams, displays); the actions are based on figurative and operative thinking.	- looking at, demonstrating, imitating - feeling, experiencing - doing things together - conceiving mental image
Acting at the verbal level	Actions are based on overt (communicative thinking) or covert speech (dialogical thinking); the tangible objects or their representations are replaced by word-concepts and speech; the actions are executed verbally (aloud or subvocal) and meet the requirements of communication and social interaction	- verbalizing, narrating, expressing ideas, feelings or knowledge in words - giving mutual verbal support - eliciting and raising problem questions - participating in discussions
Acting at the mental level	Actions are based on "pure" thought (conceptual thinking) and have become a chain of images, associations and concepts; the actions "are kept in mind"	- manipulating concepts - generating possibilities and hypotheses - posing and solving mental problems - cognitive planning and monitoring

Figure 1. The spiral formation of mental actions.