Instrumental Enrichment Program[*]

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Social services have long been plagued with "creaming up." Creaming up introduces inequities in the access to well-intentioned programs of social intervention due to their methods of helping the needy. This inequity is most clearly reflected in the fact that those individuals and groups who need help less are helped more, whereas those who are most in need of help are either not helped at all or are helped in a very limited and unsatisfactory way.

The creaming-up phenomenon, initially described in social welfare, is strongly paralleled in the field of education, in general, and in the development of programs that aim at the enhancement of intelligence, in particular. A number of programs oriented to various dimensions of thinking (e.g.. problem solving, critical thinking, creative thinking) have been developed for generalized use with relatively advantaged students. These students simply need to learn how to make better use of the opportunities offered to them within the traditional public school system. Among the better known of these programs are Meeker's Structure of the Intellect (1969); de Bono's CORT (1973); Philosophy for Children of Lipman, Sharp, and Oscanyan (1980); Whimbey and Lockhead's Problem Solving and Comprehension (1980): Harvard University's Odyssey (1983); Marzano and Arrendondo's Tactics of Thinking (1986); Sternberg's (1986) program for developing practical intelligence, . These programs have been structured in a way that makes their accessibility contingent upon a number of 'prerequisites: cognitive, emotional, motivational, and functional basic school skills. The absence of these prerequisites in a given individual or group of individuals makes these intervention programs inaccessible to them. Yet the very absence of the prerequisites is often the determinant of the individual's failure to learn and therefore makes an intervention program even more necessary.

We begin this chapter by giving several examples of the creaming-up phenomenon to show its pervasiveness. The remainder of the chapter is devoted to providing guidelines for developing programs that do address the cognitive and meta-cognitive prerequisites for low-functioning performers. Thus, this chapter is not intended to be a systematic, comprehensive review of thinking skills programs or of existing programs for students with retarded performance; rather, the purpose of the chapter is to provide a broad-stroke discussion of the creaming-up phenomenon, generally, and then a framework for analyzing current instructional programs and developing new ones. This framework emerges from over 20 years of clinical research and experience with low-functioning students. In our use of the term "retarded performance," we differentiate between the manifest level of performance and the potential for learning that has not yet been

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actualized. It is the performance that is labeled "retarded," not the individual.

The Creaming-up Phenomenon in Education

In Bourdieu and Passeron (1964), French sociologists, analyzed the effects of the open-gate policy that was instituted by the French higher educational authorities. This open-gate policy allowed individuals who usually would not have access to the university to enroll in courses there. Their findings pointed out that only a few of the students from the disadvantaged population were able to benefit from this policy; those who made best use of it were those who would have "made it" in any case. The limited success of this program, designed to help individuals and groups in need of social promotion, was due to the lack of prerequisites possessed by the participants, which would have enabled them to benefit from the program. Accordingly, Bourdieu and Passeron (1964) concluded that an open-gate policy to higher education, unsupported by adequate measures to render it effective, only gives rise to pessimism about the role that education can play in the promotion of the disadvantaged. As the limited benefit of the opportunities offered to the disadvantaged becomes more evident the finger points to heredity as the major determinant of achievement. Indeed, Bourdieu and Passeron called their book *Les Heritiers,* hinting at the emphasis placed by certain behavioral scientists on the decisive role attributed to heredity as compared with the role played by education.

Similarly, a large number of intervention programs require that an individual show a minimal degree of initiative and resourcefulness in order to have access to them. However, the truly needy often lack this minimal capacity to create and persistently maintain conditions of inaccessibility to such programs. Thus, they are unable to make use of them. As with organisms under extreme conditions of hunger, they remain passive and in a state of torpidity that is not easily overcome, even at the sight of the most appealing food. A frequently observed reaction of many of the individuals and groups is that the programs are too late to be as helpful to them as to those whose conditions may make them less eligible, but whose power, motivation, and knowledge turn them into "up-and-comers."

Thus, for example, it is said that remedial programs for reading are not effective with retarded individuals. Remedial programs are structured to be useful for the learning-disabled, intelligent individual. Paradoxically enough, according to the clinical definition of retardation, the retarded performer does not suffer from learning disability. This view has kept thousands of children and youngsters out of remediational reading programs. Instead, they are offered some very inadequate and highly ineffective reading programs that are not considered (even by those who implement them) as giving these children a real chance to acquire reading skills. So, the most needy are once again left out. This is true for many other programs that, from the very beginning, serve only those persons who have the prerequisites necessary to benefit from them, rather than being constructed so as to accommodate various individual conditions. Thus, these programs are not helpful to all who might benefit from them.

In his paper on improving thinking through instruction, Raymond Nickerson (1988) asserted that programs that address problem solving have as their major goal the *improvement* of thinking, rather than its *development.* Nickerson considers thinking as a spontaneously elicited process that therefore does not have to be produced; however, it must be improved. In his words, "While we do not have to be taught to think, most of us could use some help in learning to think better than we typically do. When we say we

want to teach students to think, we really mean that we want to improve the quality of their thinking" (p. 4). This quotation makes clear the view that many programs designed for critical thinking, problem solving, and creative thinking serve individuals who possess these functions but make little or inefficient use of them.

Further evidence of this view may be found in Nickerson's analysis of the areas of thinking typically covered by researchers in their efforts to teach thinking: basic operations or processes, domain-specific knowledge, knowledge of normative principles of reasoning, knowledge of informal principles and tools of thought, wills, attitudes, dispositions, styles, and beliefs.

Assumption of Prerequisite Cognitive Processes in Thinking Programs

Many of these areas of thinking cover the content of mental functioning but do not emphasize the prerequisite cognitive and metacognitive conditions that make this kind of thinking possible. These conditions are taken for granted, just as Piaget, in his search for conservation of matter, took for granted the presence of the process of comparative behavior. The success or failure of programs teaching these thinking operations are rarely explained by the presence or absence of these prerequisite conditions. Similar comments may be made of .the framework for dimensions of thinking developed by Marzano and colleagues (1988), which covers parallel aspects of thinking.

This point can also be made for the work of Piaget. The authors did not find the Piagetian concept of conservation of matter as a developmental, maturational phenomenon in the functioning of Moroccan children, despite the fact that they were 4 or 5 years older than the age suggested for this achievement in a Genevan population. When we started to look into the process responsible for this difficulty and to manipulate the assessment procedure, it became evident that the most important component of this mental operation – namely, comparative behavior – was missing, and therefore the conservation of matter could not be achieved. Assuming that this activity at this stage of the child's development was universally present, the absence of conservation seemed like a pathological phenomenon. However, when we oriented the children to compare the variations in the form of the plasticine with the constancy of its weight, we found that once this elementary cognitive prerequisite was established, the conservation of matter and even the conservation of volume (which represents an even higher level of operation) were acquired and adequately used (Feuerstein & Richelle, 1963).

Educational systems and intervention programs are replete with false assumptions as to the universal and obligatory presence of certain prerequisites of thinking. Conversely, whenever an inaccessibility to a given program is established or even anticipated, program planners conclude that the cognitive functions addressed in this program are simply not appropriate, not designed, or not necessary for the person who does not respond to them. One can see the circular nature of this assumption. On a most simple level, these programs are not made available as a matter of choice. Some educators even invoke the noble need to protect the children from the undue pressure with which they will be confronted if they are faced with a program whose set of goals is too high, and therefore their accessibility to the program is denied.

The senior author remembers the negative reaction of teachers and supervisors of educable mentally retarded children when it was suggested that they introduce one of the Instrumental Enrichment program instruments that requires a high level of spatial

functioning and hand-eye coordination. Teachers did not criticize the instrument for requiring a high level of information processing, but for requiring a level of visual-motor skills that was assumed to present particular difficulties for the educable mentally retarded child. This did not prove to be true. The fact that, after adequate mediation, these children mastered the tasks on the instrument became proof to many teachers that indeed these children were much more modifiable; in their cognitive performance than had been expected.

In order to make such modes of thinking available to the disadvantaged and to make them able to achieve what such programs require, a system-oriented approach must be implemented. Much more is required than offering some specific skills or mental operations. In a system-oriented approach, a single school system or school district is totally involved in (a) assessing the students' characteristics and their level of modifiability more dynamically; (b) offering the information obtained through this assessment to policy makers, teachers, parents, and last, but not least, to the children themselves; and then (c) establishing guidelines for intervention based on the preferred modes for increasing modifiability, as derived from the results of a dynamic assessment. In a system-oriented approach, emphasis is placed on the system that is the target for change, rather than on the individual. The environment is shaped so that it becomes a modifying environment. Ultimately, however, with the shaping of the environment, the modifiability of the individuals is increased.

In their thorough review, Resnick and Resnick (1977) pointed out that the movement to teach thinking is distinctive in no longer addressing a small elite as in the past, but rather in its attempt to serve all learners in a truly democratic educational system. The question is: To what extent have the programs in current use been designed to make them accessible and beneficial to the masses of persons in need of development? It is our belief that these masses have been largely unable to benefit from whatever the school system offered them in curricular, content-oriented programs because they have been unprepared for this confrontation and limited in their use of cognitive skills necessary for mastering the curriculum. These disadvantaged students were even less able to derive from their acquisition of basic school skills either higher mental processes or "good" thinking behaviors. To some extent, this failure is true even among students who are well prepared for their schooling and have benefited from instruction by becoming better achievers in school, although not necessarily better thinkers. This position accords with Nickerson's (1988) view that it is possible to finish 12 years of public education in the USA without developing much competence as a thinker.

Prerequisites for Learning: Targets for Intervention

Feuerstein and his colleagues (1980) have emphasized the decisive role played by the presence of prerequisites of thinking in the capacity of the learner to benefit from learning opportunities. Specifically, three levels of cognitive deficiencies found in retarded performers have been defined. Input level deficiencies concern the quantity and quality of data gathered by the individual. Elaboration level deficiencies include those factors that impede efficient use of available data and existing cues. Output level deficiencies include those factors that lead to an inadequate communication of final solutions. Examples of deficiencies at each level are shown in the Appendix. Deficiencies at the input, elaboration, and output levels markedly reduce the

accessibility of the content of thinking. We explain what this means for each level of deficiency.

The Effects of Input Deficiencies

A blurred perception that renders the gathering of data laborious, fragmented, partial, and imprecise will set strict limits on the individual's interaction with the stimuli, necessary for the process of thinking itself. Similarly, a lack of systematic exploration of the data at the input level will expose the individual to the hazards of a probabilistic perceptual encounter with stimuli and will not be conducive to the elaboration of all of the available data. Failure to use two or more sources of information will limit the individual's cognitive processes to the simple act of recognition and will not be conducive to the higher order conceptual thinking. The various objects that are thus perceived will not be coordinated. Such deficient functions on the input level will both affect and be affected by inadequate elaborative processes. Inadequate elaboration will follow an inadequacy in perceiving and registering a problem, because the individual will not ascertain the incompatibility between the stimuli that are perceived.

The failure to adequately register and define a problem, which may be due to blurred perception or to a lack of relevant data (with consequent insufficient information processing about the characteristics of the stimuli), will meaningfully limit any motivation to search for additional data. As a consequence, the learner will not experience the disequilibrium produced by a perceived incompleteness, incompatibility, or controversially of data. A lack of curiosity, reflecting a lack of motivation to know more, is often the outcome of a deficiency on the input level.

The Effects of Elaborative Deficiencies

In many cases, deficiencies on the elaborative level, such as lack of need for logical evidence or a lack of need to compare, are responsible for a lack of critical thinking behavior. In turn, elaborative deficiencies often create insufficiency in the input processes. Gathering data not only determines the nature of thinking but, to a very large extent, is determined by it. The goals set by elaboration for the perceptual apparatus during the input phase – such as creating relationships between discrete units of information through their comparison, creating substitutes, or producing groups through categorization – all these operations and elaborative activities result in a greater need for accuracy and precision, a more systematic exploration, and a meaningful reduction in the individual's impulsivity. These are conditions of thinking itself that affect the disposition and orientation of an individual's interaction with reality, with external or internal sources of information, and with formal or informal opportunities to learn. As a result, the individual benefits from experiences by developing higher level cognitive processes. Presenting low-functioning individuals with tasks that aim at producing problem-solving behaviors, strategic thinking, and critical thinking without equipping them with the prerequisites of thinking leaves their deficiencies uncorrected and will necessarily render these efforts inefficient. Intervention programs that do not include the correction of these deficient functions are, of necessity, inaccessible to individuals with such deficiencies.

The Effects of Output Deficiencies

The output level, that phase of the mental act in which individuals communicate the product of their thoughts, also largely determines the efficiency of the mental processes. Impulsive responses and egocentricity (in the Piagetian sense of the term) may leave

even an adequately elaborated answer without the attributes necessary to make it acceptable. Furthermore, imprecision, or the lack of need for precision on the output level, may, but need not always, result in limited needs for precision on the input or elaborational levels of the low-functioning individual. All mental processes will be affected by the confrontation with tasks to which the individual has not learned to respond with the required degree of precision. The result will be a failure to use such tasks for the development of meaningful learning processes.

Goals of Remedial Programs

A number of goals can serve as guidelines in the selection and production of tasks to include in programs designed to develop cognitive processes, problem-solving behavior, creative thinking, critical thinking, philosophical modes of thinking, or even lateral thinking (such as is present in the de Bono program, 1973) when they are addressed to students with retarded performance, regardless of the distal determinants of their low functioning. In order to benefit from any program, students must have the capacity to learn from experiences, whether those experiences are intentionally produced for developing thinking or emerge from informal circumstances that individuals may be exposed to in their daily life. The capacity to learn cannot be considered as universally and equally present in all individuals. Some people benefit from each exposure, be it accidental or incidental, no matter how organized the experience is or whether or not it is meant to be a learning situation. Others have an extremely limited capacity to benefit from such learning opportunities. These individuals are exposed to experiences, are confronted with many and often powerful sources of stimuli, and yet are affected by them very little. For disadvantaged learners, it is not sufficient to make these stimuli available; they need help in rendering stimuli accessible to them.

These individuals need to enhance their propensity to use their encounters with stimuli in order to become modified and more experienced by this exposure. They must be rendered more flexible so that their previous ways of thinking and the established schemata can interact with the new data by new ways of perceiving them, new modes of elaborating them, and new and more adequate ways of responding to them. Through this process of assimilating the novel and the more complex and becoming modified by this very process of assimilation in the direction of a better accommodation to the new situation, they will become better able to benefit from experience. Without this process of enhanced assimilation and accommodation, the simple presentation of data will affect the population of low-functioning individuals very little, if at all.

In other words, the first goal of a program that aims at enriching low-functioning individuals will be to render them permeable to the program by creating in them the prerequisites for learning, that is by increasing their modifiability. To this end, a number of subgoals are necessary. These subgoals must guide the construction of the program and the selection of its materials and its content. Even more, they must be considered in determining the program's presentation, didactics, and techniques that shape the interaction between the teacher (turned mediator) and the learner (turned mediatee). In the following subsections, we present the six subgoals that we chose as the basis for an intervention program whose major goal is to enable individuals to better learn what is being offered them by life or by education.

Correction of Deficient Cognitive Functions

The first subgoal is to correct the deficient cognitive functions. What we presented as

prerequisites of learning we now define as goals. The overarching goal aims at correcting the deficient functions that characterize the individual with learning problems and reduced modifiability. This goal requires that the program be designed and applied both implicitly, in the way that tasks are structured, and explicitly, in the way the tasks are presented. The program is, therefore, designed to correct those deficient cognitive functions that are responsible for the reduced learning propensity of the individual.

Thus, in the Instrumental Enrichment program, tasks are shaped so as to compel the learner to invest much more meaningfully in their perception. For instance, the learner is compelled to search at great length for a given figure in a cloud of dots in which the figure is superimposed among others. The act of segregating a given shape in a cloud of dots requires that the perceptual activity be regulated, that impulsivity be inhibited, and that the number of dots identified as belonging to the sought-after shape be kept constant until the other dots that belong to it are found. Learners will have to look for strategies to facilitate their search, such as keeping their fingers on two of the dots while looking for the other two missing dots of the square, or finding certain systems of references that facilitate greater efficiency in the process of searching. Perception must be much more accurate than when it is confronted with unequivocal stimuli. Furthermore, by making the task require more than sheer perceptual processes, the learner must actively use cognitive processes to solve the problem.

Thus, in the search for the hidden square, individuals will have to gather more precise data about the model figure. The square's attributes will have to be compared with the attributes of a triangle or quadrangle.

For this end, learners will have to use numerical criteria, such as four sides and four angles. The concept of equilaterality will have to be applied, as opposed to the differences in size of the sides of the rectangle. They will have to use the concepts of distance, length, and size. The constancy of the object across changes in its orientation will have to be maintained. From the presence of a given set of dots, the presence of another set must be inferred. From the absence of one particular dot, conclusions will be reached as to the inadequacy of the set under consideration (see Fig. 1).

The elaborational process is initiated by confrontation with incompatibilities inherent in the task, which are intended to produce a state of disequilibrium. The immediate feedback of; lie outcome of their activities will correct many deficiencies on the output level and will create a greater readiness in individuals to control their impulsivity and to check on their hypotheses, restructuring them according to the outcomes of previous trials. Instrumental Enrichment has been shaped by this need to confront the learners with stimuli, experiences, and tasks that correct their specific deficient functions. The list of deficient cognitive functions has been very important in the development of tasks designed to reach this particular goal (see Appendix).

Fig.1. Selected tasks from Organization of Dots, page 2. The individual must seek the necessary dots in an irregular, amorphous cloud so as to project figures identical in size and form to the given model. Successful completion involves segregation of the dots and articulation of the field. Tasks of Organization of Dots become more difficult with increased density of dots, complexity of figures, overlapping, and changes in orientation.

Acquisition of Prerequisite Repertoire

The second subgoal is to equip the learners systematically and intentionally with the prerequisite information, verbal labels, types of relationships, and modes of operation that they need to do the exercises. Terms such as *square, triangle, parallel, equilateral, central, peripheral, before, after, simultaneous, identical, similar,* and *opposite* are necessary prerequisites whose presence in the individual's repertoire should not be taken for granted, even though, in practice, there may be evidence of their application even by the most low-functioning individual (Bryant, 1974). For purposes of learning and generalizing, however, the explicit meaning of such terms is a precondition for adequate learning. Similarly, operations such as analogical reasoning, logical multiplication, permutations, substitutions, and elisions will have to become active and explicit components of the repertoire of the individual's mental functioning .

This second subgoal is achieved mostly through the active intervention of teachers/mediators who interpose themselves between the learner and the task and, according to their knowledge of the individual's need, introduce the vocabulary, operations, and strategies necessary for the mastery of the tasks. This subgoal should not be seen as the specific content of learning, even though it represents the content aspect of the program, which itself is not content-oriented.

Production of Generalization and Transfer

The third subgoal is to build into the program itself a propensity for generalization and transfer as a dimension of the learning process. This subgoal, the most neglected in many other programs, is mainly achieved through the creation of insight and opportunities to activate this propensity immediately. Teachers/mediators interpose themselves between the learners and the tasks and help in the analysis of the processes involved in solving a specific task. The mediator interprets to the learners the meaning of these processes and the way such processes can be applied in a variety of situations. Insight enables the learner to recognize that the functions that have been applied in a given task are relevant and applicable in others. Insight is also oriented towards discovering (through a self-reflective process) the kinds of changes produced in one's own cognitive structure by exposure to given experiences. These will be the source of new strategies applicable to other situations. Thus, insight will become an effective and powerful tool in producing transfer of the acquired elements and their generalization over situations differing from those to which the individual has been exposed.

Insightful learning, leading to generalization and transfer, relies heavily on the concept of transcendence, taken from the mediated learning experience. Mediators do not interact with the learner only to the extent that the current task requires; they go beyond the immediacy of the needs of the current situation into other areas of functioning that the individual may be called upon to fulfill. Many of the programs that fail to generalize and transfer to other tasks have failed because there was no provision for those elements that would ensure that such generalization and transfer would occur; they relied heavily on what the processes themselves would do. It was supposed that individuals who were given a set of principles would apply them spontaneously, by themselves, because development was assumed to be spontaneous and from within, outwards. The social origins of generalization and transfer have been neglected very badly. They originate in a mediated orientation toward such processes. Through the

transcendent nature of their interactions, the mediators orient individuals toward a process of generalization.

In Instrumental Enrichment, for instance, the passage from learned rules, principles, strategies, and habits to other areas that are unrelated to the initial task is accomplished through what we refer to as *bridging*. The process of bridging consists in creating a certain orientation of the individual's mental activities. The individual is constantly oriented to seek areas of affinity between situations that warrant the application of the same principle. Transfer is ensured by the individual's acquired propensity toward comparing situations in terms of their commonality and difference; by an orientation toward facilitating problem-solving behavior by referring to previous experiences; by the use of the solutions of previous experiences; and by the selection of specific strategies, or modes, or styles .

The teacher as mediator not only activates one particular individual in the classroom, but enriches that person's propensity to generalize through the participation of the whole group, which offers the variety and diversity of its particular experiences, thus fostering divergent thinking. Insight, defined here largely as metacognition, orients the individual toward the search for the mental process to master a given task. This metacognitive activity, involving self-reflection and control, leads to activating a variety of cognitive processes that will enhance meaningfully the structural nature of the changes produced by learning. For example, the current task may be compared to a past task in which difficulty was experienced. Following this comparative behavior, the current task will be solved more easily by the application of a strategy that was found to be efficient in the previous situation.

Development of Intrinsic Motivation

The development of an intrinsic motivational system is the fourth subgoal that must be kept in mind in developing programs for the disadvantaged learner. This intrinsic motivation is necessary in order to ensure that the learner will apply those learned rules, principles, sets, strategies, and problem-solving behaviors to situations in which there is no explicit demand to do so, as in the classroom (in particular), or in life situations (in general), it is not enough to know that there is a strategy. In order for it to be applied, one must also be motivated to use it. Such motivation may be extrinsic, as when one is specifically asked to implement the strategy; but such situations are rarely present in the life of disadvantaged individuals, whose encounters with situations that demand higher order thinking may be very limited (at least as long as they function as disadvantaged, both in school and at home).

The motivation to use adequate cognitive processes may become possible through an internalization and an intrinsically determined activation of part of the repertoire of functioning. One disadvantage of many available programs is that intrinsic motivation as a determinant of behavior is not addressed. Producing intrinsic motivation is especially important for disadvantaged learners. The great problem is how intrinsic motivation can be produced where it does not exist. The disadvantaged learner is often very much of a "realist," seeking types of skills or information that can best serve in immediate encounters with situations. When it comes to intellectual higher order mental processes, internal needs rarely animate. There is a pragmatism in grasping at the easiest way to perform and achieve immediate goals.

How, then, can we produce intrinsic motivation towards types of functioning that are not always needed and not necessarily economical? What types of investment are

required in order to endow the low-functioning individual with a motivation that is detached from the immediately experienced, extrinsically generated need? To deal directly with low-functioning individuals, we must confront this question. Our answer is that intrinsic motivation can be equated with habit formation. A habit is an intrinsic way of determining behavior. In certain cases, the habit is not contingent on any situational constraints. In some extreme cases, it is even incompatible with extrinsic needs. When we are habituated to do something, we do not do it because it is necessary; but because we have the habit of doing it. The habit itself makes it necessary that an act be performed in a specific way.

Habit formation has been badly neglected in an era when everything has had to rely on internal reconstruction, on discovery learning, and on a spontaneous and fluid kind of approach. Many educators have fought against habit formation, which has been considered – and rightly so – as too mechanical, less thought-through, and as having no requirement for the fluid intelligence that is applied in operational thinking. Habit formation, therefore, has been totally neglected in programs in which thinking rules and problem solving are the major goals. Principles that are taught are applied to a situation in the immediate experience episodically and spuriously, leaving place for another principle to be taught. All that is taught remains on the level of fluid intelligence. There is no purposeful, intentional way of producing a crystallized form of thinking in the learner.

Habit formation usually relies heavily on a repetitive, rote type of learning. It requires repeating the same thing until it gets applied mechanically. The question, therefore, is to what extent should rote, mechanical learning be used in order to form habits of thinking and functioning? The damage that may be produced in the motivation of individuals (in having them do things they do not like to do), and to the fluidity of their thinking (by making them do things without having to think) may be greater than the benefit derived from forming habits of cognitive functioning.

In attempting to solve this problem, which sounds very much like "squaring the circle," we have used a Piagetian concept initially termed by Baldwin (1925) as the "circular reactions." We have made sure that habit formation through repetition of the same principle will never become purely mechanical. We achieved this by designing tasks that repeat themselves in one or two or the parameters they have in common but change in other parameters. A need has always been created to rediscover the familiar, the mastered part of certain skills in situations that constantly become different, more complex, more novel. Even when the same rule is applied, it will always be done with the help of more fluid types of thinking, by rediscovery, and by shaping the known element so it will fit the situation that was previously unknown. This need to create habits is addressed in Instrumental Enrichment by producing numerous repetitions of the .same principle, but never applying it mechanically or blindly nor using exactly the same situation. The repetitive tasks require a great effort of discovery and restructuring. The goal of producing intrinsic motivation through habit formation makes the program require more time than does a usual enrichment program in which principles and rules are taught in a hit-and-run fashion, with hopes that by hitting and running the goal will be attained (see Fig. 2).

The need to crystallize the acquired cognitive processes is felt mostly in the input and output phases of the mental act, which are more resistant to change than the elaborative phase and, therefore, require much more investment in order to reach higher levels of automatization and efficiency. Thus, in order to make individuals with blurred,

sweeping perception invest more and focus longer in order to reach a greater level of clarity and accuracy in the perceived, many situations must be created in which this will be imposed by the nature of the task. The same is true in the output phase. Inhibiting impulsivity in the output level is not achieved by imparting to the individual the meaning of control of impulsivity. It will require a neutralization of the original determinant of impulsivity and then the undoing of the habit that has become established through long years of practice. Undoing a habit is best achieved by substituting another and more desirable one for it. Formation of a new habit requires more effort and is spread over longer periods of time.

Follow-up research (Rand, Mintzker, Miller, & Hoffman, 1981) found an increase in the effects of Instrumental Enrichment with time elapsed after cessation of the program, a fact at least partially explained by the process of consolidation and crystallization of the cognitive habits. Time has thus acted as a reinforcer rather than as a weakening determinant of the acquired cognitive functions (see Appendix, p.).

Habit formation adds the dimension of efficiency to the mental act. Efficiency (defined later as the "rapidity-precision" complex and the feeling of ease by which a given task is performed) is strongly dependent on whether the program allows for habit formation. The more habit formation, the greater the efficiency. The greater the efficiency, the more chances that the individual will use the acquired cognitive functions, because it will be easier, require less investment, and hence be more economical.

FIG. 2. Orientation in Space I. page 5. The preceding task illustrates the controlled repetition of the same principle. The field must be constantly restructured for mastery. The instrument. Orientation in Space I, introduces a personal, stable system of reference by which to describe spatial relationships. It also seeks to develop and enhance the use of representation and the ability "to put oneself in the shoes of the other." A transcendent goal of the instrument is to develop an understanding and tolerance for ideas and attitudes that stem from perspectives different from one's own.

The Piagetian concept of assimilation and accommodation has been used in shaping the formation of habits. We create a schema through repetitive behavior. Hut then, in order to make this schema able to accommodate to the new elements that the schema assimilates, we create conditions by which to keep the schema flexible and plastic. Thus, in Instrumental Enrichment, we have made sure that the rules and principles, strategies, modes of search, and the various subgoal that deal with the correction of cognitive deficiencies will be spread over the whole program, and that individuals will

again and again have the opportunities to apply what they have learned to other areas and in a large variety of tasks. Bridging and insight will render explicit the applicability of certain automatized strategies implicit in other situations.

Development of Task-Intrinsic Motivation

The fifth subgoal is the creation of task-intrinsic motivation. This requires producing types of tasks that will entice the disadvantaged learner and stimulate a readiness to act in response to the appeal of the task itself. To be stimulating, Instrumental Enrichment uses rather complex and difficult tasks. Instrumental Enrichment makes these tasks accessible to learners by offering them the necessary mediation, carefully gauged to individual needs, to help them succeed. Once the learners are successful, the mediator leaves them to work independently. The task may be complex, but the learners' competency is not based on their previous experiences. We have carefully avoided making success contingent on previously known units of information. The complexity of the task relates only to the mental act that the individual will have to perform to solve the problem, with very little reference to previous experiences. Of course, some individuals will be more advantaged when confronted with these tasks because of their greater generalized or specific experience. However, even the advantaged must invest again and again when they are confronted with the same task. Teachers themselves must invest and make an effort when presented with our materials. In certain cases, their effort is even accompanied by their feeling, "How is it possible that I cannot do what the children are supposed to learn, and I must make an effort to do what the children will have to learn with ease?" Usually, programs used in training for problem-solving behavior are easily mastered by the teachers themselves. By the nature of the complexity of its tasks, and its independence from demands for previous learning, this program becomes a target worthy of mastery by individuals with a proficient education, as well as being interesting and appealing to the disadvantaged who have had very little or very inefficient modes of learning (see Fig. 3.

This task-intrinsic motivation, which is produced by the very nature of the tasks, has both a substantive and a social aspect. The substantive aspect is, of course, the nature of the mental operation in which the individual becomes engaged while doing the tasks, which tends to become "addictive" because it is both challenging and a source of success. Some of the children cannot stop doing the exercises. Some adults, as well, experience this because of the challenge of the exercise and the prospects of success. In many instances, low-functioning individuals may initially be frustrated when they see themselves caught in a task in which they have to invest, because they have never done anything requiring from them more than a very fleeting, sweeping kind of perception and attention. They may actually tear up the page of exercises. But if the mediator has enabled them to experience a first success, they come back slowly, so that what was initially a source of frustration becomes enticing. Then the task-intrinsic motivation and the curiosity emerge, not only about the task but also about themselves ("How will I be able to do it?," "How much better will I be able to do it at a later stage?," "How much more difficult will the tasks be that I will be able to do later?"). Indeed, some of the learners, having once experienced success, request more difficult tasks. This kind of task-intrinsic motivation is very seldom experienced with disadvantaged, dysfunctional learners. They usually avoid learning. They also avoid anything that is new because of the difficulties it presents to them. This behavior is followed by the evasion and lack of

persistence that so strongly mark the disabled learner.

Fig. 3. Selected tasks from *Comparisons*. These exercises illustrate the level of difficulty posed In the tasks for even advantaged learners. In order to draw items that are similar to the given model in only a few aspects, it is necessary to process information from several sources simultaneously and to devise a strategy for checking the completed work. The instrument, Comparisons, teaches the student to find and describe the similarities and differences between two or more objects or events. It also aims at enriching the verbal repertoire of parameters to direct clear, precise and accurate perception.

Another positive aspect of task-intrinsic motivation is the social meaning that the mastery of such tasks bears for the learner. The learner – child or adult – learns the worth of this type of activity as a socially valued and appreciated experience. Many of the children in the classroom situation who have experienced constant failure learn through Instrumental Enrichment for the first time that they can do as well as the more successful students do in subject-matter areas. Furthermore, the nature of the tasks is such that they require a constant rediscovery when they are presented to even initiated, experienced learners, including the teacher, who have performed the tasks before. A constant need exists for investment each time they are confronted with similar tasks. Even if, admittedly, they will need less investment, nevertheless they will hot be able to perform just by looking at the task. Learners cannot solve the problem by simple recognition, they must restructure and rediscover the problem. The tasks have been shaped in a way that will make such discovery possible, but it requires a reinvestment. Teachers and students then realize that they are very close to each other in doing these tasks and that the relationship in the teacher/mediator-task-student triangle is much more equilateral than in any other instructional experience (Fig. 4).

A new social status emerges when a disadvantaged student becomes involved in Instrumental Enrichment. Opportunities are created for the individual to succeed and to feel competent areas in which even adults have to work hard in order to succeed. Students feel an attraction to tasks that are so effective in changing their status.

FIG. 4. Teacher-Student-Material- Relationship. In teaching curriculum material, the

teacher is usually very familiar with the lesson's content. Students perceive the teacher and material as a unit and feel very distant from both. In Instrumental Enrichment, however, the teacher-mediator and student confront the tasks together. This, cooperative relationship makes the distance from the material the same for both, The teacher-student-material interactions more closely resemble an equilateral triangle.

Changing the Role of the Learner

The sixth subgoal, probably the most important in dealing with the disadvantaged, is to create a feeling of not being just passive reproducers of units of information that are offered to them ready-made, but as people who are called on to generate new information that would not come into existence without their direct contribution. In many instances, deficiencies in the functioning of the disadvantaged, deficiencies in their learning process, are the direct result of a view of themselves as the recipients of information and, at best, the reproducers of the received information, without any pretense or even readiness to see themselves m the role of those who are called on arid able to produce information. In many instances, programs designed to create higher mental processes offer the learner problems that are matched to the presumed repertoire of prerequisites of thinking, the componential skills, and the motivation to solve them.

Success in such programs is built on the conditions for solving the tasks, which presuppose certain prerequisites. However, low-functioning learners do not possess these prerequisites. They will not be able to solve such problems unless they are properly and systematically prepared for them and unless they are equipped, through previous focused intervention, with the necessary conditions for such problem-solving behavior. Presenting tasks that require the production of new modes of thinking, new strategies, and the discovery of rules in situations not previously experienced leads towards their perception and awareness of themselves as generators and creators of new information, which is essential in solving problems. Many of the individuals experience this change as having a significant impact on their lives.

Low-functioning students often attribute their failure to that to which they have not been exposed. If they do not function properly, they comment: "I have never learned it. Nobody taught me. I have never been told to learn it," as if everything one knows depends on external sources of information. It is noteworthy that outer-directedness is described by Zigler and Butterndd (1966) as a typical phenomenon of the mentally disadvantaged individual. This affects the output phase of the mental act, turning even a properly elaborated problem into a failing response, just because the students do not dare think they will ever be able to respond to something about which they have never been told. Programs addressing themselves to the low-functioning learners have to create the situations, the modes of presentation, and the interpretation that will convey to that learner, "Yes, you are the generator of information and thereby can be engaged in the processes of discovery and creativity, and in more efficient learning." Processes of generalization and transfer to situations other than those that have been learned will then take place.

The Dilemma: Embedding or Isolation

The literature is replete with questions about the nature of a program aimed at developing cognitive processes or enhancing problem-solving skills. Should it be given as an independent type of activity? Or should the ingredients and components of the program be intermingled and entwined as interstitial tissues in an otherwise content-oriented academic studies curriculum? (Resnick, 1987; Jones, Palincsar, Ogle, & Carr,

1987; Perkins and Salomon, 1989). Those who advocate the latter approach would say that teaching intelligence without a specific content to which it is applied may leave it totally isolated from the areas of performance in which the individual is called to function. What is learned may remain isolated without any effect on the performance of the individual in a real-life or academic situation. Other arguments pertain to the structure of the intellect and to some theoretical considerations about the specificity of certain modes and types of thinking operations that are not considered to be freely and easily generalized, but must be taught, learned, and applied to specific content. The question is, therefore, to what extent will creating cognitive skills outside of, or free from, specific content be as efficient as when they are taught within their specific context? This argument is, of course, valid when we deal with higher mental processes in a direct way. However, it cannot be considered a valid argument once we deal with prerequisites of thinking, such as adequate data gathering on the input level through proper focusing, through sharpened perception, through prolonged and persistent investment, and through systematic search for data. It is not valid when we must equip the individual with the most elementary type of mental functions, such as comparative behavior, or when we deal with the episodic grasp of reality that is characteristic of the learning disabled.

An episodic grasp of reality hampers the individuals' orientation and readiness to create relationships between things, and keeps them from organizing the experienced events in a sequence that permits the perception of causal relationships, the means-and-goal relationship, or the types of associations that are necessary when one is involved in such higher order thought processes as categorization and inductive and deductive reasoning.

When one deals with elementary cognitive functions that have not been established, for whatever reason, in the individual's cognitive apparatus, then the issue of specificity is much less important. These basic cognitive functions have to be mediated and consolidated in order to render them efficient, especially when dealing with the peripheral phases of the mental act (the input and the output phases; see Appendix). They must be dealt with in a very focused way in situations- that permit the exercise of these functions in a systematic, repetitive, and crystallizing way. This cannot be done when one deals with the curricular content-oriented programs that require a particular strategy or a particular type of function. Therefore, in attempting to increase the cognitive modifiability of the low-functioning individual with deficient cognitive functions on the input, elaboration, and output levels, the usefulness of the curricular, content-oriented approach is very doubtful.

The controversy around the question as to which is the preferable approach to the development of cognitive skills is best resolved when one refers to the broader goal of learning to learn, notably to increase the modifiability of individuals by rendering them more sensitive to opportunities for learning in a formal and informal manner. Learning to learn may then become the source of the acquisition of new strategies, the development of specific cognitive skills, the acquisition and retention of information, and the organization of sets or units of information in a way that will permit easy access and retrievability whenever required. This goal is to be considered as a precondition for any attempt to involve low-functioning individuals in more specific types of objectives that would render them accessible to content-oriented goals of learning.

Reasons for Content-Free Programs

In addition to the preceding arguments, four specific reasons in favor of using a specially designed content-free program for these goals, rather than making them a derivative of curricular content-oriented approach are as follows.

Resistance of the Student

The first difficulty in using curriculum materials for creating prerequisites of thinking resides in the resistance-of the student. When these students are involved in learning and acquiring units of information of any nature, they usually show very little readiness to allow themselves to be "led off or "taken away" from the subject matter with which they are dealing in order to elaborate on the relationship between units of information to which they are exposed or to deal with certain molecular components of the mental act. Low-functioning learners are often marked by a materialistic approach. They want to master the presented material. They are not interested in going beyond the stimuli, the data, or the events with which they are dealing in order to speak about the relationship between these events, the way they are organized, the way they are grouped, substituted, generalized, and conceptualized as accomplished by using higher mental processes. Some of the learners claim their right to finish a given number of pages or a given number of exercises. Never mind how much comprehension accompanies this "mastery." Teachers who attempt to derive from the acquired information the supraordinate inferences (the "moral of the story") are met with the resistance of the learners whose orientation is focused very little on the relationships and much more on the facts themselves.

The detachment from the content to the more formal aspects of thinking that can be derived from it is to be considered as an end product of a process of mediation and training, rather than as a primary goal. It is only after the program has created a state of accessibility in the disadvantaged learners that they will be able to use content-oriented learning, as well as any other event they directly experience as a source of rule learning and conceptualization. The two programs, content-laden and content-free, have to run parallel to each other with the teacher as mediator, building bridges between the two streams of learning. In this way, the resistance of the learner will be more neutralized. Once equipped with the orientation and the proper tools for the acquired information, there are much greater chances that the learner will be ready to invest in organizing, planning, encoding, categorizing, judging situational conflicts, searching for criteria for truth and falsehood and the "objective" logical evidence within it. Hopefully, then, the way of learning the curriculum content materials will prove to be much more effective and mean more than when the learning is devoid of the principles, rules, and efficient modes of input and output.

Resistance of the Teacher

A second source of resistance to the use of curriculum learning for training toward higher mental processes (such as critical thinking and problem solving) are the teachers. The teachers' materialistic orientation is encouraged by the educational system and its supervisors as well as by the children themselves. Teachers become very reluctant to spend too much time on formal aspects of learning, because this interferes with the possibility of dispensing the amount of information the learners are supposed to acquire during a given period in their school activities. Teachers often jealously guard the time

allocated for teaching content even when they know how little of what is offered the children reaches them. Asking teachers to stop the flow of in formation or the learning of basic school skills in favor of teaching formal elements of thinking is considered to be a true loss of time, especially, if they do not believe in the modifiability of the learner and when their teaching efforts are not found to lead to measurable, palpable academic achievements.

Teacher resistance is even more difficult to counteract, because teachers are little aware of the prerequisites of thinking that are responsible for adequate cognitive processes. This lack of awareness is due to their training or orientation, or their interest and motivation. They take for granted certain conditions of thinking that do not necessarily exist in each student; or, even when they do exist, they are not always used efficiently by the student. Thus, teachers base their instructional strategies on false assumptions.

For all these reasons, teachers trained in the traditional manner do not use the content of their teaching for the broader goal of teaching how to learn. However, according to our experience, a program that uses mediational interaction and "bridging" to content is more acceptable to teachers. When the program's major goals and subgoals focus on the learning-to-learn strategies, teachers will be more likely to use even content-oriented learning in a way that is compatible with this broader objective of education.

Resistance of the Subject Matter

A third reason for not combining instruction in prerequisite skills with subject-matter instruction is that the structure of the subject matter may compete with the enhancement of the process of learning. The subject matter (e.g., literature, geography, history, biology, mathematics, physics) resists the imposition of a structure of learning that is alien to the content's nature. For example, consider an attempt to use a poem written in an associative way in order to derive from it the cognitive dimensions of organization and succession. Trying to create types of grouping of events that are totally inadequate in order to learn categorization or classification may render the learning of the content extremely difficult, if not impossible. Changing the flow of a given set of data in order to reflect upon it, as required by the more formal goals of learning, may again seriously disturb the learning of the subject matter. This may result in a double loss, with the subject matter and the process of learning neutralizing, rather than reinforcing, each other.

As previously described, a program designed to produce the prerequisites of thinking has its own rhythm and rationale, and cannot follow the natural succession of the events required by the subject matter. Indeed, some programs fuse the two goals, with the consequence being that neither one is adequately reached. Therefore, we consider it much more appropriate to keep the programs of teaching .subject matter and teaching thinking parallel to each other, rather than to have them mixed and integrated. The two streams of learning can be integrated by the active interpretation of the teacher and amplified by the participation of the students in the classroom.

Resistance Associated with Failure

Finally, another danger in the use of content-oriented material lies in the fact that some of this content was experienced as a source of failure and negative experiences by many of the dysfunctional students. Any attempt, therefore, to use this content as the way to provide a more positive, more optimistic experience may be met with great

student resistance. Some of them say quite openly, "I won't try again," "I have failed so many times to learn this," "I give up." The use of a neutral program that is not content-oriented is much less conducive to such negative attitudes.

Even difficult tasks, hut those that the students have no reason to believe they are supposed to know without learning, are more appealing and easier for the learners than engaging in something with which they have a repeated history of failure. The conditions of mediation that accompany the Instrumental Enrichment program ensure successful mastery by varying the amount and nature of the mediation that is offered. This may offset the negative orientation and enhance in the learners a readiness to re-engage in the process that they previously adamantly rejected.

In conclusion, a program mainly designed to help students acquire the prerequisites of learning will be required to make accessible to individuals those cognitive processes that are necessary for their greater adaptability.

Expected Outcomes of Intervention

Another consideration in constructing programs for low-functioning individuals is deciding upon which areas to place the greatest emphasis. Such decisions cannot be made simply as a function of the individual's greater or lesser strengths. Because the goal of an intervention program is to create a greater facility for benefiting from learning processes, the decision as to which dimensions to choose for greater investment must be guided by conceptual, theoretical considerations.

Our own work has been guided by the "cognitive map," a conceptual framework that has enabled us to analyze tasks that require mental operations. The cognitive map is not limited to the construction of intervention programs, but it is an important tool for understanding the differential responses of individuals to different tasks in various universes of information and domains of skills. Through its parameters, it is possible to analyze and pinpoint the anticipated sources of failure inherent in the nature and characteristics of a particular task. With this information, a teacher or mediator is able to devise strategies and techniques by which to overcome or bypass the difficulties a particular individual (with a specific cognitive structure and level of information) will encounter.

The cognitive map (see Appendix) , as opposed to the list of deficient cognitive functions, does not describe the individual; it describes the mental act associated with solving specific tasks. Analysis of tasks according to the cognitive map contributes significantly to the teaching of all curricular materials. It not only permits a differential diagnosis of possible pitfalls, it also orients the teacher to the particular elements students must acquire in order to cope efficiently with the demands of the material of a lesson. It also becomes a powerful guide in decisions concerning the choice of one or another type of task, or mode of presentation, as suitable for attaining the goals set by a program.

Each cognitive task, each mental activity, can be analyzed by the following seven dimensions:

1. Universe of content.
2. Language of presentation.
3. Phase of mental act.
4. Type of operation.
5. Level of abstraction.

6. Level of complexity.
7. Degree of efficiency.

Universe of Content

The first, the universe of content, is the least relevant to the area of cognitive functions and operations. Categorization, permutation, or logical multiplication can be literally applied to any universe of information. A task's content has the least relevance to the individual's mental capacity and also probably the least influence on the nature of teaching. A very simple story may illustrate an elaborate array, and the most complex content may be used to reach a very pedestrian, illogical, irrational understanding.

Although each universe may have its own rules, they are not necessarily exclusive. Therefore, when we deal with the prerequisites of thinking, content learning should be the last component of concern. To a certain extent, anchoring the thinking process in. a specific content may either cause too strong an attachment to it or narrow it too much.

As previously mentioned, this is one of the reasons why we suggest making the intervention program as content-free as possible. This means choosing the content that is best fitted to teaching a given principle or mode of thinking, rather than choosing the latter and adapting it to a given content. In evaluating functioning, one must be extremely careful not to judge an individual on the basis of a content that, for a variety of reasons, may be unfamiliar. By the same token, teaching thinking (or reading) with content that is too familiar may become so boring that it obstructs learning, because the necessary orienting process and alertness are not produced.

Language of Presentation

The second parameter of the cognitive map, the language of presentation, is also a relatively peripheral component as compared to the cognitive processes. Of course, verbal language is the most economical and adequate modality for conceptual, abstract thinking. However, there are many languages by which problems and concepts can be presented for learning and elaboration. Symbolic language (symbols and signs as in algebraic and mathematical thinking) or figural, spatial elements may be woven into a logical network no less complex than when words are used as the major modality of presentation and communication. Failing in one modality may not necessarily obstruct the more successful use of another.

A linguistic modality may be better for training individuals who may then be able to apply what they have learned in another modality. In one of our research studies, we offered training of analogies in a figural modality; then we looked for the effects of this training in the verbal modality of presentation (Feuerstein, Rand & Hoffman, 1979).

In planning a program for an individual or a group with certain deficiencies, one must consider using a language that will not, at least in the beginning, arouse too many resistances on the part of the learners because of their specific deficiencies. Thus, the first instruments of Instrumental Enrichment require very little, if any, literacy. Verbal components are introduced only following a thorough preparation with nonverbal exercises. Similar planning decisions may be necessary in dealing with people with low levels of literacy, reading comprehension, and decoding ability. To wait until they are literate before they acquire the prerequisites of thinking and of learning may result in a very costly delay that will negatively affect their learning capacity and achievement.

Too many intervention programs and measurements of intelligence and achievement use verbal, literate behavior as the sole criterion for success and totally neglect other

modalities of communication, interaction, comprehension, and problem solving. This does not mean that the verbal element should not be given a very important role in the education processes; however, it should be considered as a goal to be achieved through intervention, rather than as a means.

Phase of Mental Act

The third parameter is the phase of the mental act. As previously mentioned, we used the information-processing model of input, elaboration, and output as the major phases of the mental act. The choice of a program for the disadvantaged learner or its development should clearly define its goals at a given stage of intervention in order to choose deficient functions in one or two of the three phases for special emphasis.

The elaborative phase, responsible for the data's transformation, their categorization, classification, labeling, and other operations by which new information is generated, is certainly the essential goal of a program that aims at developing thought processes. However, for increasing the individual's capacity to learn through a learning-to-learn program, mediating the input (i.e., increasing the efficiency by which the individual gathers the data, makes use of the perceptual apparatus, and registers information) and, at a later stage, the output level (i.e., defining the results of elaboration in order to convey them to oneself or to a partner) may be crucial. Choosing programs that emphasize only the elaboration of data may not necessarily enhance the learning process. In certain cases, they may even miss the major goal itself if the peripheral input and output phases have not been corrected through adequate investment.

Instrumental Enrichment emphasizes correcting deficiencies on the input and output levels, and exercises are structured so as to confront the learners with the need to gather data systematically and to be precise and to elaborate events using a spatiotemporal grid. Through the nature of the task and the mediated learning experience, which is the prevalent mode of interaction, learners search for modalities of presentation, learners search for modalities of presentation that are most responsive to the need for logical evidence as the way to make the conveyed response acceptable to partners. If the elaboration phase represents the core of the thought processes, the peripheral phases of input and output represent those means that make the elaboration possible and the output acceptable.

Analyzing the mental act according to phases permits the ascription of a differential weight to the success or failure of functioning and achievement instead of the global evaluation that results from a product-oriented measurement.

Type of Operation

The type of operation is the fourth parameter to be considered when constructing tasks of an intervention program. Operations may range from purely perceptual and reproductive, such as the process employed in "re-cognition," or may reach the upper levels of formal and abstract thinking, such as inferential, inductive, and deductive reasoning. A certain number of basic operations, monitored by a taxonomy of operations requisite for further learning, must be imparted to the learner in the course of any enrichment program.

In Instrumental Enrichment, a number of such operations have been dispersed over the entire program. These operations include tasks that can only be accomplished by representational thinking, tasks that require inferential and hypothetical thinking, seriation of events according to rules, transitive relationships, logical multiplication,

analogical thinking, eduction of rules, deductive and inductive processes, and so on. Whenever the operations are not explicit, they are evoked and shaped in the mediational interaction of the classroom. Thus, inferring the presence of a little square from a cluster of dots allows us also to infer the presence of other figures intermingled in an amorphous cloud (see Fig. 1). The co-existence of two conditions permits us to infer the existence of one condition from the presence of the other. The same is true for inductive and deductive modes of thinking and transitive relationships (see Fig. 5.9). It is most interesting to see how operations from hierarchically higher levels of thinking can be implemented in programs that address otherwise low-functioning individuals. This is done by choosing appropriate content, language, and phase without necessarily renouncing the operation itself.

Level of Abstraction

The fifth parameter that must he considered in choosing or constructing a program is its level of abstraction. The level of abstraction is a very ambiguous concept, especially when it is used by educators to define certain tasks and the failure to achieve them. Thus, the ability to count or to compute is considered a higher level of abstraction, although we know that learning to compute may be based on a purely reproductive, technical memorization process and serial learning and need not rely on abstract thinking. By the same token, certain verbal interactions are considered abstract when very little operational thinking is either necessary or used during their generation.

It is, therefore, necessary to define the level of abstraction operationally (very much in line with the Piagetian approach) as the distance between a mental act and its concrete component. Piaget, who relates to mental behavior as an interaction ("conduit"), describes the sensorial concrete interaction as marked by a zero distance between the act/"conduit'/behavior and the reality upon which it is effected. Touching a table represents an interaction of zero distance between organism and the object. Zero distance also defines an interaction between a star and the eye that sees it. It does not really matter whether the light of the star reaches the eye or whether the finger touches the table. In both examples, the interaction is limited to a sensorial experience, and the distance is zero.

Calling an object "a table" immediately sets a great distance between the object itself and the mental act that results in its labeling. Think of the considerable differences in size, color, material, function, and so forth that are included in "table." From what distance will the labeler perceive the common traits of all these objects and be able to ignore the number of differences among them? The distance is increased even more when two objects that exist in isolation are brought together by a mental act and grouped by the words, "two tables." When "furniture" is used, conceptualizers climb up a number of steps, and the distance between them and the specific objects to which they relate is increased even more. The concept of distance is very useful in gauging the modalities by which abstract thinking can be introduced and evaluated.

Thus analyzed, the mental acts of various levels of retarded performers may actually be far more abstract than one would tend to believe, so that barriers considered as unsurpassable are actually much less so. Abstract thinking may be considered more accessible and, wherever necessary, more economical to the individual's adaptation.

Level of Complexity

The level of complexity is also a parameter that must be borne in mind in attaining a

well-defined goal of creating the prerequisites of thinking. We define the level of complexity as the number of units of information required to elaborate a given task. The absolute number may be corrected and even reduced significantly by certain cognitive processes. Categorizing a list of units or bytes of information may reduce the number by simply using categories instead of units. By the same token, the degree of an individual's familiarity with certain units of information may reduce the level of complexity of certain tasks. Deciding and selecting the desirable level of complexity at a given point in the development of an individual or a program may have an important bearing on the efficiency of the intervention.

It is clear that disadvantaged learners are accustomed to dealing with very limited levels of complexity. In certain cases, due to their episodic grasp of reality, they ignore whatever is beyond their threshold. Therefore, it is important to endow them with adequate cognitive strategies to enlarge their capacity to deal with complexity, teaching them how to group, to categorize, to generalize, and to use other cognitive approaches.

Level of Efficiency

The seventh parameter, and probably the most controversial one, is the level of efficiency. The reader must take note that the concept of efficiency refers to the level of efficiency required for a given task to be mastered; it is neither the individuals nor their functioning that is the target of analysis. Tasks differ in the amount and degree of efficiency required for their mastery.

Efficiency is defined by two measurable dimensions. One is referred to as the "rapidity-precision" complex. The other, an imponderable but still important dimension, is the subjectively experienced effort involved in working on a given task. Rapidity can be measured by the time required to do the task. Precision can be scored by simply counting the number of errors. The effort can be evaluated indirectly by the statements of subjects about their feelings, their readiness to continue, their fatigue, or from other cues. Tasks that require efficiency for their mastery may require special investment, lest the achievement be very poor.

Efficiency may best be acquired through automatization and habit formation, which, in turn, are produced by repetitive, mechanical, rote kinds of learning. Any reluctance to use rote repetitive learning may deleteriously affect the mastery of tasks that strongly depend on high levels of efficiency. By illustration, reading is one of the activities whose mastery depends mostly on efficiency. Somebody who reads too slowly may understand very little of what has been read because of a broken gestalt and an overload on the mnemonic functions due to the dispersion of the data over time. Somebody who takes a year to read a book may have very little understanding of the basic denouement of the story because the beginning may have been forgotten by the time the end is reached. This also occurs with sentences. Children who have difficulty in decoding forget the beginning of a sentence by the time they reach its end. Also, without a satisfactory level of precision in reading, comprehension will be very limited. Rapidity attained at the expense of precision, or precision to the detriment of rapidity, may render reading extremely inefficient. By the same token, when accompanied by a subjective feeling of effort, reading will be very limited, even if it is rapid and precise. Efficiency, therefore, is a dimension that must be purposefully, systematically developed, particularly with tasks that require efficiency as a precondition.

Certain new modes of learning, such as discovery learning and critical thinking, have totally ignored the development of efficiency. We suspect that many of the difficulties

in learning may be due to the inefficiency of individuals in their interactions with the new elements they must learn.

In summary, as described by both the discussions of the deficient cognitive functions and the cognitive map, the types of tasks to be offered in a program designed to increase the modifiability of individuals, that is, to render them more sensitive to learning experiences, must be guided and purposefully related to the combined needs of the learner and the tasks.

Teacher Training

Another characteristic of programs addressing disadvantaged and low-functioning individuals is their strong dependence on training the teacher to act as a mediator and not merely as a dispenser of information. Mediated Learning Experience (MLE), a pivotal component of the theory of Structural (Cognitive Modifiability, is defined as a quality of the organism-environment interactions that are characteristic of human beings and responsible for their modifiability. It serves as a powerful guideline for structuring programs for the enhancement of Structural Cognitive Modifiability.

To turn teachers into mediators instead of conveyors and dispensers of units of information requires a very meaningful change in both the perception of the child as a modifiable entity and in the belief that, indeed, education can play a significant role in this process. Furthermore, turning teachers into mediators means equipping them with the skills and motivation to produce such changes. Additionally, teachers must reach mastery of the program they offer the child, a mastery that will be buffered by a good knowledge of its theory and a full understanding of the "whys, the hows, the whens, and the when nots." The more theoretically based the teaching activity, the more modifying the interactions and the greater the degree of freedom teachers will have in structuring the learning experiences of their students.

MLE is characterized by closing the loop between the teacher as an emitter of a message (the proximal partner of the interaction), the receiver of the message (the distal partner of the interaction), and finally, the emitted message itself. The three partners involved in the interaction (mediator, stimuli/message, and mediatee) are manipulated and transformed so that, indeed, the emitted message will be received and have the desired effect on the receiver.

By way of contrast, consider the regular modality of teaching. The teacher emits a message, presents a unit of information to a classroom of children or even to a single individual, and is contented with the process of emission, without considering the need to ensure that what was transmitted was truly registered, received, and eventually integrated into the receiver's system. Regular teaching often neglects to ensure that the communication loop is closed. In many cases, teachers ignore the need to change all three partners in this interaction so as to guarantee that the mediational process has been accomplished.

The intention of the mediators is recognized by the way they transform the message, amplifying it, detailing it, substituting language to make it better understood, and increasing its appeal so that it will penetrate the system of the mediatee. By manipulating the mediatee's state and rendering them more attentive, more eager, more affected by the unit of information, they are transformed and rendered more accessible and sensitive to the particular element mediated to them. By the same token, mediators are changed by their intention to mediate to the child. By the intentionality of the

mediators, the teaching interaction receives the quality of a mediational experience (see Appendix, p.).

It is for these reasons that teacher training is a condition sine qua non for making any program accessible to the disadvantaged. We consider that teacher training is a necessary condition for many of the required qualities of any instruction. However, programs for advantaged individuals whose functioning allows them to benefit from direct exposure to stimuli and learning opportunities are less dependent on Mediated Learning Experience interactions. On the other hand, disadvantaged learners can benefit very little from even the most powerful programs if there is not adequate mediation. Teacher training, though it may be costly and problematic logistically, should therefore be considered as an integral quality of the program. Without it, the program's value may be extremely limited, even though it may be attractive and easy to implement.

Many evaluators of intervention programs consider dependence on teacher training as a costly burden and, to a certain extent, a negative feature. We contend, however, that programs that are carried out without teacher training as a condition of their application may do more damage than good, even if they show some effects. As strong as this assertion sounds, it highlights our belief that disadvantaged learners do not simply need tasks to master nor principles to learn. A disposition must be produced in them that will change their cognitive structure, their way of interacting with new aspects of information, and the way they perceive themselves as changing entities affected by experience in the direction of a higher level of efficiency. Exercises and activity alone, even if they are efficient and very meaningful, do not always lead to this state of awareness. People may repetitively experience certain events, become familiar with them, and even reach mastery, and still have a feeling of incompetence unless a mediator interprets their behavior to them and turns it into a source of their self-perception of being producers of information through processes of inference, of being decision makers through planned exploration of alternatives, and of choosing among priorities by comparing various processes. In fact, they must perceive themselves as contributors to reality rather than as being subdued by it.

For this end, direct experience is not enough. This is borne out by the great number of people who do not derive these cognitive and emotional structures from their direct experience. A mediator is needed for much of what makes us human. The fact that we are dependent on mediators does not reduce our status as independent autonomous thinkers. It only interprets the story of our autonomy as a product of millennia of cultural transmission through our Mediated Learning Experiences. Teacher must be mediators. To turn teachers into people who believe and who are sufficiently skilled, training is a must. In addition to its role in increasing the efficiency of any program, a vital by-product of teacher training is the large body of information on human modifiability and the most efficacious ways in which it can be achieved. Through such training, a teacher will acquire a better understanding of cognitive processes, the prerequisites of learning, and the deficient cognitive functions responsible for learning disabilities, thereby becoming more aware of the skills by which to turn the student into a willing and efficient learner.

Summary

In this chapter, we have attempted to show that the tendency today is to produce programs with built-in conditions for accessibility, but that the conditions do not exist in

the most needy population. The "creaming up" phenomenon then becomes a natural selection process that renders those who cannot "make it" unable to benefit from such programs. We have outlined a number of conditions that may make programs accessible and beneficial to such individuals, even when their own conditions seem to show no promise of benefit. These suggested conditions become especially useful for programs deemed essential to modify the individual's course of life. The modifiability of individuals, in turn, is dependent on the cognitive processes, their capacity to learn from formal and informal experiences, and their disposition or readiness to adapt to more novel and complicated life situations.

The mass of disadvantaged learners represent an untapped reservoir of human resources. In these days when life requires a constant adaptation through the process of learning, we cannot afford to turn these neglected human resources into a danger to themselves or society, nor to offer them a menial, restrictive life. Investment in intervention and enrichment programs must not be considered a luxury but a vital instrument for personal and societal progress.

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Review Questions:

1) What are the sub-goals if IE?
2) How to use habit formation for creating intrinsic motivation ?
3) How the relationships between teacher, material and students in the IE program are different from these relationships in a particular discipline ?
4) List the reasons for a content-free nature of the IE program.
5) How the Cognitive Map is used in the application of the IE program?