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ABSTRACT

Research summarized here demonstrates how similarity thinking can be used in training programs to help ethnic minority children acquire basic skills. Current achievements are often attenuated by poor language skills, especially when English is not the first language of the child. Similarity thinking assesses the child's ability to learn without achievement constraints. The model of similarity, composed of seven types of thinking, is discussed in relation to several theories, including (1) Piagetian theory, (2) Feuerstein's model and (3) Vygotsky's zone of proximal development. Aids are used in present research studies not only to assess children's potential to learn, but also to help them move along Vygotsky's "zone of next or potential development". According to this view, "competence" is not a "point", but rather a range or zone on a developmental scale (the similarity thinking scale) which is affected both by environmental and organismic influences. A practical consequence of this approach is that ethnic minority children will be more appropriately placed in school learning environments.
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The Assessment of the Potential to Learn:
A Multicultural Perspective

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The Assessment of the Potential to Learn:

A Multicultural Perspective

The program of research summarized here demonstrates how similarity thinking can be used in training programs to help ethnic minority children acquire basic learning skills. There is considerable evidence (see Gamlin, 1985) that ethnic minority children are incorrectly placed in learning environments because traditional assessment procedures document current achievements and not the child's potential to learn. For example current achievements are often attenuated by poor language skills especially when English is not the first language of the child. Prior research with the model of similarity thinking (see Gamlin and Bountrogianni, 1984) has demonstrated that this approach to assessment is sensitive to children's potential to learn since it is not constrained by children's current achievements. Very briefly this approach assesses the child's "current" ability to generalize from original learning to novel situations as well as the child's "potential" to do so. Similarity thinking is fundamental for the child to notice what is familiar in new learning situations. Similarity thinking is also fundamental for the child to make "conceptual leaps" (as found in analogical and metaphorical thinking) thereby discovering commonalties between different and sometimes quite diverse domains of experience. This kind of thinking is essential if the child is to "read between the lines" or "go beyond the information given". In the present research studies aids are used in training programs, not only to assess children's potential to learn, but also to help them move along Vygotsky's (1934/78) "zone of next or potential development". On this view "competence" is not a "point" but rather a range or zone on a developmental scale (the similarity thinking scale), which is affected by both environmental and organismic influences. This research makes a significant contribution more generally with respect to how we understand the notion of potential to learn and very specifically with respect to applying this knowledge in training programs designed for ethnic minorities. One practical consequence of this is that with the development of this approach ethnic minority children will be more appropriately "placed" in school learning environments.

Issues

1. The gearing of instructional aid to the needs of ethnic minority children; for example the use of non-language based aid.
2. The use of developmental scales (e.g. model of similarity thinking) and tasks that have content that is familiar to individuals of different ethnic minorities.
3. The use of models of intellectual development for making recommendations to school system staff for "placing" ethnic minority children in appropriate learning environments.
4. Individual differences (e.g. fast and slow learners) with respect to amount of aid required on learning and transfer tasks.
5. The modification of learning potential as a function of both the individual's cognitive development and instructional aid.
6. The extent that social and cultural contexts in which children are studied, affect the paradigms used.
7. The use of normatives vs. non-normative methods of assessment.

Introduction

The Model of Similarity Thinking

The model of similarity focuses on the mental operations that constitute the ability to apply old knowledge (prior learning) in new situations. The model is made up of seven types of thinking. The seven types of thinking are hierarchical and are a function of the understanding the individual has for similarity relationships. For the purposes of this study each type of thinking is described as the dominant strategy used when solving similarity problems. For this reason, the model of similarity is used as an educational assessment.

The seven types of thinking are, briefly: identifying objects or events that are "most like" a target on the basis of shared similarity criteria that are continuous (e.g. intensity) in the context of "objects in relation" where all objects bear a similarity relationship to the target on the basis of continuous or qualitative information (type 1); equivalence matching on the basis of "countable features" in the context of "objects in relation" where all objects bear a similarity relationship to the target on the basis of discrete unit information (type 2); joining objects or events into extended strings such that earlier connections "anticipate" later connections in "means-end" relationships (type 3); using rules to organize prior knowledge in such a way that both the method of analysis (as in the use of analogy) and goal point begin to yield rule based inferences (type 4); using task goals to plan (as in the use of blueprints) so as to determine how objects or events can be organized or structured to achieve the stated goals (type 5); innovating so as to use old rules (and prior knowledge) in different ways (deviating from the blueprint) at the service of an overall goal. (type 6); using imagination and the synergy principle that the whole is more than the sum of the parts in metaphorical thinking so as to invent new ways for relating experiences and achieving goals. (type 7); The ability to generalize or apply old knowledge in new situations is somewhat limited in the early types of thinking but develops as a function of progressively exercising the 7 types of thinking. The ability to generalize culminates in the understanding that similarities between seemingly different experiences as in metaphorical comparisons across disparate meaning domains may result in a totally new idea. This is a radical view of creativity accepting the Gestalt view that the whole is more than the sum of the parts. On this view the model provides an emergent theory of meaning.

The similarity model has received initial empirical support through a project funded by the Ministry of Education (Gamlin, 1975). When the thinking skills (similarity judgments) described in the model were practiced, an experimental group showed significant gains over a control group on the Raven's Progressive Matrices Test (a test of logical thinking) as well as a reading comprehension test. Subsequently, the model was developed as an educational assessment. Support for the model in this context has been provided in the form of face validity derived mainly from the usefulness of the model for describing learning problems that can be understood by both parents and teachers. Furthermore, the model has been found useful for program development including recommendations to school system staff around specific learning problems experienced by clients at the OISE clinic. A manuscript describing the model and assessment procedures for teachers and parents is available (Gamlin, 1981) as well as book for teachers wanting to respond to the

individual needs of their students (Gamlin and Fleming, 1985). Evidence has been provided for the construct and concurrent validity of the model and for the reliability of the educational assessment in the form of M.A., Ed.D. and Ph.D. thesis dissertations (Bountrogianni, 1980; 1983; Djap, 1983).

Research supported by small scale research grants from OISE over several years has provided further evidence for the holistic properties of the model (see Gamlin and Tramosch, 1981; 1982). The model has also been applied to number concept development for j-k and kindergarten children with positive results (Gamlin, 1982; Allan, 1984; Rizwan, 1984).

Testing procedures based on the similarities model have been developed at OISE and FEUT through a project funded by an OISE transfer grant from the Ministry of Education. Although ongoing research continues to revise these procedures, the results of field testing provide further evidence for the concurrent and construct validity of the model as well as internal consistency of the tasks themselves.

In summary, there is considerable evidence both on the basis of clinical observation and empirical investigation for the face, construct and concurrent validity of the similarity model from which the assessment of learning potential has been developed.

A) The Model of Similarity and Piagetian Theory

Both the model of similarity and Piagetian theory are based on stage theories of intellectual development. Types 1, 2, 3 and 4 thinking in the model of similarity can be compared to the pre-operational, concrete-operational stages and beginning formal operational stages in Piaget's theory. In Piaget's pre-operational to beginning concrete operational periods, children's awareness of similarity relationships is limited by the fact that they rely mainly on their perception of the sub-set parts and not so much on their conception or logical structures. As in Piaget's pre-operational period, children using types 1, 2 and 3 reasoning do not coordinate several complex categories. They can sort, or solve simplified concrete operations tasks but primarily on the basis of perceptual quality. Types 1, 2 and 3 thinking in the similarity model are different than that described by Piaget for pre-operational to beginning concrete-operational stages since the emphasis is not on how the "logic" of structures is acquired. It is argued that similarity relationships and therefore children's understanding of "whole" is more dependent upon the child's ability to "see" objects in relation. For example, an object might bear a "most like" relationship to a target in a context where all objects have some varying degree of similarity relationship to the target (see Gamlin 1984 for a more thorough discussion).

Type 4 thinking (knowledge that prior learning can be reorganized through the use of conceptual rule systems) can be compared to Piaget's mature concrete-operational performance and beginning formal operations. Piaget claimed that with this development the child is able to focus on several dimensions of a problem and can relate dimensions to form abstractions and hypothetical ideas. The child uses logical operations and his/her reliance on perceptual information declines. The ability to classify events and to 'see the similarity relationship between the parts and the structural whole of concrete objects or concrete collections of objects emerges during this stage. ~~Piaget's description of formal operational thought is similar~~ to the description of type four thinking although it is suggested that the child continues to use perceptual strategies that become global (type 5) and that remain instrumental in types 6 and 7.

Unlike Piaget's theory, the similarity model puts an emphasis on an "open" system where creative (discontinuous) behavior emerges spontaneously as a consequence of exercising the skills of the entire similarity thinking process. The model moves away from a propositional logic (binary) framework to include more global (perceptual) strategies. It does not exclude logic or thinking informed by logic, but describes the kinds of thinking that can be used to challenge the conclusions achieved through the use of deductive rule systems. The model therefore makes it possible to provide a different account of how children go "beyond the information given" - how children learn to "read between the lines" and how, as the culmination of the creative process, they come to think using metaphor in an "open" system of thought. Piaget was interested in the knowledge and skills of the competent scientist, especially the physicist and mathematician. His system is closed or convergent in that it describes structures composed of operations involving interiorized and reversible actions such as found in addition and subtraction. Creativity, or divergent (open system) thinking is not seriously taken into account since Piaget did not agree with the Gestalt position. He opposed the view of nonadditive composition where the whole is quantitatively different from the sum of its parts. For example, $2 + 2$ always equals 4. The whole is a sum that is strictly additive (Piaget, 1970). The model of similarity describes an open system where both divergent and convergent thinking is included (unlike Piaget's basically, closed and analytical system).

B) The Model of Similarity and Feuerstein's Model

The model of similarity relationships has many parallels with Feuerstein's (1980) model. These are: 1. Cognitive operations are basically of a transferable nature, implying the encouragement of their applicability to a great variety of situations, contents and aspects. This has implications for reading and writing. Both approaches go beyond language to the abstract thinking skills through which problem solving and concomitant learnings are accomplished. 2. Both models adopt the clinical and dynamic approach to assessment, evaluation and research (in their theoretical framework) instead of a static testing procedure which typically characterizes conventional psychometric testing. 3. Both perceive intelligence as dynamic and not as a fixed endowment. 4. Both emphasize the role of interaction between the individual of his environment as an important process determining thought.

There are differences between the two approaches however. The similarity model is based on a stage theory of intellectual development, whereas Feuerstein's model is not. The similarity model describes the process of normal cognitive development across a wide age range while Feuerstein's work relates to the cognitive characteristics of low functioning adolescent individuals. Feuerstein has concentrated on the remediation of adolescents who are at the developmental stage of formal operations, between the ages of 11 and 15 years, which he sees as an ideal span in which to place remediation for the culturally different or deprived. He has not immediately accepted attempts to implement his program at much younger ages where this maturational level would not have been attained. Some argue however that any useful intervention must be made at preschool age. The similarity model concentrates on cognitive development from early childhood through adolescence. This has obvious implications for the use of the model in early identification programs.

Literature Review and Background to the Problem

Assessing Learning Potential

It has been well documented that static IQ tests do not provide direct information concerning potential levels of performance. Given this finding it is necessary to supplement these test procedures with more direct assessments of learning in order to obtain more refined diagnoses of academic potential (Campione et al. 1982).

This problem has been somewhat ameliorated by several investigators who advocate a test-train-test method for assessing learning potential (training with respect to graduated aids) (Campione et al., 1982). This approach is strongly influenced by Vygotsky's (1978) definition of learning which is the internalization of knowledge and processes resulting from a guided instructional interaction with a knowledgeable adult. Quite explicit in the description of this testing program is the role in Vygotsky's theory of the "zone of proximal (or next) development", and his emphasis on the use of graduated aids to uncover the readiness of children to perform competently in a task domain.

The Zone of Proximal Development

Vygotsky (1934/1978) defines the zone of proximal (or next) development as "the distance between the actual developmental level as determined by individual problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86). A biological metaphor is used to describe learning (see also Piaget, 1970). The potential to learn is awakened (p. 90). The processes that are awakened are functions that will mature tomorrow but are in embryonic state. These functions could be termed the "buds" or "flowers" rather than the "fruits" of development. The actual developmental level characterizes mental development retrospectively, while the zone of proximal development characterizes mental development prospectively" (Vygotsky, 1934/1978, pp. 86-87). This zone of next development is a map of the child's sphere of readiness, bounded at the lower end by her or his existing level of competence, but at the upper end, by the level of favourable circumstances.

The essential feature of learning for Vygotsky is that it creates the zone of next development and this will occur only, and for Vygotsky this is a key issue, "when the child is interacting with people in his environment and in cooperation with his peers. Once these processes are internalized, they become part of the child's independent development achievement" (Vygotsky, 1934/1978, p. 90).

Application of Vygotsky's Theory

Figure 1 shows a type 1 task in the model of similarity thinking.

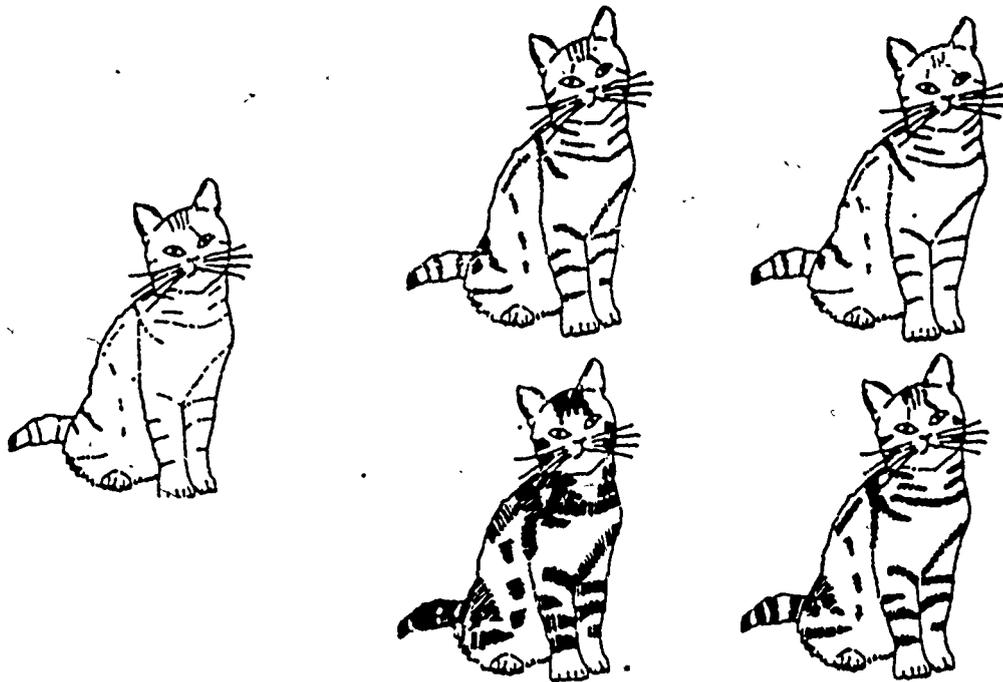


Fig. 1

Children are asked to consider the target as well as the entire array of items in order to choose one alternative that is the most like the target. Prior to the presentation of the tasks children are assessed for their understanding of the word most. By using a task analysis, it is possible to provide a series of structured aids in the form of questions directed to the children. In the above figure the cat task could be used as a learning task. The question aids would inform children as to the demands of the task. The child may incorrectly choose an alternative (1) as the one that looks most like the target. In this event a series of question aids would be administered to the child until the correct answer was given. An example of a question aid might be "which one of the cats (alternatives) has the same nose as the target?" Another question aid might be used with a specific alternative and ask "which part of this cat is the same as the target cat?" A second cat task might be used as a near transfer task where all that is changed is the target. Gain scores are derived by considering children's responses to the question aids in the transfer task and comparing this performance with that obtained in the learning task. The development of transfer tasks therefore, is crucial for the assessment of children's potential to learn.

The Potential to Learn and Training with Graduated Aids

The approach advocated here is similar to the one proposed by Campione et al., (1982). Process-oriented task analyses are performed on test items and transfer tasks. The objective is to delimit those processes which are used when children employ personal plans or autocritical skills, since these kinds of thinking predict well for adequate initial learning and flexible (broad-band) transfer to similar tasks. The prompts or aids are assessed with respect to their frequency (of need) across tasks. One would expect that the number of prompts would decrease across tasks as the child applies prior learning across transfer tasks. By evaluating how well children are able to use these prompts, we are able to describe how much "gain" or generalization is shown across these tasks and in addition we discover whether a child is a fast learner (requiring few prompts) or a slow learner (requiring many prompts). In this way, we begin to define a particular child's zone of next development.

Task-analytic procedures are crucial to the success of these assessment procedures. In agreement with Campione et al., (1982) and Sternberg (1983) "We would argue that testing the zone of next development as a means of diagnosis requires a detailed analysis of possible transfer probes. Without this information, it would be difficult to select either the series of graduated aids for the original task or suitable methods for assessing the speed and efficiency of transfer" (Campione et al., 1982, pp. 441-442). A point here that requires additional emphasis is the method by which a possible set of transfer tasks is selected. This is exactly where the similarity model is useful, particularly with respect to issues surrounding the rationale for determining that a task is a suitable transfer task (comes from an appropriate task domain).

Feuerstein's (1969; 1980) Learning Potential Device (LPAD) also uses a testing-training and retesting paradigm. It is essentially similar to the previously described approaches although it lacks the systematic graduation of aids based on a process analysis. A task is presented initially without prompts which means that children succeed or do not succeed on their own. Subsequently, they are provided with prompts ("training") to help make it possible for them to solve this initial problem. Some examples of these prompts are probing for reasons for incorrect answers, teaching the examinee how to independently evaluate responses and accordingly to seek ways of correcting errors, and teaching the examinee to systematically explore by exposing him or her to the examiner's own activities as a model of systematic scanning. Once mastery on this initial task is achieved through the use of such prompts, the child is then presented with a series of tasks that represent progressively more complex modifications of the initial training task. Feuerstein works with disadvantaged Israeli adolescents and claims considerable success ("gains") using a training program that has adults guiding problem-solving activity by structuring the learning environment. In addition, Feuerstein has developed an intensive intervention curriculum, the IE program, to be used in conjunction with the LPAD (see Feuerstein 1980; Haywood and Arbitman-Smith, 1981). Campione et al. (1982) suggest that the assessment paradigm, the test-train-test procedures, may be more important than the actual content of the IE program. For example, the IE materials are similar to IQ test items including as they do systematic easy-to-hard sequences involving analytic perception, comparisons, categorization, orientation in space, temporal relations, transitivity and use of part-whole relations. When training to the test in this fashion, it has been possible to demonstrate IQ gains on the very similar test items.

The Relation of Theory to Questions of Process

Most investigators who employ test-train-test procedures for assessing the potential to learn agree on several issues: (a) static measures of intelligence are merely "suggestive" of underlying "competence" revealing only current performance which may be influenced by a variety of "performance" variables; (b) an instructional testing environment (the ability to profit from structured aids) is more likely to reveal the potential to learn; (c) the ability to learn is governed by a Vygotsky-like notion of internalization proceeding from adult instruction to self instruction including the ability, by way of planning, to transfer old skills and strategies to new situations. This latter behavior, it is believed, requires the use of self-regulatory or autocritical skills.

The foregoing points of agreement imply a theory of intelligence which describes intelligent behavior as that behavior which is active, responsive to instruction, resulting in the formulation of plans that anticipate application to new situations; plans which are eminently susceptible to revision, evaluated as they are by general executive-metacognitive skills. Campione et al. (1982) conclude that:

"there is agreement that the more intelligent, the more phylogenetically advanced, or the more successful learner is the one who can manipulate his or her knowledge to achieve multiple access or transfer... Thus converging lines of evidence implicate learning and transfer mechanisms in general and executive decision making more specifically as central to views of intelligence." (p. 473).

A theory of intellectual development (the similarity model) has been advanced containing just these characteristics (see Gamlin, 1975b, 1981; and Robertson, 1979; Djap, 1983 and Bountrogianni, 1983). Executive skills are assessed as well as multiple access and more general cognitive skills. In general, the child's ability to plan and self-correct is assessed across seven types of thinking that are hierarchically related (see section on similarity model). Considerable emphasis is given to describing how children make similarity judgments since these judgments make it possible for children (and adults) to apply old learning to new situations, e.g. to determine that a new situation is familiar in certain respects. This is a classic example of learning to learn via awareness. Furthermore, on this view not only are individuals able to understand how new situations can be interpreted against old criteria, they will also come to understand that similarity comparisons between conventional but disparate domains (as in metaphor) may also result in the emergence of a totally new idea. This kind of behavior has also been called radically creative (Rotenberg and Hausman, 1976).

Ethnic Minorities and the Assessment and Training
of Similarity Thinking

There is considerable literature addressing assessment issues as they relate to minority and cross-cultural groups. Gamlin (1985) has summarized these issues in the context of the major theme of this discussion assessing and stimulating the potential to learn. An issue that has received considerable attention is whether ability or "intelligence" is a "state" or a "trait". Gamlin (1985) shows that this binary approach to understanding potential creates a red herring around "competence" and "performance" distinctions. He argues instead following Vygotsky (1934/78) that learning potential is plastic, influenced partly by the learning skills individuals can access as a function of their cognitive development and partly by their understanding of particular knowledge domains. That these ideas constitute the "Zeitgeist" around which investigators are coming to some consensus receives considerable support in two recent reviews (Glaser, 1984; Fischer & Silvern, 1985). Glaser (1984) notes that thinking programs have traditionally focused on either domain-free methods (general problem solving skills) or on problem solving in the context of specific knowledge structures. He suggests that,

"A central issue for theory and experiment in resolving this issue will focus on the transferability of acquired knowledge and skill. There are several possibilities. First, if we believe that broad domain-independent thinking and problem-solving skills are teachable in a way that makes them widely usable, then we can adopt the tactics of general methods programs. Second, if we believe that humans for the most part show limited capability in transferring such general skills, and if knowledge structure-process interactions are powerful aspects of human performance, then training in the context of specific domains is called for" (p. 102).

The problem that Gamlin (1985) addresses, concerns how individuals are able to transfer broadly (as with some metaphors) across quite diverse domains. This would seem to require both domain independent thinking skills and domain dependent knowledge structures. Gamlin (1985) is in general accord with Glaser (1984) who suggests:

"Teaching specific knowledge domains in interactive, interrogative ways so that general self-regulatory skills are exercised in the course of acquiring domain-related knowledge" (p. 102).

This approach has the merit of considering both the cognitive development of the learner and the characteristics of the domain to be learned. Clearly a developmental scale is a prerequisite as well as an intimate knowledge of the domain to be mastered. Apprenticeship programs achieve many of these goals when instruction emphasizes not only domain specific skills but includes as well practice using general problem solving skills (similarity thinking) across different context domains. Practically this might mean discovering which thinking skills electricians, plumbers and carpenters might use in common when solving problems in each of these different content domains. The argument here is that this kind of

program would produce more successful problem solving since individuals are required to transfer their knowledge (cast their nets) across several content domains and in the process pick up ideas that they would not have considered otherwise.

The important point here for ethnic minorities is that entrance to apprenticeship programs often is determined by passing achievement tests of one sort or another and not on an individual's potential to learn. Similarly in school settings entrance to particular learning environments (e.g., classes for the gifted) are often determined by tests of achievement and not on students' potential to learn. On this account what we need is a developmental scale (e.g., similarity thinking) that is sensitive to individuals' potential to learn - as Gamlin (1985) has defined potential-sensitive to individuals' ability to make generalizations from the old to the new across quite diverse content domains.

Fischer and Silvern (1985) are in general accord with the foregoing,

"Any incompatibility between stages and individual differences arises not from nature but from two incompatible viewpoints - the organismic-structural approach and the mechanistic-functional approach..... One of the main attempts to resolve the incompatibility has been to distinguish competence from performance and to hypothesize that stages are associated with the former and individual differences with the latter. While clearly a helpful step toward integrating organism and environment, competence/performance approaches in general suffer from a common shortcoming: They continue to isolate the stages of organismic structure (competence) from directly observable and variable ordinary functioning performance)" (p. 643).

And again,

"Theories should build explanatory constructs that simultaneously incorporate organismic and environmental factors. For example, the evidence suggest that behavior in a domain varies along a developmental scale as a result not only of developing capacities but also of other factors, such as environmental support and arousal state. Competence does not seem to be a point but a range on a developmental scale, with both environmental and organismic influences affecting movement within that zone" (p. 643).

The model of similarity thinking is a theory that is robust to both organismic and environmental factors. Adopting Vygotsky's notions for the "zone of proximal (or next) development" means that an expert's use of instructional aids, in both assessment and learning environments, brings together the individual's current level of cognitive development with an optimum teaching environment in such a way as to help the individual move along "a range or zone on a developmental scale" (Fischer and Silvern, 1985, p. 143). The approach is especially suited to the needs of ethnic minorities since every means is used to help the individual understand what he or she is being asked to do. This is accomplished in two ways: By using materials in both the assessment and teaching environments that are familiar to the individual and by using

instructional aids that are meaningful. In this way we are able to achieve more accurate assessments of learning potential and more successful placing of individuals in appropriate learning environments.

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