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UMI
CONSULTING WITH TEACHERS TO DEVELOP
AND VALIDATE
THE SIMILARITY THINKING INSTRUMENT

by

Mohammad Sanikhani

A thesis submitted in conformity with the requirements
for the degree of Master of Arts
Graduate Department of Adult Education, Community Development, and Counselling Psychology
The Ontario Institute for Studies in Education of the
University of Toronto

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0-612-29175-8
Abstract

CONSULTING WITH TEACHERS TO DEVELOP
AND VALIDATE
THE SIMILARITY REASONING INSTRUMENT

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Master of Arts
November 1997

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Twenty-one teachers from a variety of educational settings viewed a video presentation on generalization skills and the Similarity Thinking Instrument (STI). Subsequent to the presentation, the teachers participated in a semi-structured consultation session in which validity and application issues were discussed. A needs-assessment model was used to identify potential area of development for the instrument. A number of proposals were drawn up in relation to fitting the STI to the needs of potential users. The teachers' perceptions of the STI provided strong support for the validity of the STI as both an assessment and instruction tool. The discussions provided for an exchange of opinions on both conceptual and application issues with regard to dynamic assessment and instruction.
Acknowledgements

As a token of appreciation for his friendship, this work is not monumental enough of an undertaking. I have thus resigned myself to simply thank my supervisor, Dr. Peter Gamlin, in his own understated manner, for the care and trust which he has shown me in some of the most difficult periods in my life.
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Introduction

Traditional means for determining potential are based on standardized intelligence tests. Such tests provide a static measure of cognitive development in that an individual's current achievement level is compared with his or her peers at a particular point in time. Commonly used intelligence tests predict academic performance in elementary and high school fairly well (Seigler & Richards, 1982; Sternberg, 1984). The idea that 'the best predictor of future success is current achievement' has thus become the implicit identification token for school curriculum expectations.

In following the static approach, however, educators have faced various problems in meeting the requirements of present-day educational settings. These requirements include, but are not exclusive to, reaching out to the economically disadvantaged, the mentally handicapped, the learning disabled, and the culturally-different (Feuerstein & Hoffman, 1982; Campione & Brown, 1987).

The Static approach

The problem with the static approach in the educational domain arises, at least partly, as a consequence of an unwarranted conceptual generalization. By comparing the findings of studies on various physical characteristics (such as height, weight, etc.), Galton found that the range of such characteristics across individuals in a population can be represented by a bell curve. Next came the
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population performance patterns in any form, including that of a bell curve.

The second factor in the maintenance of this assumption is related to the profession, rather than the discipline of psychology. The bureaucratic organization in which the discipline of psychology is framed worked has, much like any other bureaucracy, a tendency to protect itself. Included in the consequences of such a tendency is the exercise of control over modes of communication — such as journal publications. This control is a guarantee for the survival of the ideological fencing which is performed within the dominant paradigm over issues that are soon replaced with more fashionable ones. In this manner, questions and discussions about conceptual issues which may shorten the life-span of the currently dominant paradigm are effectively contained within the peripheral, less powerful channels and circles of the discipline. This mode of conduct further ensures the safety of the privileged point of view which the members of the paradigm assume.

Overlooking the conceptual shift which was made over a century ago has thus led a large volume of scientific work in which various components — test questions, for example — of research have been fitted to the theory. A psychometrician who does not find a bell curve in the data from his or her research is thus likely to automatically doubt the validity of the findings. Needless to say, the requirements for 'clean' data have found their way in contexts other than the academia. There has been a need for filling the bell curve with individuals. Not surprisingly, the lower bottom of the curve has been usually filled in with those
from the least powerful segments of the society.

The social implication of an erroneous conceptual leap has thus been magnified by the creation and maintenance of paradigms. The most destructive of these implications includes a focus on not the potential of the person itself, but the fitting of each person or group into the 'appropriate' categories. It is not hard to see how the propagation of such a focus has been easily abused in fanning the flames of discrimination. Furthermore, in adopting the static approach, the education system serves those who, in relation to the demands of the system, either are naturally fit or have already successfully prepared themselves.

An obvious consequence are the challenges which have become more prominent in present-day educational settings. There is a large segment -- if not the majority -- of students in a typical school setting, who are unable to fully benefit from the educational process. These include, but are not exclusive to, the economically disadvantaged, the mentally handicapped, the learning disabled, and immigrant students (Feuerstein & Hoffman, 1982; Campione & Brown, 1987).

Emphasis in the static approach on independent performance, as opposed to potential, can lead to a failure in tapping into each individual's unique abilities. At best, the heavy reliance in the static approach on outcomes and performance results in a self-fulfilling prophecy which prevents us from reaching out to those who are supposed to be at the focus of the education process.
**Vygotsky and the ZPD**

Among alternatives to the static approach, the Dynamic approach to intelligence has become popular with some educational psychologists. The latter approach is based on Vygotsky's concept of the Zone of Proximal Development (ZPD). Vygotsky (1934/1978) defined ZPD as "the distance between the actual developmental level as determined by independent 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). This definition neatly distinguishes between the static and the dynamic approaches to intelligence. In contrast to the static approach, the dynamic approach asserts not only that the child's responsiveness to instruction may improve his or her test performance, but also that such instruction should be used when testing potential. What is achieved today with instruction should be both the focus of teaching and tomorrow's successful, independent problem-solving.

An example may help to gain a better grasp of the notion of ZPD. Using conventional intelligence tests, two six-year olds may be shown to both have the mental age of a typical six-year old. However, when intervention -- for example, in the form of teaching generalization skills -- are provided to both individuals, one child may show no performance change on the post-test while the other's performance improves to the level of an eight year old.

In conventional practice, interpretation of the pre-test performance results
would show the two individuals to have comparable levels of cognitive ability.

According to Vygotsky, however, these two children are not at identical planes of cognitive functioning. Intervention served to facilitate the movement of only one of the children in their ZPD. Vygotsky criticized the conventional use of intelligence tests on the grounds that such an approach results in measuring only the static aspects of ability, and not the potential ones (Kozulin, 1986).

This criticism is most valid when intelligence tests are used in the educational domain. The concept of potentials, which is largely untapped by static assessment, is of obvious importance to educational psychologists. Assessing potentials helps identify both the relevant strengths and weaknesses in a student's cognitive makeup, thus shedding light on the intervention or educational route which is appropriate in the case of each particular individual.

A concluding statement in a recent review on what is known and what is unknown about intelligence is apt here: "...because there are many ways to be intelligent, there are also many conceptualizations of intelligence" (Neisser, Boodoo, Bouchard, Boykin, Brody, Ceci, Halpern, Loehlin, Perloff, Sternberg and Urbina, 1996, p.95). These authors offer a refreshing -- and candid -- review of the literature on what it means to be intelligent. They point to the increased acceptance within mainstream psychology of alternative conceptualizations of intelligence. This trend is an indication of both the importance and the necessity of dealing with the issues discussed in the above passages.
Dynamic Assessment

In practice, the dynamic approach to learning is commonly referred to as 'dynamic assessment'. The assumption behind dynamic assessment is that the child's learning potential, or intelligence, is modifiable rather than fixed or innate. Centred around the child's 'responsiveness' to instruction, the assessment procedure incorporates instructional components into assessment. Responsiveness to instruction is thus viewed as a measure of the child's potential which is realized through external help.

The specific order in which the assessment and instruction components are administered in a dynamic assessment procedure can vary. Stemming from differences in interpreting the concept of ZPD into practice, the aforementioned variation distinguishes different traditions in dynamic assessment from each other. Researchers such as Brown, Campione, and Budoff (Budoff, 1974; Brown and Campione, 1987) employ a test-train-retest format in order to obtain quantitative measures of the modifiability of ability.

Feuerstein, on the other hand has forgone the use of a pre-test in order to provide a method which is more sensitive to each individual's strengths and weaknesses (Feuerstein, Hoffman, & Miller, 1979). In comparison to the former tradition, Feuerstein's approach can be described as a more qualitative, flexible method which is more likely to assess the child's maximum potential. However, the advantage of Feuerstein's methodology over Brown et al.'s in sensitivity is
balanced out in part by the unsuitability of the former methodology for obtaining strictly quantitative measures of change.

The distinction between the two methodologies may have been overly exaggerated within the current, empirically-oriented scientific era. In relevance to the goals of dynamic assessment, the two approaches are both complimentary to each other and needed (Minick, 1987). Essentially, the choice of methodology comes down to the goal for the planned project: Feuerstein's method may better-fit an enrichment-oriented project, whereas Brown et al.'s may be more appropriate for quantitative, empirical research.

**Theory of Similarity Reasoning**

Within the dynamic approach to learning potential, Gamlin has developed a theory of intelligence, at the core of which lies the notion of generalization of knowledge. The process of generalization of knowledge can be defined as "how individuals decide upon the information that is most relevant to problematic or unfamiliar situations" (Gamlin, 1989a, p.101). The process involves using prior experience and knowledge to go beyond 'surface' structure when dealing with a situation. In this manner, both 'surface' and 'deep' structure are utilized in selecting general strategies which are applicable to the task at hand.

In his Theory of Similarity Reasoning, Gamlin describes the interaction between several types of similarity thinking. Perceptual, analogical, and metaphorical similarity thinking types are assumed to form the basis for learning
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facing new task demands, the individual needs to restructure his or her old knowledge. Instruction from others can facilitate this restructuring process. Such facilitation can play an important role in the process of strategy selection and, consequently, the individual's adaptation to his or her environment.

Gamlin (1989a, 1989b) makes use of work by Vosniadou and Brewer (1987) and Carey (1985) to describe two different routes of knowledge restructuring: ‘weak’ and ‘radical’. In ‘weak’ restructuring, the expert attempts to either broaden or to directly put to use the knowledge base which the novice possesses. The plane of task observation and the theory of knowledge both remain at the same qualitative level.

‘Radical’ restructuring, on the other hand, requires transforming the theoretical underpinnings of the novice's knowledge structure. The novice is assisted in observing the task from a qualitatively different plane of observation, or ‘higher ground’. The choice of weak or radical restructuring within the instructional domain will in turn decide the extent to which the novice's generalization of knowledge will be in the corresponding ‘weak’ or ‘radical’ form.

The third assumption in the Theory of Similarity Reasoning is related to developmental issues. Gamlin states that, at any age-range, neurological development influences the form of generalization of knowledge. From a developmental perspective, then, the range of children's potential is constrained by changes to the central nervous system (CNS) (Piaget, 1970). It is thus important to
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correspond to neurological change within the individual.

The typology includes at least one type of developmentally-appropriate metaphoricity tasks for any skill level. Furthermore, some degree of generalization is needed for going through any type in its entirety. For each type, there are both simplified versions of tasks as well as more complicated ones -- which require a greater degree of generalization to solve than the former. A child may easily solve some of the simple tasks within higher problem-types and yet have difficulty with the complicated tasks in an earlier type.

A brief description of the thinking types within the developmental hierarchy follows this section. The typology may be utilized, however, to not only describe performance in developmental terms but also to devise a plan of intervention for individual cases. According to the theory, metaphorical reasoning is believed to be the core metacognitive activity which is used to restructure knowledge.

Performance gaps within each type, then, represent barriers in weak generalization; while the tasks which are performed last are approximate frontiers within the individual's current theory of knowledge. Utilizing the following typology as a structural guideline, the teacher can identify any gaps as well as the frontiers in the learner's knowledge structure. Familiarity with this structure would be of use to the teacher in determining the focus of the intervention process. Weak restructuring -- generalization of the existing knowledge structure across tasks -- would be used at the 'gaps', whereas radical restructuring -- utilizing the existing
knowledge domain to introduce a qualitatively novel thinking type -- would target the ‘frontiers’.

_Type 1: Grouping Objects on the Basis of Partial Perceptual Information._

Gamlin (1980) proposes that type 1 thinking emerges when the child is between two to three years of age. Having all the relevant features in the visual field, the child can use one major perceptual feature -- such as thickness of contours -- to sort objects in a continuum of just noticeable differences from most-like to least-like. Some understanding of metaphorical relationship is achieved through selecting a strategy based on a salient ("most like") criterion. For example, non-identical objects may be categorized as similar, and thus get organized from 'most like' to 'least like'. To organize the objects on the basis of perceptual similarity, the child does not necessarily need to understand the concept of 'most and least'. Moreover, simultaneous consideration of disparate features -- such as shape and shading -- is not expected to occur since there is no internalized superordinate organizer.

_Type 2: Grouping Objects on the Basis of Complete (matching) and Partial (perceptual) Information._

Children between the ages of 3 and 5 are expected to be the youngest to successfully perform in this type. Utilizing discrete features of the tasks, the thinking type involves forming exact rather than approximate (type I) judgements. Conceptual counting information is used as the primary source, sometimes in a
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Type 4: Integration of Parts into a Whole.

The thinking of the child at this stage, between five and seven years of age, is predominantly conceptual. Understanding of part-whole rather than part-part relationships is characteristic of thinking at this level. Having become more flexible in metacognition, the child is capable of organizing experience through multiple routes, such as the transitivity rule ("A>B & B>C" : A>C). Moreover, the child at this stage has an understanding of rules of classification, such as class inclusion. Gamlin (1989a) points to changes in the CNS as being influential in the qualitative changes in generalization skills at this stage.

Type 5: Organizing Parts as a Function of the Plan as a Whole

This thinking type emerges in the child at the same time -- between the ages of 5 to 7 --as type 4 does. The distinction between the two types is seen in the representative thinking styles: holistic thinking in type 5, which is a "right-brain" function, as opposed to the "left-brain" function of language usage in type 4 (Gamlin & Fleming, 1985). Paying attention to content and structure, the child with type 4 thinking uses only language to self-instruct, whereas the child at type 5 can flexibly use "the big picture", in addition to language, pictures or blue-prints, to solve a problem.

Type 6: Using Old Rules to Form New Patterns.

Beginning at around the age of 7, the capacity to innovate emerges as the characteristic mark of type 6 thinking. As with skills in previous types, innovative
skills incorporate earlier-type capacities, such as type 5 'big picture' thinking, in different ways than in the original type. To be innovative, according to Gamlin (1980), is "to use old parts or pieces or words in a different combination or sequence to achieve the same goal" (p.25). The process involves forming unique structures by using old material or rules in ways that are novel. An example of this process is the use of ordinary words to create 'code language' by children at this stage.

**Type 7: Metaphorical Reasoning.**

Emerging after the age of 7, the highest level of metaphorical reasoning requires the understanding that the whole is more than the sum of its parts. There is an emergence of deep metaphorical thinking where the meaning can be derived neither by knowing each individual word (part) of the expression nor by knowing the literal meaning of the sentence (whole), but only by going beyond the information given (more than the sum of the parts).

Metaphorical reasoning at this level requires extracting the deep structure common to seemingly disparate meaning domains. Functioning within a new mental paradigm, the child is able to 'create' linkages among experiences. In sum, Gamlin proposes that children progress from responding to one salient perceptual feature (Type 1), through progressively more complex utilization of part-whole inter-relationships (Types 2,3,4,5, and 6), and finally creating or radically restructuring all the information into a new schemata (Type 7).
In relation to issues of intervention, inter-individual differences should not be ignored while following the above model. Due to the uniqueness of each individual's range of potentials, instructional mediation should be tailored accordingly to meet individual needs if movement in the ZPD is to be facilitated. This point will be further highlighted in the discussion section.

**Application Instrument**

Gamlin has provided an instrument which both compliments and puts to practice his Theory of Similarity Reasoning. Comprised of a hierarchy of problem tasks, the Similarity Thinking Instrument (STI) was designed to evaluate the thinking skills described above. A total of 51 tasks (see Appendix A) make up 5 Types. Each Type is made up of a number of tasks that increase in difficulty. Two versions of the same problem task are presented with each change (phase) of difficulty level (see, for example, Appendix A, figures 1 and 2). There are 4 phases within each Type. As with the hierarchy of the thinking Types, the degree of task-difficulty in the STI increases as one moves both within and across the Types (see Appendix A, figures 12-19 for increasing difficulty levels in Type 2 tasks).

The STI may be used as both an assessment and an educational tool. As an assessment tool, the STI can be used to developmentally examine the current performance level of the individual. Moreover, the STI can be useful as an educational tool. First, the design of the STI both emphasizes the importance of and provides practice for finding commonalities across meaning domains. Secondly,
utilizing the STI facilitates intervention by providing clear indications of both the level of as well as gaps within the child's metaphorical reasoning ability.

The STI will be further discussed in the Methods section.

Research Questions

Previous studies have provided strong support for both the concurrent and the criterion validity of the STI (Savron, 1989; Gamlin & Koo, 1990; Sanikhani, 1995; Barker, 1996; Koo, 1995). These studies have also provided performance norms for children as young as 3 years of age in a variety of educational and multicultural settings.

The present study was aimed at both concurrent validation and examining application issues in relation to the STI. The attempt was to, first, obtain teacher attitudes towards the utility as well as the actual use of theories of dynamic assessment and instruction in educational settings, second, assess the potential of the STI as a dynamic assessment and instruction tool from the perspective of experienced practitioners in the field of teaching, and third, come up with suggestions on making the STI more useful for application in educational settings.

Method

Participants

For the purposes of this study, group discussions lasting one and one half hours were held with a total of twenty-one teachers. Two sources of recruitment were used in the study. Nine teachers were recruited from three franchises of an
education centre in the greater metropolitan Toronto area. The education centre in question was specifically chosen for its unique, cognitive instruction approach to facilitating the clients educational success. Unlike the traditional approach of the common 'tutoring' centre, the educators at the centre believe in the necessity in mediation of facilitating cognitive growth at a structural, 'deep' level as opposed to solely training the student on the school subjects. The approach embodies the idea that a weak restructuring of the students knowledge base on the academic subject alone will not be sufficient to provide long-term results. In other words, equipping the student with 'deep', cognitive tools rather than rote procedural information is seen as essential to educational success.

The author first sought and gained the approval of the education company owner for conducting the study at the franchise centres, presenting in the process the a summary of the research goals and intended methodology. Franchise directors were subsequently contacted by both the owner and the author in order to seek co-operation for the conduct of the study. A summary of the goals and methods was presented again, and potential areas of concern, such as anonymity of responses, were discussed. A convenient time for the group meeting would subsequently be arranged with the teachers, during which a minimum of two teachers would be present. Three group meetings were eventually held, each with three teachers in attendance.

The second source of participants was the building of the Ontario Institute
for Studies in Education. Contact were made through classmates with teachers who were enrolled in classes at the institute. The goals and the methodology of the study would be described to each potential participant, along with potential areas of ethical concern -- such as anonymity as in the case of the education centre.

Upon agreeing to participate, the teachers would be asked to inform the author of potential time slots for the group meetings. Three group discussion sessions were subsequently held with this group, each of which included four teacher participants.

Informed consent from every participant in both groups of participants was obtained before any group discussions were held. Consent forms were signed by each participant (see appendix B for sample consent form) for a sample consent form. Each participant both was asked for permission to and agreed to be audio tape-recorded during the session along with the rest of the group for transcription purposes. The participants were also informed that, in order to assure confidentiality, no names or other identifiable information would be included in the final transcripts, and the audio-tape recordings would be destroyed at the end of the study.

The range of teaching experience for the members in the groups was between one to six years of teaching, with the teachers from the educational centre having slightly less teaching experience as a group. Included in the participant group were teachers who had taught exclusively at educational centres, at public
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encompass 5 hierarchical types of thinking. Each problem type has several phases, each with two versions of the same problem. As one progresses through the tasks in each type, they become more difficult. Getting through the last problem tasks in a type, then, indicates a comprehensive mastery of the thinking which is required for that type.

*Type 1 tasks: Grouping objects based on Partial Perceptual Information*

Tasks in this type are accessible to most 4 year-olds. A continuum is to be formed by choosing the option card which is 'most like' the target one. Global perceptual features, such as intensity of shading or thickness of contours, are used to form a continuum. Passing through a task is then possible through observing the global visual information which is presented in the diagrams. Tasks in this type are accessible to some children as early as in the third year of life.

Each task in the first two Types includes 5 cards, one of which is the target card (see, for example, Appendix A, Figure 2 for Type 1, Figure 12 for Type 2). The other four cards are the options from which the child makes choices, one at a time, until the continuum is formed. Solving a task involves forming a continuum based on some form of common, 'deep' structure -- such as intensity of shading in some Type 1 tasks.

The first two phases in each Type involve forming a continuum by choosing and placing cards in one direction only (see Appendix A, Figure 2). The target card in each task is placed in the left-end of the continuum. The child is
shown the remaining 4 cards with the possible diagrams. While pointing first to the options and then to the target, the researcher asks the child: "which one of these is 'most like' this card". Once the child makes a choice, the chosen card is, first, placed to the right of the target card, and then, turned over. This procedure is continued until the continuum is completed.

In the last two task phases in the first two Types, building the continuum is begun with the card that goes in the middle (see Appendix A, Figure 6, for an example). Pointing first to the option cards and then to the right of the target card, the child is asked to make a choice as to which of the option cards goes to the right of the target. Once the child makes a choice, the researcher places the chosen card on the grid to the right of the target card. The researcher then turns the chosen card over and asks the child to choose the card to be placed to the other -- left -- side of the target. This process of going back and forth between the two sides continues until all the option cards have been selected.

*Type 2 tasks: Grouping objects based on Complete (Matching) and Partial (Perceptual) information*

Getting through the tasks in this Type requires judgment based on discrete units of information. The tasks are similar to those in Type 1, to the extent that the same criteria -- global, perceptual information -- which was used in the earlier type can be useful in solving the tasks in this type as well. For example, one can refrain from counting the number of apples on the depicted trees and rely instead on the
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to be transferred to a new domain of information in order to find the appropriate analogy.

*Type 5 tasks: Analogy matrices: utilizing manifest meaning in addition to latent structure*

The same structural set up is used for Type 5 analogy problems as in Type 4 ones. The tasks in Type 5 require deriving metaphoric grounds based on the meaning of the analogical relationships. The critical information for uncovering the meaning domains is, unlike in Type 4 tasks, not visually explicit. Discovering the analogy in Type 5 tasks further requires the consideration simultaneously of a number of different criteria. The above represent the capacity for generalizing knowledge in the most developmentally advanced manner, which is a requirement for functioning as an adult in the modern society (see Appendix A, Figure 43).

In the standard set up, testing in each Type begins with the first task in the first phase of the tasks. If the correct continuum is formed, testing resumes with the first task in the following phase. If the child is unable to form the entire continuum correctly in the first task, testing resumes with the second task in the same phase. Once the child fails to provide correct continua (responses) for both versions of the task in the phase, testing in the Type stops. Testing then resumes for the next Type until the same pattern of failure is observed -- at which point the testing session is terminated.

Since the video was prepared mainly for demonstration purposes, however,
the above 'objective' testing procedures were not followed in the presentation. Instead, an emphasis was placed on providing the viewer with a better understanding of the generalization strategies used by the students in the video. For this purpose, there is a good degree of questioning the student/actors by the tester on the reasoning for any response. Moreover, students are presented with incorrect but close responses once they have correctly passed a task in order to examine the extent to which they are able to eliminate competing hypothesis in their responses -- a test of their ability to generalize. The responses closely follow the ideas which are presented in the section on the Similarity Reasoning Theory.

A point must be made in respect to the ideal way of utilizing the STI for educational purposes. In addition to the above procedures, metaphorical knowledge can also be assessed on the STI by asking the learner to form the tasks when he or she is given the cards. Taking this procedure one step further, the learner can be provided with raw materials, such as markers and blank cards, and then be asked to create similarity continua based on this or her own preferred dimension.

In either of the above cases, the idea is to use generativity as a measure of the extent of metaphorical understanding. Conceptually speaking, a child who has an understanding of 'deep' metaphorical structures should be able to construct as well as solve problems in metaphorical domains. It is obvious that utilizing such a procedure can also increase the fun the child has at the same time as facilitating the
generalization of his or her knowledge within a novel task.

Discussion Questions

Subsequent to the video-presentation, a group discussion was initiated by the researcher on the video contents. The discussion was initiated by but not fully structured upon a set of questions which were drawn out of consultation with the research supervisor. In formulating the question, the goal was to ground the research question in terms which link the contents of the video presentation with the participants experiences. Moreover, it was hoped that the utilization of the questions in a semi-structured group interview format would facilitate both the initiation and maintenance of a discussion while allowing for the expression of individual insights into relevant area of interest.

The following section presents the questions in the order in which they were originally conceived. The questions were not, however, presented in this order during the group discussion. Rather, questions were presented whenever the flow of ideas would approach the underlying ideas in the relevant area for the question. This was an attempt to maintain a steady flow of ideas by fusing questions into the discussion rather than constant shift focus from one area to the next for the sake of maintaining the order of questions.

While standardization of the order of questions may have merit in a quantitative, experimental design, the goal and design of the present study were geared not only towards normative attitudes but also towards obtaining the
participants idiosyncratic insights as gained through individual experiences. In other words, following one particular order of questions would require the participants to continuously come up with insights into new questions, a feat which would be taxing on the participants' focus -- if not impossible -- due to the time constraints for the discussion. The discussion typically lasted for the 40 minutes of time which remained in the group session.

1) Looking at what the students are doing in the presentation, do you understand the type of thinking that the students have to use to solve the tasks?

2) Are you clear about what the students are expected to do during the assessments? Do the instructions by the testers make sense?

3) Is the video presentation coherent in its entirety? Does it express the ideas in the theory and application in a sufficiently clear manner?

4) Do you think of the skills which the students are using in the video as being important? Do these thinking skills have relevance to either learning or school curriculum?

5) In which content areas in school curriculum do you see the thinking skills as being most relevant? Where would the effects of learning this type of thinking have the most impact?

6) Can these skills be learned by students while other subjects matter is being
taught at (school or the educational centre)?

7) Can you see yourself working with these cognitive skills at (school or the educational centre)? If so, how? What would you like to see developed, altered? Alternatively, if you can not see yourself working with the tool, what would have to be changed in order to work with the tool?

8) Do you think it would be valuable to have every child assessed on the STI for the teacher at (school or the educational centre) to know at what level of functioning they presently are?

9) Do you think assessment and instruction with the STI would be more valuable with younger or older children?

Procedures

Once the testing date was established, the researcher would arrive at the location of the meeting -- either the educational franchise location or a room at the OISE building, where a VCR and TV would be set up prior to the onset of the meeting for the purposes of viewing the video presentation. At the onset of the group meeting, the teachers were reminded once again about the need for taping the discussion, and also informed about their right to withdraw from the study at any point. None of the participants withdrew from the study. They were also asked to use any means appropriate to their learning style in order to absorb the material presented in the video presentation -- although active listening without note-taking
was considered sufficient.

The researcher next presented a brief summary of the contents of the video presentation, including a demonstration of the actual cards which are used in the assessment procedures. Alternative ways of administering the STI, such as self assessment, as well the finding of recent empirical studies -- such as those of Savron, 1989; Koo, 1991, 1997; Sanikhani, 1995; and Barker, 1996 -- were also briefly discussed. Tools such as self assessment modules were also present for viewing by the teachers.

Finally, the teachers were each given a training manual both to become familiar with training as a tester and also to have better visual access to all the tasks which are presented in the video in case of a faulty or less than clear picture. This last procedure was complemented during the video presentation by informing the teachers about the page number in the manual in which the current task was depicted. The procedure proved to be an effective one particularly since the outlines of some of the task diagrams in the video were relatively undistinguishable from their background material. The entire introduction to the session took up no more than 10 minutes.

Results and Discussion

1) Looking at what the students are doing in the presentation, do you understand the type of thinking that the students have to use to solve the tasks?

The participants as a group had no difficulty understanding the underlying
thinking skills which was brought out through the demonstrations. Many
participants expressed familiarity with generalization skills in some form, although
not all had experienced a direct focus on the skills in a theoretical framework such
as the one presented in the video:

"...yes, I understand the type of thinking they are talking about, it’s something that everyone uses, whether or not they are aware of it. It’s an intuitive thing almost, I certainly use it myself, it is something very ... fundamental...”

"...what I see here is very obviously a part of learning, I understand what the kids are doing, but I don’t think that the skill is regularly taught, or that many people are conscious of having it; it is not what some would call a technical skill, although it is probably more important to possess than many technical ones.

"...I understand what type of thinking skills they are using, I haven’t been exposed to a specific focus on generalization skills before in my training as a teacher, but I can see this type of thinking going on when a student is learning new material...”

In general, the participants’ responses indicated close familiarity with as well as an understanding of the concept of generalization skills. Since this question was an early litmus test -- in order to ensure that the presentation had made sense to the participants -- in the discussion, the positive responses allowed for further exploration of the research area.

2) Are you clear about what the students are expected to do during the assessments? Do the instructions by the testers make sense?

The participants were divided on whether or not the instructions were ‘appropriate’ in the video, although all were clear about what the students were to
do. Some participants expressed their doubts at the clarity of the instructions for samples of younger children in assessment situations. Others believed the instructions were either too ‘helpful’, or not objective testing procedures in the case of post-assessment explication scenarios -- where the child would be presented with alternative, ‘close-but-not-correct’ responses.

“...it’s pretty clear what the children are asked to do, but that is from my perspective. The question is, whether or not a 7 year-old child is also able to start a continuum from the middle point just by listening to the instructions...”

“... I think the children understood what was expected of them, but at the same time, I don’t think that the testing procedures were exactly neutral. A lot of answers were being given away...”

“...I think that the children were pretty clear on what they expected to do, and the instructions were appropriate to the tasks. It was interesting to see that with the older children you can assess them with non-verbal instruction, only by using hand gestures. That is probably an indication of their higher cognitive ability compared to the younger ones...”

The responses to this question indicates two interesting points. First, the teachers were concerned regarding the appropriateness of instruction for all age groups. This concern was, while justified in a real life situation, due to the circumstances and aims of the presentation method. As mentioned earlier, the emphasis was intentionally placed on providing familiarity with the theory rather than either demonstrating or training the teachers on standard application procedures. Thus a young child might first appear in the video while working on a more difficult task, which would not be the normal assessment procedure in real
A second concern related to the objectivity of the instruction or assessment procedures. Again, the same explanation applies to this instance. The children were intentionally questioned about and times tested on the level of their confidence in order to provide a rich array of information for the purposes of presentation. The video content did not constitute standard assessment and instruction procedures with the STI. It is interesting to note that the above concern was raised even though the participants were informed prior to viewing the presentation about the 'non-standard' nature of the contents. The concern is perhaps an indication of the extent of pre-occupation in today's educational circles with standardized procedures.

3) Is the video presentation coherent in its entirety? Does it express the ideas in the theory and application in a sufficiently clear manner?

The responses to this question were generally positive, although quite a few people complained about the excessive amount of time allocated to some parts in the video. More interestingly, however, was the observation by many participants regarding the sequencing of the presentation material.

"...the video is clear enough for anyone to understand what the theory and the instrument are about, but I wish they would go through some parts more quickly..."

"...I felt that the right material was being used, although I was confused for the first half of the presentation. I didn’t see a clear enough structure, or maybe I was just trying hard to see where they were going with the content, trying to see where the applications
were. I didn’t see the parts as being well-connected at the beginning...”

“...The picture quality could be better. The last part of the video where they go over all the different Types in the instrument really straightened things out for me...”

“...I think that it was clear overall, but I would have a lot of questions in my mind if you hadn’t gone over the whole thing before it started. Also, the fact that we had the manuals with us and you were telling us where to look simultaneously helped, because most of the task cards in the presentation were hard to see on the screen. Figuring out the Type 5 diagrams was guess work for me until I saw them in the manual...”

The theme in the responses to this question was that of sufficient -- or, at times, excessive -- amounts of information on the topics. There were some participants who felt that the second part of the presentation was crucial in pulling together the different discussions in the video. In the overall sense, the presentation was accepted as having been successful as a tool to introduce the participants to the ideas, and thus is recommended to be used in future studies or work-groups. Nevertheless, providing copies of the tasks on paper as well as presenting a brief summary of the contents of the video prior to viewing may enhance the effectiveness of the presentation.

4) Do you think of the skills which the students are using in the video as being important? Do these thinking skills have relevance to either learning or school curriculum?

The participants as a group indicated that similarity thinking is a relevant
and somewhat under-examined aspect of the learning process. For many participants, the question was almost rhetorical in nature: these teachers felt generalization skills to be a part of, if not an essential backbone, to learning.

"...I see this type of thinking as an important part of learning, you can't really learn without the ability to draw on what you have already learned, and the type of drawing on or inferencing will depend on and probably improve with maturation...you also need to understand what is being presented, by seeing relating the parts to each other, which is what they are doing in the video when they build a continuum."

"...what they are showing is something so important and yet so basic that even we as adults might take it for granted or neglect it as trivial stuff. How many times have you heard of work sessions designed to make you more in tune with your past experiences in order to bring out creativity and improved learning..."

"...it's nice to see that this area is being looked at, I think of this ability to generalize as something that my students can use; in fact, some of the things they were talking about in the video were exactly what I do and see in my own teaching...I always make it a point to start a lesson by drawing on previous lessons, or the underlying concepts that have been learned before jumping to the next level...You can't make that jump without providing a base to work from, even if the new stuff is radically different, it is still linked to, or comparable with, what the person already knows. In some cases, you can use previous lessons to demonstrate new ways of learning, even if there is no real connection, I guess I am talking about using analogies even if the content areas are wildly dissimilar..."

The responses indicates not only a belief in the importance of the skills, but also ways in which similarity thinking could be involved in learning. For example, generalization was considered to be important when introducing a new topic as well as when dealing with problem sets. The linking, making explicit the similarities
between the old and the new, is what many teachers believed to be a part of their teaching philosophy.

The element of creativity can also be brought out through utilizing the old in a new, and yet relevant way. This process may be take place through forming hypotheses or functional goals in the form of an analogy, using the old in an unconventional way to explore new relationships between phenomena. Lastly, when faced with a novel problem solving situation, the learner's confidence may be increased through realizing that an element of the old -- and thus familiar -- is present in the novel, apparently foreign task at hand. Equipping the learner with the ability and tendency to recognize the old in the new can lead to better performance by reducing the level of his or her anxiety.

5) In which content areas in school curriculum do see the thinking skills as being most relevant? Where would the effects of learning this type of thinking have the most impact?

Two themes emerged from the responses of the participants. First, the majority believed that generalization skills could, if they already don't, underlie just about any subject area in school curriculum. Secondly, an interesting array of ideas emerged when the participants described the relevance of generalization skills to individual subject areas.

"...at one level, you need this type of thinking skill in just about anything you do. It is not possible to learn new things if you don't work with what you already have, to see the familiar in the novel. I see generalization to underlie learning in a very broad sense of the
term...

"...problem solving is the first thing that comes to my mind. When you are working on a problem, you have to look at the premises, the givens, and determine, as they say in the video, how similar the different components are. Then you have to look back at your own experiences, and find similarities between your experiences and the new premises...in order to find a strategy that fits the new problem. You have to be able to make connection, whether it's among the contents of the new information or the old and the new tasks..."

"I can see a lot of applications, in pretty much any subject. In particular, though, I see the sciences and math. In the sciences, you are always building on the old bases, which were also built on older lesson themselves. You can't understand a new concept without conceptualizing it within the framework of, or figuring out how similar it is to, what is already known. Also, math comes to mind. Type 2 is obviously hitting on the number concept...I think the STI could be used to introduce or get practice on something as abstract as math, it could help the kids become familiar and stay comfortable with the lessons very quickly.

"Math, and definitely geometry. I always see some students struggle with fractions, and in the instrument here they are presenting the underlying ideas in different forms, which is great for the kids to get a feel for part-whole operations...When I was looking at Type 3 problems, geometry was jumping out at me, the linking operations, building strings according to how the pieces fit together, all that is used in some form or other when I am teaching geometry. Also, since the test is so visually oriented, I thought that in itself could be used to familiarize students with the concepts."

"...a lot of subjects, but I was thinking of how I teach young kids to read and write. When they talk about similarities and learning, that's exactly what happens when you are teaching kids the similarities and the differences between two letters, ...when you are teaching them to pronounce vowels, or when you teach them to write 'E' and then 'F' by taking off a bar."

If generalization underlies learning at a deep level, a potential area of focus
can be the fitting of specific types of generalization, the way the different thinking
Types are presented in the theory, to the task at hand. In other words, teachers
could work on both making the learner more conscious of the importance of
generalizing from the old to the new and subsequently facilitating the choice of the
appropriate generalization thinking ‘Type’ to fit the task at hand.

In the latter role, assessment of the learner's cognitive level would
explicate the types of thinking, or the sophistication of their cognitive tools at the
present time. This assessment would be necessary in order to then chose the
appropriate, present type of skill for the particular problem to be solved. An
example of this is often seen with 3 or 4 year-old children, who possess the
capacity to count. When faced with a Type 2 task, however, these children may,
despite possessing a number concept, resort to a global, partial strategy.
Facilitation at this point would utilize the learner’s potential to use a more
appropriate strategy -- complete, matching thinking type -- in solving the task.

6) Can these skills be learned by students while other subjects matter is being
taught at (school or the educational centre)? The participants generally
agreed on the possibility of learning generalization skills alongside other subjects.
A few even expressed their belief in the linking generalizing skills to the subject
areas by teaching both simultaneously.

“I always make it a point to start a lesson by drawing on previous
lessons, or the underlying concepts that have been learned before
jumping to the next level. So from what I have seen, I think that
you can teach these skills while you are teaching other subjects. It’s
the strategizing part of the lesson that I can see these types of thinking as being very relevant to.”

“I can see these skills being taught just by themselves. At the same time, I can see that teaching the skills along with the subject matter can also be done. In a way, you can be modelling for the students by explicitly using these skills, in reviewing before the problem solving, by making connections, ... so that the student can pick up the skills as a part of the package.

“...I don’t see why not, as a matter of fact, the skills should be taught not along alongside other subjects, but they should be highlighted for the learner to make them more salient, for the student to understand what happens during the learning...”

An interesting point that emerges from the responses relates to application issues. Just how directly can we teach these skills, especially considering their nature as fundamental to learning? While not ruling out the possibility of teaching the skills by themselves, the responses can be used to infer that generalization skills can be effective if they are taught in the context of the other. Teaching in this manner may afford generalization skills a more direct illustration of their academic relevance and specific application utility.

7) Can you see yourself working with these cognitive skills at (school or the educational centre)? If so, how? What would you like to see developed, altered?

Alternatively, if you can not see yourself working with the tool, what would have to be changed in order to work with the tool?

This question prompted the greatest variety of responses. While many participants expressed their wish to use the STI for assessment and especially
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PAGES

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own merit... For teaching, I could use the tool. I would need to have it fit my teaching style. For example, I would need to be able to use it for group work, and doing that would mean having a whole bunch of cards around, setting the questions up, and then supervising each child. I would need a more efficient method than what you have here.

"...I would like to say that I am interested, and I see the point in using the STI to assess or teach with, but the reality of the matter is that public schools are not terribly interested in this sort of thing. I know that teachers in private schools are much more likely to work with these skills... I did when I was teaching at a private school. So I would think that enrichment programs, or tutorial work could be where the instrument would be very useful, especially when you think about how public school are neglecting so many aspects of learning..."

"...I could use the instrument, and would be able to use it with different groups. Right now, the non-verbal characteristic of the test is appealing, but I think that it can be more useful if it was changed to accommodate different learning styles... so many tools are hitting on the visual domain... so maybe adding a tactile dimension would make it accessible to people who use that channel. Using blocks, for example, with Type 3 problems. Blocks that can fit together. Also, an auditory section could be very useful, a narrative of a list of items, something that can make the test very unique..."

In examining the responses, a few suggestion can be made on the task of developing the STI. The issues at hand are increasing motivation, attention, meaningfulness, and accessibility for differing learning styles. Particularly for use with the younger age groups, the diagrams could be made bigger, less cluttered, and better defined. This would serve to both reduce unnecessary distractions in the cards and to make the diagrams more interesting for the students. Moreover, student enthusiasm for the assessment or instruction could be increased by adding
colour to the cards. Providing teachers with large enough diagrams could be the key to facilitating group play activities with the STI: large depictions of the tasks could be presented on a board and the students would subsequently reference the board while working on response booklets.

A number of suggestions can be made to make the tasks more accessible to learners with non-visual learning styles. For example, utilizing blocks for tasks such as ones in Type 3 would not only introduce the element of tactile manipulation, but also make the tasks more directly aimed at the ‘linking’ operations which they are aimed at. Using actual toys or mini models, such as toy animals instead of the diagrams in the first two types, would probably increase the learners enthusiasm for playing with the tasks. This would prove to be particularly effective since the first two types are cognitively the most accessible parts of the STI for young learners.

In sum, then, the participants identified a number of trends: the STI can be most immediately useful in private, tutorial educational settings as opposed to the public school ones. The STI can in fact be particularly useful in these setting by a focus on remediating thinking skills which are left out of the public school curriculum. Moreover, a large number of the participants expressed the need for further developments of the tool while indicating their interest in the tool. The factor pointed at most frequently in such indications of interest was the flexibility of the STI as a teaching tool.
8) Do you think it would be valuable to have every child assessed on the STI for the teacher at (school or the educational centre) to know at what level of functioning they presently are?

The responses to this question again echoed the current problems in school curriculum which have already been discussed. A point was made by many participants on the need to link any assessment findings with teaching efforts.

"...we are looking at a situation that is too familiar for many teachers. You send a student for assessment, they come back, and nothing happens. You will end up with an identification of the student's talents, difficulties, etc. Then you are not given room to move into action..."

"It would be nice to know how good your student is at making connections between different areas. I think that it would be useful for the teachers to be the administrators in this case..."

"...I think that I would like to use it not just to assess but to work with, as a game to be played with the kids, to teach different concepts with...."

The responses to this question highlight the need for following up assessment with teaching efforts. In essence, the participants opinions were a reflection on the short-coming in the educational system at the present time. For various reasons, the participants felt that they would very much like to see the ideas in the STI incorporated into their teaching curriculum in the form of assessment-intervention. They also proposed that assessment on the STI could still be valuable were it to be utilized with intervention or teaching with another procedures, in case the STI would not be available for use in teaching. This
proposal may be viewed as the participants belief in the utility of the STI in
providing a useful assessment of the learners’ learning potential even if it was not
to be used as a teaching tool -- although ideally it would be.

9) Do you think assessment and instruction with the STI would be more valuable
with younger or older children?

The responses of the participants provided a ‘fit-dependency’ profile. Many
respondents believed that, particularly with further development of the formatting,
the STI could be utilized across the age groups which it aims at -- children
between the ages of 3 and 12 as studied in previous studies (e.g. Savron, 1989;
Koo, 1991). Some participants believed, out of a concern for both ceiling and floor
effects in performance, the middle childhood years -- between 6 to 9 years of age --
would be the most appropriate period for training on the STI. This was expressly
linked with the possible short attention span of the younger children and the
insufficient challenge that the later Types would pose for the adolescents.

“I think that it can be used with all those [3 to 12] age groups you
talked about. It should be challenging enough in different forms,
and I also think that a resourceful teacher can do a lot with the
tasks to provide a good learning context. The tool allows for that
degree of flexibility, especially with the later analogy tasks...”

“...learners in their middle childhood, I think, would be the safe bet
to go with. The younger ones may not find the tasks easy enough,
or exciting enough in the age of the video game, to stick with
[learning] in a meaningful way...”

“...I can see the tasks are appropriate for kids up to adolescence; at
that point, they might not be challenged enough to engage
themselves. Then again, a good teacher can rearrange the tasks,
make it more demanding on the student’s cognition...like in the video, where they show how the tasks in the last type include manifest meaning, which have to be figured out by the student in a non-perceptual way..."

While the above responses to the specific question posed at the session provide a great degree of expert knowledge into the research area, it is important to discuss some of the other issues which were partly pointed to by the participants in the sessions. An important point of discussion relates to application issues. Gaps in the knowledge structure of the children are often differentially located according to the age group, and thus the conceptual level of maturation, to which they belong. Conceptual readiness must therefore be present for any intervention effort to be successful. In other words, the focus of intervention for each child should be targeted on developmentally-relevant gaps in the child's knowledge structure.

**Application Issues**

Conceptually speaking, there are two ways in which we can talk about application issues. The first relates to the framework which the STI provides for establishing an interaction with the child. Children from a variety of cultural backgrounds (Gamlin & Koo, 1990) and, as shown in this study, as young as 3 years of age, are able to benefit from instruction on the STI. We are, in other words, making a statement of universality in relation to the application utility of the STI.

A potential inference from the findings would be to focus intervention or
teaching efforts on those specific metaphorical reasoning skills which are developmentally relevant to the target age-group. Therefore, one would avoid directing training programs to skills which are, developmentally speaking, either too basic or too complex for the target age-group.

While the above point is generally a valid one in relation to training, one should avoid utilizing exactly the same training schedule with all members of an age-group. Illustration of the latter argument requires an examination of the theoretical underpinnings of this study. The ZPD refers to the existence of a range of potential, rather than a line or some fixed state of ability. Furthermore, the roles of biological (lower) and sociocultural-mediation (higher) factors are distinguished from one another in the development of mental processes. Biological factors influence the range of the learner's cognitive potential. This range of potential is then transformed into the learner's higher mental processes through interaction between the learner and sociocultural mediation forces. As a result of this interaction, the learner is afforded the chance to internalize social and cultural tools. The mental adaptation of the learner to the living environment is thus facilitated as his or her biologically-determined range of potential is realized through sociocultural mediation.

In relation to the second point in teaching applications, then, two points are relevant. First, variations in the range of potential across individuals should be expected as a function of biological diversity. A strictly standardized application of
any instruction procedure may thus fail to realize the learning potential of a young person in its entirety. The application of any such procedures should be complemented with the establishment by the teacher of a flexible, discovery oriented interaction with the learner. It is only by using this kind of approach that the teacher can gain a clear sense of the learner's knowledge structure. Standardization of procedures may be a safe way to ensure that basic skills are well-grounded in the learner, or that the range of possible potential is accounted for.

Due to practical purposes, however, such procedures are not tailor-made to fit the needs of every child. At best, the procedures provide an account of the general issues at hand. In order to gain insight into the child's ZPD, then, it is necessarily to establish a flexible interaction in which the ZPD would implicitly reveal itself. The important point here is that, in order for the interaction to be revealing, the teacher needs to try to take the perspective of the child. As in other facets of life, understanding comes about by viewing the phenomenon through the plane of the-lived-world as opposed to the (detached) plane of observation. In other words, understanding should precede description, or taking actions of any kind.

The second structure-related issue concerns the role of socio-cultural factors in mediation. As mentioned above, interaction between the learner and socio-cultural factors results in the internalization of cultural-historical knowledge,
such as found in culturally-salient forms of dance. When initiating a mediation interaction, therefore, it can not be assumed that the learner's potential has been fully realized through his or her past learning interactions. The future remains to be learned, wherein the child will find a direction for development.

A relevant example of the above is the case of teaching immigrant students. The true potential of these students is not easily assessed if one is to follow the conventional route. At least two points must be remembered in such interactions.

First, the immigrant learner's potential has been largely mediated by the socio-cultural variables of his or her native environment. In the learner's home environment, the interaction between the socio-cultural variables and the learner might have resulted in a good degree of adaptation to that context. In the new environment, however, the learner may be facing challenges which are different than those in his or her home environment. The mediation route -- e.g. the format of the educational curriculum -- may have taken a different route than those of the host-culture's. The immigrant learner may thus not be well-adapted yet to the host culture, for example, due to lack of familiarity with culture-specific routes of learning.

The second point in relevance to teaching immigrant students concerns the channels of communication. Establishing effective lines of communication between the immigrant student and the teacher may often be trying for both parties. The difficulty is often due to environmental differences in verbal as well as other modes
of communication-- such as body gesture. This may be the case even if the
student's knowledge structure is rich in respect to the area of discussion. This point
is routinely demonstrated in the common complaint of immigrant students about
not being able to express the ideas which they have in mind. Consequently, the
assessment of the immigrant students knowledge base may then be biased:
difficulty in expression may be taken as an indication of not having learning
potential. In either of the above two cases -- whether the person has not been well
equipped with knowledge relevant to the new environment or is not able to
express his or her ideas effectively -- assumptions about either ability or the
effectiveness of previous interactions may lead to errors in assessment. As in the
earlier discussion, the establishment of a flexible interaction should enable the
teacher to gain a clearer understanding of the learner's true potential. Such an
understanding must be in place before making attempts to either describe the
learner's knowledge-gaps, or to engage in mediation. As discussed before, such
understanding can only come about through perspective-taking. In the event that
assessment of the learner proceeds without taking into account the relevance of
contextual factors, we may risk the inclusion of our own biases in both assessment
and intervention processes. Therefore we must try to set aside our biases in order
to see the learner and his or her experiences as they are, rather than through the
filter of subjective stereotypes.

The importance of flexibility in the educational process has been discussed
in relation to both structure and method. Flexibility in teaching is also important in
a third, theoretically-oriented way. Within the dynamic/contextual approach to
cognitive development, the process of mediation is not highlighted solely by the
content of the teacher-learner interaction. Instead, the interactive nature of the
process itself is considered to be the essence of mediation (Smagorinsky, 1995). In
analysing the mediation process into its components (as is routinely done in much
of the research from 'Cognitive Science') , the components are rendered
meaningless as they are de-contextualized. Cognitive activity, then can not be
viewed as the bare psychological process, but rather as the dialogue between this
process and the object or socio-historical tool at which it is directed. Discussing
cognitive mediation as a de contextualized activity, is akin to viewing the process
as the simple loading up of a certain type of software into the learner's 'computing'
machinery.

The interaction between the educator and the learner is therefore what
both makes the process a mediational one and leads to the evaluation of the
learner as a unique individual -- in the idiographic sense of the word. Mediation is
a process which is comprised of multiple relations among its components. These
include the context of verbal communication, metacognitive activity by the teacher
to maintain the interaction, as well as metacognitive activity by the learner, to
utilize the learned material in his or her knowledge base.

We conclude the above discussions by referring back to where we started.
In utilizing the STI, we are trying to merge two points: Firstly, the STI should be useful to educators by providing a conceptual framework in conjunction with the Theory of Similarity Reasoning. This framework provides the educator with a tool which will guide the teaching of concepts. Additionally, we have stressed that there are very real individual differences in children's ability to benefit from the framework. Consequently, we need to pay attention to these differences when we mediate.

And finally, in reference to the overall approach to mediation, the process of mediation itself, the theoretical underpinning of the Theory of Similarity Reasoning is based on the Vygotskian notion of integration. While the components (or Types of reasoning) in the theory are distinct from one another, each component nevertheless maintains the characteristics of the theory as a whole. The sum of the theory is represented within the parts of the instrument much in the same way that mediation reflects flexibility in the learning interaction. In other words, the teacher must always keep in mind the objectives of the mediation taken as a whole, as represented through all the Types of metaphorical thinking. This is critical because the essence of the theory as a whole, is represented within the individual parts. Such a representation is central to both the theoretical cohesiveness of the theory and its application goals.

Conclusion

Gamlin's Theory of Similarity Reasoning represents a unique approach to
both assessment and instruction issues within an educational curriculum. The theory recognizes both the importance of individual differences and the importance of social factors in the development of cognitive skills. The approach is different than that of Piaget and is in agreement with Vygotsky in believing that there are no cognitive structural boundaries. In the Zone of Proximal Development, then, one can teach to and facilitate development. That is to emphasize Vygotsky's idea that learning precedes development.

In relation to the above, the STI may be successfully and reliably utilized as both an assessment and an educational tool. There is a strong relationship between similarity thinking and the ability to generalize knowledge. This is the reason why similarity thinking is fundamentally related to both learning and the ability to think. By focusing on metaphorical thinking, the teacher can explore what lies behind reflective abstraction. The latter concept is what has been thought, by Piaget as well as other scholars, to be the driving force behind cognitive development.

The STI is aimed at the assessment of instruction to metaphoric reasoning. This type of reasoning has been shown, through the use of words as well as pictures, to be highly related to cognitive ability (Epstein & Gamlin, 1994). It may well be the case that metaphorical reasoning is the essential component of cognitive ability: metaphorical reasoning is needed to generalize knowledge from one domain to another; a mode of adapting to our living environment. Through
the use of the STI, we can try to reliably capture developing competence in metaphorical ability.
References


Appendix A:

The Similarity Thinking Instrument (STI)
Figure 7.
Figure 11.

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Figure 20.
Figure 22.
Figure 23.
Figure 35.
Figure 47.

- Soft blue colour
- Orange colour
- Volcano
- Three people
- Train wheel
- Person with megaphone
- Person with megaphone
- Red colour
- Question mark
Appendix B: Sample Consent Form

Dear teacher:

Doctor Gamlin at the Ontario Institute of Studies in Education (OISE) has developed an instrument which can be used to both assess and teach generalization skills. The Similarity Thinking Instrument (STI) has already been used in several research studies with a variety of students.

I am currently planning to conduct consultation sessions on the utility and potential of the STI with teachers such as yourself. In the sessions, the participants would view a video presentation on dynamic assessment and instruction procedures, including a demonstration of the usage of the STI with students. Further elaborations on dynamic assessment and instruction will also be made by myself. Following the presentations, a group discussion will be held in which the participant views on the utility of the STI as well as ways of adapting the instrument to diverse teaching setting will be sought. For the purpose of transcribing the discussion, the sessions will be audio-taped. In order to provide complete confidentiality for the participants, however, the transcribed records will not include any names or other identifying records of the participants. Moreover, the tapes will be destroyed immediately after transcription.

Participation in the study is on a voluntary basis, and participants can withdraw from the study at any point in time. A brief summary of the findings will be made available at the end of the study to any participant who requests a copy. Please feel free to contact me with any questions which you might have regarding participation in the study. Your volunteering for this study will be appreciated.

Sincerely,
Mohammad Sanikhani, M.A. Candidate, Department of Adult Education, Community Development, and Counselling Psychology, (XXX)XXX-XXXX

________________________________________________________________________

I am volunteering to participate in the study on the validation and development of the STI. I have been informed that the sessions will be audiotaped for transcription purposes, and that the tapes will be destroyed subsequent to transcription.

Name ___________________ Date ____________________

Signature ___________________

________________________________________________________________________