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Using Dynamic Assessment to Help Students Learn to Assemble and Use Knowledge

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Advances in learning and brain research today have shifted the perception of knowledge from something that is transmitted to something that is constructed in the mind. Constructivism suggests that students achieve superior outcomes when they actively participate and generate their own information through a search for meaning and conceptual understanding. This workshop focuses on how dynamic assessment and mediated constructivism can help students to develop their cognitive and knowledge structures. Dynamic assessment involves deliberate attempts by a trained educator to develop the processes that are involved in knowledge construction. It stresses the need for the teacher to mediate the development of these knowledge construction functions in conjunction with the learner's acquisition of content knowledge and behavioral skill- all within an active, coherent and meaningful learning environment. Two specific research settings will be explored, the hearing impaired student and the primary school learner in math problem solving. The challenges and issues in applying dynamic assessment in these areas will be discussed.

Dynamic assessment is an interactive approach to conducting assessment within the domains of psychology, speech/language, or education that focuses on the ability of the learner to respond to intervention. The term dynamic assessment (DA) refers to an assessment of perception, learning, thinking and problem solving by an active teaching process aimed at modifying the individual's cognitive functioning. (Tzuriel, 2003). The idea of actually intervening in testing situations in order to discover the individual's learning potential was introduced by Haywood et al (1992) and Tzuriel (1992) in his DA tasks for young children. In recent years, more researchers have been using DA for intervention purposes. (Lidz and Elliott, 2000; Tzuriel, 2003; Jensen, 2003; Lidz, 2005). As far back as in the seventies, DA and intervention were already used by Vygotsky (1978) and Feuerstein et al (1980) in their scaffolding and mediated learning experience procedures.

Vygotsky (1986/1934, 186-87) first described the process in the following way.

Most of the psychological investigation concerned with school learning measured the level of mental development of the child by making him solve certain standardized problems. The problems he was able to solve by himself were supposed to indicate the level of his mental development at the particular time. But in this way, only the completed

part of the child's development can be measured, which is far from the whole story. We tried a different approach. Having found that the mental age of two children was, let us say, eight, we gave each of them harder problems than he could manage on his own and provided some slight assistance: the first step in a solution, a leading question, or some other form of help. We discovered that one child could, in cooperation, solve problems designed for twelve year-olds, while the other could not go beyond problems intended for nine year olds. The discrepancy between a child's actual mental age and the level he reaches in solving problems with assistance indicates the zone of his proximal development; in our example, this zone is four for the first child and one for the second. Can we truly say that their mental development is the same? Experience has shown that the child with the larger zone of proximal development (ZPD) will do much better in school. This measure gives a more helpful clue than mental age does to the dynamics of intellectual progress.

Vygotsky's scaffolding approach can yield optimal and optimistic estimates of children's learning potential only if the learning potential is realized. These predictions are doomed to failure according to Haywood and Tzuriel if nothing is done to bring out the hidden potential. The sad news is that today in many schools, we know that many children's learning potential has been underestimated but if it is not developed, then the underestimation will be true.

Feuerstein developed his DA approach based on the theory of mediated learning experience (MLE) and structural cognitive modifiability, very much like Vygotsky's development of the ZPD concept. Feuerstein described the three key assumptions of the MLE theory as:

- 1 Human beings have a unique capacity to modify their cognitive functioning and adapt to changing demands in the environment.
- 2 Cognitive modifiability is possible irrespective of the barriers of age, etiology, and severity of condition.
- 3 MLE processes explain cognitive modifiability better than do direct unmediated experience.

The theory of MLE proposes that the quality of interaction between the individual and the environment via an intentional human being plays a pivotal role in the cognitive development of the individual. Feuerstein propounded the development of cognitive structure in the individual as a product of two modalities of interaction: direct exposure of the organism to experiences as described by the stimulus-organism-response (S-O-R) model of Piaget and interaction of the organism with the environment via the human mediator (H), hence the S-H-O-H-R model. The mediator maybe the parent, facilitator, teacher or some significant other who plays the intentional role of explaining, emphasizing, interpreting, or extending the environment so that the learner builds up a meaningful internal model of the context or the world experienced. (Seng etal, 2003)

In a DA context, the examiner mediates the rules and strategies for solving specific problems and assesses the level of internalization (ie deep understanding) of these rules and strategies as well as their transfer value to other problems of increased levels of complexity, novelty and abstraction. Cognitive modifiability is defined as the individual's propensity to learn

from new experiences and learning opportunities and to change his or her own cognitive structures

Characteristics of the Dynamic Model of Assessment and Learning

A number of characteristics set the dynamic procedures apart from the traditional tests. Grigorenko and Sternberg (1998). DA is not a single package or procedure, but is both a model and philosophy of conducting assessments. Although there are variations on several dimensions of the model, the most consistent characteristics are as follows:

- *the assessor actively intervenes during the course of the assessment with the learner with the goal of intentionally inducing changes in the learner's current level of independent functioning.

- *the assessment focuses on the learner's processes of problem solving, including those that promote as well as obstruct successful learning.

- *the most unique information from the assessment is information about the learner's responsiveness to intervention.

- *the assessment also provides information about what interventions successfully promote change in the learner (connecting assessment with intervention)

- *the assessment is most often administered in a pretest-intervention-posttest format.

- *the assessment is most useful when used for individual diagnosis, but can also be used for screening of classroom size groups.

- *the model is viewed as an addition to the current, more traditional approaches and is not a substitute for existing procedures. Each procedure provides different information, and assessors need to determine what information they need.

- *the underlying assumption of DA is that all learners are capable of some degree of learning (change; modifiability). This contrasts with the underlying assumption of standardized psychometric testing that the learning ability of most individuals is inherently stable. Research with DA has demonstrated that determination of the current levels of independent functioning of learners is far from a perfect predictor of their ability to respond to intervention. (page 2. dynamic assessment website)

Feuerstein, Rand and Hoffman (1980) suggested that DA differs from traditional standardized methods of psychological and psychoeducational assessment on several dimensions: Tzuriel summarizes them as follows: (Seng et al. 2003)

1. The Nature of the Tasks

Standardized tests are characterized by an emphasis on psychometric properties of the tasks, graduating of the difficulty levels of items, and representation of children's capacities. Tasks in DA on the other hand, are constructed on the basis of the cognitive functions and measuring cognitive changes. The items in DA are also graduated in terms of difficulty level, but the focus is on the teaching of dimensions and procedures so that learning of one task prepares the child to perform a more advanced task.

2 The Testing Situation

Standardized tests require, by definition, standardized static conditions for all examinees since the objective is to compare an individual to his or her peers. There is no room for intervention.. In DA, on the other hand, the objective is to change the individual's functioning within the test context and to consider the observed changes as indicators of future changes that may be expected if proper teaching is given. There is an essential change in the role of the examiner. In DA, the examiner intervenes to change the examinee's functioning and raise performance. It is an interactive process in which the examiner uses teaching strategies to enhance the child's performance within the test situation.

3 Shift from End Product to Process Orientation

In standardized testing, the focus is on the end product of the mental act: the final answer. In DA, in contrast, the focus is on cognitive processes that bring about changes in specific deficient cognitive functions that affect the child's performance and in non-intellective factors that affect functioning. The emphasis is on process components such as the nature of cognitive behavior, the learning process and strategies, and the specific interventions required to change them.

4 Interpretation of Results

While in standardized testing interpretation of results is based mainly on quantitative aspects, in DA it is based mainly on qualitative aspects of the child's performance, on analysis of the deficient cognitive functions and on the mediational efforts required to modify them.

The Theory of Mediated Constructivism

The theory of mediated constructivism (Jensen 2003) stresses the need to mediate the development of students' knowledge construction tools or functions, in conjunction with students acquisition of content knowledge and behavioral skill. There are three parts to this theory :

- 1) the knowledge construction functions
- 2) how they are developed and
- 3) how they become integrated and used with growing efficiency within bodies of knowledge or knowledge structures (Jensen, 2000)

Jensen's theory of mediated constructivism relates three categories of functions to the development of the ability to assemble and use knowledge. The three categories are Intellectual Functions, Non-Intellectual Functions and Performance Functions. Each function is important because it enables behavior to take on significance not as an isolated

act but as a *functional outcome* of the larger, dynamic structure of mind that converts sensory stimulation into information and information again into knowledge. With mediation, each learner can learn to apply each function with increasing awareness and skill.

The mediator must have

“ (1) the ability to instigate the learner’s awareness of the function, (2) the ability to create meaningful contexts in support of the learner’s experience of the function and (3) the ability to bring the function under the learner’s volitional control. For example, a mediator can select stimuli, frame them and imbue them with meaning to create a comparison between two or more objects, evoke an experience from memory or search for a logical explanation for a series of events. The meaning of comparing, evoking from memory or inferring a logical explanation can be established using school-type tasks and everyday life experiences. The mediator can use a large variety of means such as modeling, focusing, anticipation, scaffolding, fading. Error recognition and reflection to help a learner gain volitional control over the mental act of comparing, evoking from memory or inferring a logical explanation. Such control includes not only the aspect of how each function is used but also an understanding of when and where it can be applied and why it makes a difference.” (Jensen 2000; P 191)

The theory of mediated constructivism takes the view that the human brain constructs experience and regulates behavior using systems of symbols rendered meaningful by culture (Jensen 1992) whereas instruction or teaching presents information to learners. The theory argues that *mediated learning experience* (MLE) fosters the development of the knowledge construction functions which enable people to process information, benefit from experience, learn how to learn, and learn how to modify their own learning skills. Mediated constructivism stresses the need for five qualities of the mediated learning experience (as initially formulated by Feuerstein) to foster the development of knowledge construction functions : Intentionality-Reciprocity, Transcendence, Mediation of Meaning, Mediated Regulation of Behavior and Mediation of Feelings of Competence.

The MindLadder Dynamic Assessment Model

The Mindladder dynamic assessment model (Jensen 2003) is firmly based within the field of dynamic approaches to assessment. It forms also an integral part of a classroom-based model of learning. It is designed for measuring educational outcomes where standardized achievement tests, portfolios, and authentic forms of assessment all have their place. It addresses the priority to enhance thinking and learning skills among all students, and particularly students with special needs. The model provides a set of programs and services that enables educators, parents and administrators to work as a collaborating team with specific, high-quality data to identify students’ learning needs, provide trial teaching or intervention and assess progress.

The Mindladder model is based on the following philosophy to be implemented across primary and secondary school settings.

- 1) Knowledge, skills and learning ability are constructed in the mind of the learner rather than transmitted or inherited.
- 2) Properly directed effort develops ability and
- 3) Educational investment can be made to help all students strengthen their literacy, content achievement, and problem solving ability.

The MindLadder model focuses on curricular goals and standards by securing a learning-centered course of action to enable students to acquire academic content, develop knowledge construction processes and overcome sources of learning difficulty. **Knowledge Construction Functions** form the organization and control mechanisms that are used by the mind in learning and performance. They form the operating system of the mind. (Jensen 2000). Knowledge construction functions are used, for example to regulate attention, orient in space and time, explore systematically, regulate effort, compare sources of information, access and search memory, think hypothetically, establish relationships, infer conclusions and establish rules. The development of knowledge construction functions involves careful attention to the development of cognitive processes.

There are five programs in the MindLadder model that enable educators to accomplish these goals. Each program can be used by itself and yet they support one another. Schools implement the programs in the order and to the extent that match their needs.

The Teacher as Mediator program (TAM)

The MindLadder Learning Guide (MLG)

The MindLadder Dynamic Assessment program (MLDA)

The Parent as Mediator program (PAM)

Leadership and School Development program

This paper will summarize only the Teacher as Mediator program. The MindLadder Learning Guide and the Dynamic Assessment program as detailed out in the paper by Jensen. (2003). (Helping Students Up the Mind's Ladder).

The Teacher as Mediator program (TAM) (pages 2-3)

Using TAM, teachers learn how to map academic standards and curricular objectives by identifying their underlying knowledge construction functions. They learn how to introduce the functions in their classroom via teacher-student dialogues and how to develop the functions both within and across academic content and skill areas. Teachers learn how to approach curricular achievement and the development of knowledge construction functions as two mutually reinforcing parts of one process. The program forefronts subject area contents and cognitive processes much like the two legs of a pair of scissors: both need to be present – and the better one is the better the other can be. Teachers learn to use the curriculum to mediate the development of knowledge construction functions via active student involvement in classroom learning activities. They learn how to facilitate students' transition from lower to higher levels of efficiency through experiences with real and meaningful problems and to engage students in more challenging academic content as their knowledge construction functions come into place.

MindLadder teachers approach the classroom as a community of diverse learners and provide an emotionally safe yet challenging learning environment for whole group instruction, individual work, teams, pairs and shared interest groups. The MindLadder classroom-learning model can be implemented with any coherent and updated content curriculum, any particular set of high academic standards and any particular set of outcome measurement devices. In addition to standardized achievement tests, the set of outcome measurements can include a mix of pre-post testing, portfolios tied to reflective self-evaluation, preparation of real products and other forms of authentic performance assessments. Teachers are aided in the achievement of academic goals and the development of students' learning ability by each of the additional MindLadder programs. While each program can be implemented individually all are designed to support one another.

The MindLadder Learning Guide (MLG)

This is an inventory that helps to meet the need to anticipate and recognize students' learning needs. The inventory carefully solicits information about a wide array of knowledge construction functions that have been shown in research to contribute to students' ability to acquire academic content and learn how to learn. The functions include, among many others, attention, spatial orientation, temporal orientation, systematic exploratory behavior, mental representation, memory, comparing, classification, sequencing, inferential thinking, attention to feedback and autonomy and self regulation. These cognitive processes are identified as 'functions' because their use by a student takes on significance not as isolated acts but as the functional outcomes within the larger dynamic structure of mind where they enable the conversion of sensory stimulation into information and information into knowledge that a student can apply with increasing awareness, efficiency and skill.

MindLadder LearningGuides are created from information that is collected from those who have had the best opportunity to observe and interact with a learner. Usually this means teachers and parents. The information is analysed on a secure, Internet-accessible server that enables educators to map the process learning needs for individual students or for groups of learners. This information is embedded within a rich and practical advisor function that gives classroom teachers access to the kinds of lesson plans, assistance and resources they need to develop the knowledge construction functions within the classroom learning environment using the teacher-as-Mediator program. The MindLadder LearningGuide is a planning and evaluation tool that closes the gap between tests that tell teachers and administrators where their students are and standards that tell them where they need to be.

The MindLadder Dynamic Assessment program (MLDA)

The Mindladder model uses a dynamic, interactive assessment system that is designed especially to address the learning needs of students who experience difficulties in the classroom. Rather than a test yielding a score for classification purposes, the system is a powerful assessment, teaching and learning tool that yields detailed information about learning processes and how they can best be developed. Use of the system is typically initiated by the teacher but it can also be parent and student initiated. The MLDA is not a high-stakes test. School psychologists, regular and special education teachers, resource teachers and speech-language pathologists can all learn how to use the assessment system to assist them in their individual areas of responsibility and expertise.

MLDA enables the educator to present a large variety of problem-solving tasks using different modalities of verbal, numerical, figural, pictorial, symbolic and logico-mathematical information. The tasks can be used to determine the specific knowledge construction functions in need of development. Importantly, they also provide the vehicles for the mediation of learning experiences and for trial teaching to explore and document how a student's difficulties can best be overcome. Based on a response-to-intervention approach the MLDA system can be used to provide intensive individualized services to students who are responding adequately to high quality interventions in the classroom. By the same token it can be used also as an early intervention tool for students at risk for learning failure.

Use of the assessment system over time allows for accurate, timely and efficient progress monitoring and informed decision-making relative to clearly differentiated instructional goals. MLDA provides a gateway to better learning outcomes. It is based on a problem-solving approach, mediation of learning experiences to develop thinking and learning skills and the measurement of student performance in response to effective instruction. The information obtained in the MLDA program can be applied directly within the classroom-learning environment.

Research Briefs

Study I

DA and Cognitive Mediation for Hearing Impaired Children .

Two boys are involved in this study which will be elaborated in the workshop.

Boy A

He is a 12 year old currently studying in EM3 in the mainstream school. According to his health book , he is diagnosed to have Global Developmental Delay (GDD). He has been under ISS programme since Nov 2005 and is currently receiving help to improve his thinking and problem solving skills.

Boy B

He is a 10 year old currently in the mainstream school. He has been assessed by MOE psychologist and diagnosed to be a dyslexic. He has been under the ISS programme since Oct 2005. He is currently receiving help for his phonics instructions.

Both boys' academic results have been their school's concern. They will be exposed to various dynamic assessment instruments after which their process skills will be analysed and explained to them so that they are aware of the existence of their knowledge construction functions. They are guided to use these skills in subsequent problem solving contexts.

It is hoped that through the use of MLE and DA these boys will acquire the process skills of cognitive functioning so as to make meaning in their learning journey and subsequently give them the confidence and self esteem in their work and life.

Study II

DA and Mediation based on Construction Functions on Pr 5 pupils' math problem solving

In this study the following questions are asked:

- What are the knowledge construction functions in math problem solving at P5?
- What are the common cognitive deficiencies in P5 math problem solving?
- What are the common MLE strategies used?
- Is there an effect on Math Achievement in general?

The above studies have been endorsed and supported by

Dr. Mogens Jensen

Director

International Center for Mediated Learning (ICML)

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