Towards an Effective Dynamic Model of Assessment and Learning:
A New Pedagogical Idea for the Classroom Teacher.

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ABSTRACT
Dynamic assessment is an interactive approach to conducting assessment focusing on the ability of the learner to respond to his own learning. It is a new idea whose development has come from Vygotsky and Feuerstein; to Vygotsky for the need to assess both the zones of actual and proximal development and to Feuerstein for creating procedures attempting to do just that. Today, drawing on advances in neuroscience research, dynamic models of assessment and learning aim to place additional tools in the hands of educators to enable them to identify and develop the cognitive processes children need to achieve high academic standards while learning how to learn. Dynamic assessment explores how each mind works and how each individual can learn to assemble and to use knowledge better.

This paper describes the conceptual foundations and findings of an ongoing research effort specifically referred to as the MindLadder cognitive program which is developed to better understand (a) the process of knowledge construction in the primary school child and (b) how teachers can best infuse advances in this area into the classroom environment. Based on mediated learning theory and constructivism, this research program can support the achievement of students with general and special learning needs from diverse cultural and linguistic backgrounds.

Classroom teachers and school psychologists are very familiar with two types of testing practised in the schools today - psychological tests which are given to determine the eligibility of students for a variety of learning settings and achievement tests which are given to determine student learning outcomes. Both of these tests try to meet and to improve student needs. The dynamic model of assessment and learning however represent a distinct type of assessment procedure which provides information very different from either of the current prevailing types. This dynamic model of assessment according to Jensen (2000) intends to play a key role as an integral part of a range of deliberate efforts to help students learn how to assemble and use knowledge.

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, in press). As far back as in the seventies, DA and intervention were already used by Vygotsky (1978) and Feuerstein et al. (1979) 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 (2002) 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 et al., 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.

Feuerstein, Rand and Hoffman (1979) 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.
Different models of DA

DA procedures vary on a number of dimensions, but primarily with regard to degree of standardization of interventions, as well as regarding content. There are four basic models that fit most of the procedures:

1. An open ended clinical approach that follows the learner, using generic problem solving tasks such as matrices. The approach to intervention focuses on principles and strategies of problem solution and aims to promote independent problem solving. (e.g. Feuerstein et al., 1980)

2. Use of generic, problem solving tasks, but offering a standardized intervention. All learners are provided with the same intervention involving principles and strategies for problem solution. These approaches tend to focus on classification of learners, attempting to reduce the negative results of cultural bias. (e.g. Budoff, 1987)

3. A graduated prompting procedure where learners are offered increasingly more explicit hints in response to incorrect responses. All learners progress through the same menu of prompts or hints, varying with regard to the number of prompts required for task solution. (e.g. Campione, Brown and Ferrara, 1982).

4. Curriculum-based approaches that use actual content from the learner’s educational program, with interventions based on ‘best practices’ of teaching. These can vary regarding degree of standardization of interventions. (e.g. Lidz, in press)

Recent literature on dynamic assessment have included a few more different approaches and methods. (Lidz and Elliott, 2000). Psychologists and teachers today are provided with sufficient information to carry on more practice and research. Two major underpinning influences are present: the constructivist theories of Vygotsky and the structural cognitive modifiability theory of Feuerstein. The tasks used in most of the above DA procedures have in common, the dynamic examination of elements of logical reasoning (e.g. analogies, syllogisms, inferential thinking). Most use nonverbal materials and structured or semi structured prompts embedded within the dynamic intervention section of the task. Their findings do not easily translate to what the teacher can use in the classroom. For example, the Feuerstein approach is highly clinical and one of the challenges in DA is to develop tasks that can be easily bridged into the classroom curricula.

The MindLadder Dynamic Assessment Model

The Mindladder assessment model (Jensen, 2003) is firmly 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.

* Knowledge, skills and learning ability are constructed in the mind of the learner rather than transmitted or inherited.
* Properly directed effort develops ability and
* 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 the Teacher as Mediator (TAM) program, the MindLadder Learning Guide (MLG) and the MindLadder Dynamic Assessment (MLDA) program as detailed out in the paper ‘Helping Students Up the Mind’s Ladder’ by Jensen. (2003).

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

This is a summary of a larger study as reported in the Jensen paper- (Jensen 2003 pp 11-13).

A comprehensive research program has been initiated at ICML (International Center for Mediated
Learning) to determine the treatment validity and utility of the theory of mediated constructivism and
the applied MindLadder programs across learner and setting variables. The principal findings of the
large and carefully controlled empirical investigation are briefly described here.

The investigation draw on a sample of 347 fourth, fifth and sixth grade students attending school in
regular education classes in a mixed suburban/rural school district north of Atlanta, Georgia. The
district serves predominantly Caucasian communities with significant pockets of poverty. Two experimental (‘MindLadder’) and two matched control schools participated in the study. Every effort was made to randomize the selection of schools and teachers but the study was, nonetheless treated as a quasi-experimental study. As a result efforts were made to protect the study against both internal and external threats to the validity of its findings. These protections included, among others the use of analysis of covariance to control for pre-existing differences. In the study 10 experimental teachers (5 in each of two elementary schools) received training and coaching in the identification and development of students’ knowledge construction functions while ten control teachers (5 in each of two matched elementary schools) served as the contrast group.

Systematic effects on student achievement were assessed via the Iowa Test of Basic Skills. (ITBS 1996). Systematic effects on students’ reasoning were assessed via the Cognitive Abilities Test (Thorndike and Hagen, 1993). ITBS normal curve equivalent (NCE) scores at the end of the study were subjected to analysis of covariance with covariates of age, gender, and students’ ITBS score in the respective area before the onset of the study. MindLadder students outperformed controls in Reading, F(1,339)=21.27, p<.0001, Language, F (1,334)= 11.81, p<.001, Math, F(1,338)=7.38, p<.007, Social Studies, F (1,335)= 6.23 , p<.01, Sources, F (1,331)=3.98, p<.05 and the ITBS Composite, F(1,327)=24.55, p<.0001, R squared = 0.69. The composite NCE score is derived by combining the standard scores from each of the six subject areas. A difference favoring the experimental students in Science did not reach statistical significance (p<.20).

On the CogAT, similar analyses of covariance indicated a significant difference favoring MindLadder students on the Composite Universal Scale Score, F(1,237) = 12.61, p<.0005, R squared = 0.52. The overall difference was principally due to differences in Verbal Reasoning Ability, F (1,238) = 11.66, p<.0007, and Nonverbal Reasoning Ability, F(1,240) = 10.42, p<.0001. The difference in Quantitative Reasoning Ability, while favoring the MindLadder students, did not reach significance, F(1,238) = 2.64, p<.11, NS.

Additional evidence of the systematic effects of the study was obtained by analyzing the Composite ITBS NCE score for main effects (1) between experimental and control groups and (2) between students who qualified for participation in special programs (qualifying students) versus those who did not (non-qualifying students). Qualification was based on students’ pre-existing record of testing and classification by the school system. Speech and gifted classifications were not included as qualifications. The experimental and control samples included, respectively, 39 and 26 students eligible for participation in the following types of special programs: Learning Disabilities, Remedial Reading or Math.

As before, the statistical analysis was controlled for age, gender and for student achievement prior to the onset of the study. The interaction effect was significant, F (1,328) = 5.15, p<.03. Non-qualifying students did significantly better than did qualifying students in each experimental condition but qualifying students in the MindLadder classrooms did much better than did qualifying students in the control classrooms. At the end of the study qualifying MindLadder students did not differ in overall academic achievement from non-qualifying control students.

The data from the available empirical research indicate that the development of knowledge construction functions may be of considerable importance in helping schools to find ways to secure better outcomes for their students. Replications and extensions of the existing findings across both setting and student variables are necessary but the available results suggest that the MindLadder model can be an effective way to address students’ academic achievement and cognitive learning needs. Building on these results, scientists at ICML have developed new and more powerful tools to place reliable information about students’ cognitive education needs into the hands of teachers along with field-tested resources to develop them. In this context, the development of the MindLadder LearningGuide as a secure and easy-to-use Internet-accessible resource enables school to scale their implementation of this solution in an easy and affordable manner. (Jensen, 2003. pp 11-13)
Implementing the MindLadder model in a Singapore primary school.
Training in the Dynamic Assessment Pilot Program

MindLadder is a learning model that teachers can use on an ongoing basis for all students. The programs enable teachers to incorporate the development of students’ knowledge construction functions into their work. The process of learning how to do this requires teamwork, training and ongoing coaching as well as planning and support from the school principals. The dynamic assessment instruments (as in the MindLadder Dynamic Assessment program MLDA) are best seen as tools or resources that are available to the teacher. They are not tests. While they are used systematically there is no requirement to ‘get through’ them all. While dynamic assessment can be used in conjunction with psychological testing or with evaluation for placement in special classes, it does not yield a global score or an index that can be used to classify students. MLDA is a resource to help teachers and students to be successful in the classroom and to help parents and children to be successful in the home. Teachers can use it whenever they aim for a better understanding of how to help students learn how to learn and achieve academic standards. In this the dynamic assessment informs the classroom learning and home environments. (Jensen 2003).

The main objective of the pilot study is to investigate if the model can be an effective way to address students’ academic achievement and cognitive learning needs. Specifically, the study investigates the possibility that teacher-guided development of students’ knowledge construction functions is associated with improved academic achievement and reasoning. The MindLadder classroom learning program is to be specifically developed by five teachers who have received coaching in the MLDA program. The classroom program is constructed around two fundamental design principles.

1) The program must provide the classroom teacher with the freedom and opportunity to mediate the development of students’ knowledge construction functions.
2) The program must integrate students’ development of knowledge construction functions with the acquisition of curricular objectives and academic standards.

The overall goal is to enable students to achieve high academic standards while learning how to assemble and use knowledge. The five teachers have received training and coaching in the development of students’ knowledge construction functions. However more assistance and support are needed in the following areas:

Planning for mediated instruction
Organizing and managing classroom for active learning
Adapting instructional resources and materials
Integrating the content areas
Introducing and Mediating knowledge construction functions
Incorporating a collaborative approach and
Developing real world projects and activities

Initially only one subject area, mathematics in the primary level will be chosen but gradually additional subjects can be added as the teachers gain confidence. Training and coaching are still in progress. Three sets of skills have been designed to enable teachers to develop students’ knowledge construction functions in primary mathematics.

1. Learning to identify the knowledge construction functions that underpin primary mathematics.
2. Learning to introduce the specific knowledge construction functions in the classroom and
3. Learning to create a classroom environment around learning events within mathematics

Throughout the pilot study the five teachers were encouraged to use a team format to discuss issues, get fresh ideas, troubleshoot problems and to access the MindLadder coach and trainer as needed. The pilot study will run for six months after which a more comprehensive research program will be drawn to test the ability of the MindLadder classroom learning model to improve students’ mathematics achievement and learning in the upper primary classes.
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