

Mediated Learning Experience (MLE) and Cognitive Modifiability: Theoretical Aspects and Research Applications¹

DAVID TZURIEL²

Abstract

Feuerstein's concept of Mediated Learning Experience is defined as a unique mode of interaction between the mediator (e.g., parent, teacher or peer) and the learner. It starts from a very early age in the spontaneous interactions between parents and their children, or grandparents with grandchildren and continues later with peers and in more structured interactions with teachers. In the current paper the focus is developmental aspects of MLE processes carried out informally within the family system and in peers interactions and their effects on children's cognitive modifiability. The objectives of this paper are: (a) to present the theory of MLE as a proximal factor of cognitive modifiability (b) and to demonstrate empirical validation for the role of MLE strategies in enhancing children's cognitive modifiability. The first section provides some definitions of the main concepts and a brief description of the MLE theory. The second and main section discusses selected research findings demonstrating the impact of MLE strategies in facilitating cognitive modifiability. In the third section some conclusions will be discussed, followed by suggestions for future research.

Keywords

Feuerstein, Structural Cognitive Modifiability theory, Mediated learning experience theory, review, peer mediation, cognitive development

1. This paper is based on an earlier paper: Tzuriel, D. (2013). Mediated learning experience strategies and cognitive modifiability. *Journal of Cognitive Education and Psychology*, 13, 59-80. Some modifications are made to reflect recent research on the same issues and some changes in organization of the sections of the paper. I thank the JCEP for their permission to use parts of my paper for the current paper. Above all I want to thank H. Carl Haywood and Robert Sternberg for their help in editing the earlier version of the paper published in JCEP.

2. professor of psychology at Bar Ilan University, Ramat Gan, Israel. David.Tzuriel@biu.ac.il

Introduction

Mediated learning experience (MLE, Feuerstein, Rand & Hoffman, 1979) is an interactive unique mode of interaction between the mediator (e.g., parent, teacher or peer) and the learner. It starts from a very early age in the spontaneous interactions between parents and their children, or grandparents with grandchildren and continues later with peers and in more structured interactions with teachers. In the current paper the focus is developmental aspects of MLE processes carried out informally within the family system and in peers interactions (e.g., Feuerstein, et al., 1979; Feuerstein, Feuerstein, Falik, & Rand, 2002) and their effects on children's *cognitive modifiability*.

A growing body of theory and research in the last three decades supports the crucial role of active parental and peer mediation in enhancing children's cognitive development (Belsky, Goode, & Most, 1980; Berk & Spuhl, 1995; Bornstein & Tamis-LeMonda, 1990; Bradley & Caldwell, 1984; Clarke-Stewart, 1993; Cristofaro, & Tamis-LeMonda, 2012; Klein, 1996; Laosa, 1982; Ramey, Farran & Campbell, 1979; Parker, Boak, Griffin, Ripple, & Peay, 1999; Rodriguez, et al., 2009; Tamis-LeMonda, Bornstein, & Baumwell, 2001; Tzurriel, 1996, 1999, 2001; Vygotsky, 1978; Wachs, 1992). The literature is replete with specific interaction strategies that enhance children's thinking skills and cognitive processes. Researchers suggested a variety of parents' behaviors such as *distancing* (e.g., Siegel, 1982), *scaffolding* (e.g., Wood, 1989; Wood, Bruner, & Ross, 1976), *responsiveness* (e.g., Bornstein, Azuma, Tamis-LeMonda, & Ogino, 1990; Bornstein & Tamis-LeMonda, 1990; Vibbert & Bornstein, 1989), and *mediated learning experience* (Feuerstein, et al., 2002; Klein, 1988, 1996; Tzurriel, 1999, 2001, 2011a, 2011b). The effects of these strategies on children's cognitive development are expressed along a continuum of concepts from specific behaviors (e.g., gazing) to general thinking skills (e.g., reasoning, metacognitive competence, cognitive plasticity, cognitive modifiability).

The objectives of this paper are: (a) to present the theory of MLE as a proximal factor of cognitive modifiability (Feuerstein et al., 1979), (b) and to demonstrate empirical validation for the role of MLE strategies in enhancing children's cognitive modifiability. In the first section of this paper I will provide some definitions of the main concepts and describe briefly the MLE theory. In the second and main section I will discuss selected research findings demonstrating the impact of MLE strategies in facilitating cognitive modifia-

bility. In the third section some conclusions will be discussed, followed by suggestions for future research.

Theoretical Foundations of MLE

Definitions of MLE and Cognitive Modifiability

MLE processes describe a special quality of interaction between a mediator and a learner (Feuerstein, et al., 1979; Tzuriel, 1999, 2002, 2011a). In this qualitative interactional process, parents or substitute adults or peers interpose themselves between a set of stimuli and the developing human organism (learner) and modify the stimuli for him/her. MLE processes are considered as the proximal factor that explains cognitive modifiability. *Cognitive modifiability* is defined as the individual's propensity to learn from new experiences and learning opportunities and to change one's own cognitive structures. Feuerstein's MLE theory is in some aspects similar to Vygotsky's (1978) concepts of the *zone of proximal development* and *internalization* and the concept of *scaffolding* (Wood, Bruner, & Ross, 1976), which have captured the interest of many developmental psychologists and educators (e.g., Rogoff, 1990; Valsiner, 1987; Wertsch, 1985).

The MLE Theory

A basic assumption of MLE theory is that individuals learn by way of two main modalities: *direct exposure* to stimuli and *mediated learning experience* (see model in Figure 1).

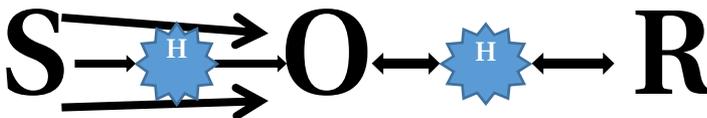


Figure 1. The Mediated Learning Experience (MLE) Model (Copied by permission from Reuven Feuerstein, The International Center for Enhancement of Learning Potential).

Direct exposure is characterized by unmediated encounters of individuals with stimuli in the environment. In Figure 1 the top and bottom arrows from the Stimuli (S) to the Organism (O, learner) represent the direct exposure. In MLE interaction, on the other hand, learning is carried out by means of an experienced adult, usually the parent, who interposes him/herself between the child and the world of stimuli. This is represented by arrows directed from the S to the H (Human) and from the H to the O. The mediator (H) modifies the stimulus in various ways and presents it to the child (O) so that it can be registered efficiently. The mediator presents stimuli to the children by modifying their frequency, order, intensity, and context, by arousing in the children curiosity, vigilance, and perceptual acuity, and by trying to improve and/or create in the child the cognitive functions required for temporal, spatial, and cause-effect relationships.

Parents mediate to their children not only the external stimuli but also their own responses to the stimuli. This is represented by the arrows from the child (O) and his/her own response (R). Mediational processes are complex, circular, and depend not only on parental characteristics but also on children's cognitive strengths and deficits, motivational orientation, emotional needs, behavioral tendencies, stimulus characteristics, and situational conditions. It should be emphasized that the H is elastic; it expands (i.e., mediation is enhanced) or shrinks (i.e., withdrawal of mediation) as a function of the child's level of understanding, task difficulty, and situational conditions that determine effectiveness of learning.

The MLE processes are gradually internalized by the child and become an integrated mechanism of change within the child. Adequate MLE interactions facilitate the development of various cognitive functions, learning sets, mental operations, strategies, and need systems. The internalized MLE processes allow developing children later on to use them independently, to benefit from learning experiences in diverse contexts, and to modify their cognitive system by means of self-mediation. The more the child experiences MLE interactions, the more he/she is able to learn from direct exposure to formal and informal learning situations, regardless of the richness of stimuli they provide.

Lack of MLE may be derived from two broad categories: (a) lack of environmental opportunities for mediation, and (b) inability of the child to benefit from mediational interactions, which are potentially available. In the first case lack of mediation derives from parents' low educational level, traumatic

life events, lack of parents' awareness to the importance of mediation, and lack of knowledge and/or sophistication in applying MLE strategies. In the second case, children might suffer from physical and/or intellectual disabilities that act as barriers to register mediation offered to them.

Feuerstein conceived MLE interactions as a *proximal* factor that explains individual differences in learning and cognitive modifiability. Factors such as organic deficit, poverty, socioeconomic status, and emotional disturbance are considered to be distal factors, that is, factors that might correlate with learning ability, but which affect the child through the proximal factor of MLE. Feuerstein and Feuerstein (1991) suggest 12 criteria of MLE, but only the first three are conceived as necessary and sufficient for an interaction to be classified as MLE: *Intentionality and Reciprocity*, *Meaning*, and *Transcendence* (see description below). These three criteria, which are responsible for the individual's cognitive modifiability, are also considered to be universal and can be found in all races, cultures, ethnic groups, and socioeconomic strata. Mediation does not depend on the language modality or content and can be carried out by gestures, mimicry, and verbal interaction, provided that the three major criteria are present. The other nine criteria are task-dependent, strongly related to culture, and reflect variations in cognitive styles, motivation, type or content of skills mastered, and the structure of knowledge.

The first five MLE criteria were operationalized and observed in interactions of mother-child (e.g., Klein, Weider & Greenspan, 1987; Klein, 1988, 1991, 1996; Lidz, 1991; Tzuriel, 1999, 2001, 2011a, 2013), peer-assisted learning (e.g., Tzuriel & Shamir, 2007, 2010), siblings (Klein, Zarur & Feldman, 2002; Tzuriel & Hanuka-Levy, in press; Tzuriel & Rokach, 2010), and teacher-student instruction (e.g., Tzuriel & Gross, 1992; Tzuriel, Kaniel, Zeliger, Friedman, & Haywood, 1998; Remer & Tzuriel, 2011).

The first five MLE criteria that were operationalized for research are as follows:

- (a) *Intentionality and Reciprocity* refers to a mediator's deliberate efforts to change a child's attention, awareness, perception, processing, or reaction. Mediation for Intentionality alone is inadequate without the child's reciprocity. Reciprocity is defined when the child responds vocally, verbally, or nonverbally to the mediator's behavior. For instance, Intentionality and Reciprocity are observed when a caregiver intentionally offers a toy to a child or verbally focuses a child's attention on some aspect of the environment and the child undeniably responds. This criterion is considered crucial for the "ignition" of the mediation process and later on for development of feelings of competence and self-determination.
- (b) *Mediation of Meaning* refers to a mediator's response that conveys the affective, motivational, and value-oriented significance possessed by the presented stimuli. This can be expressed verbally by enlightening the present context, relating it to other events, and emphasizing its importance and value, or nonverbally by facial expression, tone of voice, repetitious actions and rituals. According to MLE theory, children who experience mediation of meaning will actively connect future meanings to new information rather than passively wait for meaning to appear.
- (c) *Mediation of Transcendence* refers to interactions in which the mediator provides both the immediate or concrete needs of the children and attempts to reach additional goals that are beyond the specific situation or activity. In mother-child interactions the mother may go beyond the specific experience by teaching strategies, rules, and principles in order to generalize to other situations. For instance, in a play situation, the mother may mediate the rules and principles that direct a game and generalize them to other situations. Mediation for Transcendence depends on the first two criteria, intentionality/reciprocity and meaning, though the combination of all three criteria enhances the development of cognitive modifiability and expands the individual's need system.
- (d) *Mediation of Feelings of Competence* is observed in interactions in which a mediator conveys to a child that he or she is capable of functioning both successfully and independently. The mediator may organize the surroundings in order to supply opportunities for success,

interpret them to the child, and reward attempts to master the situation or deal with problems efficiently.

- (e) *Mediation of Control of Behavior* refers to interactions in which a mediator regulates a child's reaction, depending on the child's reactive style and the task demands. The mediator may either reduce impulsivity or accelerate the child's behavior. Control of behavior can be mediated in various ways, such as arousing awareness to task characteristics and suitable responses, analyzing the task components, modeling of self-control, and providing metacognitive strategies.

An integrative component of the MLE approach is related to the conceptualization of the developing individual as an open system that is modified by mediating agents. This component has led to both theoretical elaboration of dynamic assessment (DA) of learning potential (Feuerstein et al., 2002; Tzuriel, 2001) and development of an applicative system of measuring cognitive modifiability (Embretson, 1992; Haywood & Tzuriel, 1992; Lidz & Elliott, 2000; Sternberg & Grigorenko, 2002; Tzuriel, 1997, 2001, 2012). The term DA refers to an assessment of thinking, perception, learning, and problem solving by an active teaching process aimed at modifying cognitive functioning.

MLE and Cognitive Modifiability: Scientific Research

Methodological Aspects

Observation of MLE Processes

Research on MLE processes and cognitive modifiability has been carried out using both observation techniques and a DA procedure. Usually the interaction has been videotaped and analyzed later by trained observers using the *Observation of Mediation Interaction* (OMI, Klein, et al., 1987). Klein (1988) has preferred to assess the quality of mother-child interaction by a *macroanalytic* rather than by a *microanalytic* approach. For example, when a parent focuses the child's attention on some aspects of a stimulus (handing an object to a child), it has been coded as behavior reflecting *focusing* only if it was reciprocated by the child's response. Whenever the parent made an attempt

to generalize a rule, suggest a concept, or a principle that goes beyond the concreteness of the situation, it is coded as *expanding*, regardless of the specific content being conveyed. The basis of Klein's observation system is an interaction "event" that might contain one or more MLE criteria.

An advantage of the MLE molar observational approach is its allowance of the identification of meaningful patterns of continuity in parents' behavior across a developmental dimension. The qualitative characteristics of the MLE observation approach allow comparison of similarities in behavioral patterns across generations and coincide with other patterns such as emphasis on holism and the need to look at the meaning of behavior within a psychological context rather than as isolated events (Santostefano, 1978; Sroufe, 1995; Sroufe & Waters, 1977). One of the basic assumptions behind the OMI is that observation of MLE processes in a semi-natural experimental context reflects the spontaneous MLE processes at home. This assumption has been supported in several studies (e.g., Klein, 1988; Klein & Aloni, 1993).

In Tzurriel's studies dyads of mothers with their children (or peers or siblings) were videotaped during free-play and/or structured situations and analyzed later by the OMI. Each dyad was videotaped in a semi-natural context of an adjunct room of the kindergarten, or in the child's home; both places were familiar to children and their mothers. In the free-play condition, which took 15 minutes, sets of games and play materials were placed on the table. The only instruction to the mother was: "you can play in whatever you want with your child in the next 15 minutes, try to do what you are used to doing at home." In the structured situation, the dyad was given one or two problem-solving tasks which mother had to teach her child. The tasks were composed of teaching analogies, picture arrangement, and/or inferences; all tasks were not related to the tasks used in the DA procedure. It should be emphasized that while the tasks were explained to the mothers no directions were given as to how to teach the child. The OMI was found as strongly reliable as measured by inter-rater reliability and as a robustly valid in many studies (Klein, 1996; Tzurriel 1999, 2013). A summary of inter-rater reliability coefficients compiled from 12 samples is presented in Table 1. As can be seen in Table 1 the inter-rater reliability coefficients across the samples are high and significant.

Table 1.
Reliability Coefficient of MLE Strategies in Different Studies

| MLE Criteria | Tzuriel & Ernst (1990) | Tzuriel & Weiss (1998) | Tzuriel (1998) | Tzuriel & Weitz (1998) | Tzuriel & Hanuka-Levy (2014) | M-C Siblings | Tzuriel & Isman & Weitz (2007) | Tzuriel & Shomron (2008) | Tzuriel & Rokach (2009) | Tzuriel & Caspi (2010) | M-C Peers | |
|------------------------------|------------------------|------------------------|----------------|------------------------|------------------------------|--------------|--------------------------------|--------------------------|-------------------------|------------------------|-----------|--------|
| Intentionality & Reciprocity | .54 | .42 | .75** | .95*** | .82** | .77** | .95*** | .87*** | .91*** | .97*** | .79** | .90*** |
| Meaning | .85** | .73* | .78** | .86** | .88*** | .91*** | .86** | .89*** | .90*** | .99*** | .87** | .98*** |
| Transcendence | .80** | .83** | .98*** | .86** | .86** | .94*** | .86** | .96*** | .95*** | .96*** | .86** | .77** |
| Feelings of Competence | .87** | .94*** | .80** | .86** | .89*** | .97*** | .95*** | .94*** | .93*** | .97*** | .86** | .76** |
| Regulation of Behavior | .55 | .85** | .81** | .95*** | .90** | .94*** | .85** | .91*** | .92*** | .95*** | .90** | .74** |
| MLE – Total | .93*** | .93*** | .94*** | .85** | .86** | .90*** | .89*** | .92*** | .92*** | .97*** | .86*** | .82** |

M-C-Mother-Child

* $p < .05$ ** $p < .01$ *** $p < .001$

Measuring Cognitive Modifiability

Cognitive modifiability was measured in most studies by DA which allows recording of change criteria. The conceptualization behind using change criteria as predicted outcome of MLE interaction is that interactions by which the child is mediated how to process information efficiently are more closely related to measures of modifiability, than they are to standardized static measures of intelligence. The mediational strategies used within the DA procedure have more “matching value” to learning processes in other life contexts than do conventional static methods and therefore give better indications about future changes of cognitive structures. Accumulating evidence from educational research provides indications that a score reflecting individual differences in “modifiability” added substantially to the predictive power of learning (Embretson, 1992) and future academic success (Haywood & Lidz, 2007; Sternberg & Grigorenko, 2002; Tzuriel, 2000a, 2000b; Tzuriel, Kaniel, Kanner, & Haywood, 1999).

Use of Structural Equation Modeling (SEM) to Validate the MLE Theory

A comprehensive venue for data analysis used in many studies is the *structural equation modeling (SEM)* analysis. The use of SEM for the validation of MLE theory seems to be a promising approach since we can design complex models and infer causal relations among variables without having to use experimental designs. Also the nature of the variables involved in testing the theory are not always given to experimental manipulations, and the accumulated effects that several variables have on outcome variables are not easily given to manipulate simultaneously. The holistic approach used in SEM contributes to understanding of the conceptual whole more than the sum of fragmentary separate analyses. The SEM analysis is considered in the literature to support causal inferences (Joreskog & Sorbom, 1984) and was found as useful statistical tool in MLE strategies and cognitive modifiability research.

A summary of characteristics of studies relating MLE interactions to cognitive modifiability is presented Table 2. The studies in Table 2 are limited only to those in which MLE interactions were observed and analyzed using the OMI and cognitive modifiability was examined using DA measures for young children (i.e., K-Grade 3). In most studies the focus was on mother-child interactions whereas in other studies mediation was examined also with peers (Shamir & Tzuriel, 2004; Tzuriel & Caspi, 2010) and siblings (Tzuriel & Hanuka-Levy, 2014; Tzuriel & Rokach, 2010).

Table 2.
Studies on MLE Strategies and Cognitive Modifiability: Sample Characteristics, DA Measures, Analyses Used, and MLE Strategies

| Study | Grade | Age | n | Characteristics | Dyad | DA Tests | Analysis | MLE Strategies Explaining Cognitive Modifiability |
|-------------------------------------|-------|-------------------|-----|----------------------|----------------|-----------------------------------|----------------------|---|
| 1. Tzuriel & Eran (1990) | K | 5-6 | 47 | Typical | M-C | CITM | Regression | MLE Total |
| 2. Tzuriel & Ernst (1990) | K | 5-6 | 48 | Typical | M-C | CATM | SEM | Transcendence |
| 3. Tzuriel, Kaniel & Yehudai (1994) | K | 5-6 | | Ethiopian Immigrants | T-C | CATM | Regression | None |
| 4. Tzuriel (1996) | K | 5-6 | 48 | Typical | M-C | CATM | Regression | MLE-Total Feelings of Competence |
| 5. Tzuriel & Weiss (1998) | 2 | 7-8 | 54 | Typical | M-C | CITM | SEM | Transcendence Regulation of Behavior |
| 6. Tzuriel & Hatzir (2002) | K | 5-6 | 60 | Typical | M-C + F-C | CATM Complex Figure | Regression | Transcendence Intentionality and Reciprocity |
| 7. Tzuriel & Weitz (1998) | 3-4 | 5-8 | 56 | LBW+ NBW | M-C | CATM Complex Figure | Regression | Transcendence Regulation of Behavior |
| 8. Tzuriel & Weitz (2007) | 3-4 | 9-10 | 85 | LBW+ NBW | M-C | Analogies (CMB) Complex Figure | Regression | Transcendence |
| 9. Tzuriel & Shomron (2009) | 2-4 | 7-10 | 100 | LD | M-C | Analogies (CMB) | SEM | Transcendence |
| 10. Tzuriel & Bettan (2007) | K | 5-6 | 72 | ADHD | M-C | Analogies (CMB) | SEM | Transcendence |
| 11. Tzuriel & Rokach (2009) | 3-6 | 8-12 ^a | 90 | Typical | Siblings | Analogies (CMB) | SEM | Transcendence |
| 12. Tzuriel & Caspi (2010) | 3 | 8-9 ^a | 100 | Typical | M-C + Peers | Analogies (CMB) Seria-Think | MANOVA Regression | Transcendence |

^aAge of older sibling

Reading: LBW-Low Birth Weight, NBW-Normal Birth Weight; LD-Learning Disabled; ADHD-Attention Deficit Hyperactive Disorder

M-C-Mother-Child; F-C-Father-Child; T-C-Teacher-Child; CATM-Children's Analogical Thinking Modifiability; CITM-Children's Inferential Thinking Modifiability; CMB-Cognitive Modifiability Battery; SEM-Structural Equation Modeling

The most striking finding emerging from Table 2 is that in 9 out of 12 studies the strategy that has emerged as most powerful in predicting cognitive modifiability was *mediation for Transcendence* (expanding); a finding that will be discussed later.

In the following I will present (a) some studies demonstrating the relation between parent-child MLE interactions and cognitive modifiability among typically developing children and (c) among children with learning difficulties, (c) the effects of intervention for peer-mediation on cognitive modifiability, (c) sibling's MLE interaction and cognitive modifiability. Because of space limitation only example studies are presented.

Mother-Child MLE Interactions and Children's Cognitive Modifiability among Typically Developing Children

The main objectives of the studies reported below were (a) to validate the relationship between MLE processes and children's cognitive modifiability and especially the relative strength of distal and proximal factors (MLE) in predicting cognitive modifiability, (b) to find the specific combination of MLE strategies that best predicts cognitive modifiability.

A major finding repeated in almost all studies was that children's Post-teaching scores on DA measures were better predicted by MLE mother-child interactions than by static test scores (or Pre-teaching DA scores). In our first study, a sample of kibbutz mother-child dyads ($n=47$) was observed in a free-play situation for 20 minutes (Tzuriel & Eran, 1990). The kibbutz young children (22 boys and 25 girls, age range = 4:7 to 7:8 years) were then administered the *Raven Colored Progressive Matrices* (CPM, Raven, 1956) and the *Children's Inferential Thinking Modifiability* test (CITM, Tzuriel, 1992). Three scores are derived from the CITM: Pre-teaching, Post-teaching, and Gain. In a series of three stepwise regression analyses, the CPM and MLE-Total scores were assigned as predictors of the Pre-teaching, Post-teaching, and Gain scores, respectively. A schematic presentation of the findings are presented in Figure 2.

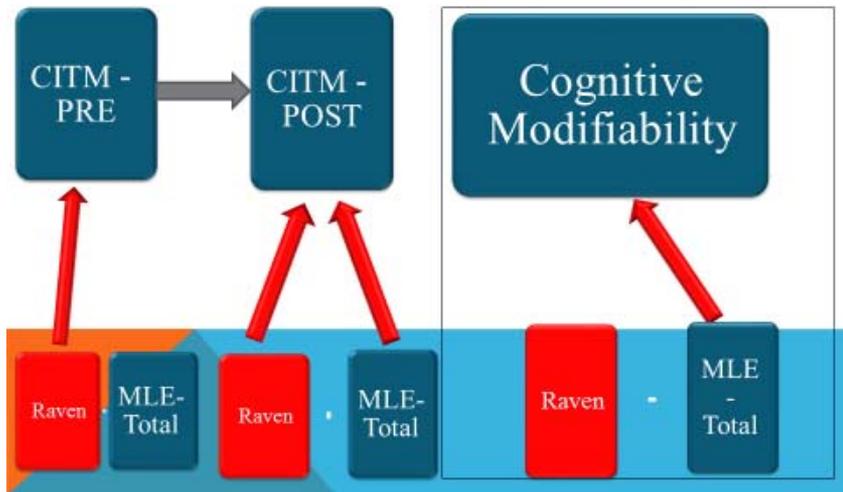


Figure 2. Schematic Description of the Prediction of CITM Pre- and Post-Teaching and of Cognitive Modifiability by MLE Strategies and Raven's Score

The findings revealed that the Pre-teaching (static) was predicted only by the CPM ($R = .40, p < .004$), the -Post-teaching was predicted by both MLE-Total and CPM ($R = .69, p < .002$), and the Gain was predicted only by MLE-Total score ($R = .43, p < .001$). The Pre-teaching score was predicted only by the CPM scores, as both tests are actually conventional static tests. This result verifies what is commonly known, that the common variance of two cognitive tests is higher than the common variance of a cognitive test with an observed behavior (i.e., MLE mother-child interactions). The Post-teaching score seems to be composed of two components: the previously acquired inferential skills as manifested in children's Pre-teaching performance and what has been learned as a result of mediation given by the examiner in the teaching phase of the DA procedure. It is plausible to assume that the first component (Post-teaching score) is attributed to the CPM score, and the second component (Post-teaching score) to the MLE-Total score. When the Gain

scores were taken as the criterion variable, only MLE-Total emerged as a significant predictive variable. This predictability pattern across the three regression analyses is quite intriguing as it shows that *the more the criterion score was saturated with teaching effects, within the testing DA procedure, the higher was the variance contributed by MLE mother-child processes.*

The SEM analysis approach was applied in a series of six studies (Bettan & Tzuriel, 2007; Tzuriel & Ernst, 1990; Tzuriel & Rokach, 2010; Tzuriel & Shomron, 2010; Tzuriel & Weiss, 1998; Weitz & Tzuriel, 2007). In the first study by Tzuriel and Ernst (1990), a sample of kindergarten children (n = 48) and their mothers were observed interacting in free-play and structured situations. The children were then tested by the *Children's' Analogical Thinking Modifiability* test (CATM, Tzuriel & Klein, 1985). In the second study by Tzuriel and Weiss (1998), a sample of mother-child dyads were observed interacting in free-play and structured situations. The children (Grade 2, n = 54) were then tested with the CITM test. Both the CATM and CITM are DA tests of learning potential. In both studies the SEM approach was applied to test a theoretical model of the effects of distal and proximal factors on cognitive modifiability. Figures 3 and 4 describe the findings of the SEM of Tzuriel and Ernst (1990) and of Tzuriel and Weiss (1998), respectively. The two studies are different in the set of distal variables used, the age of subjects, and the DA tests used (see Table 1).

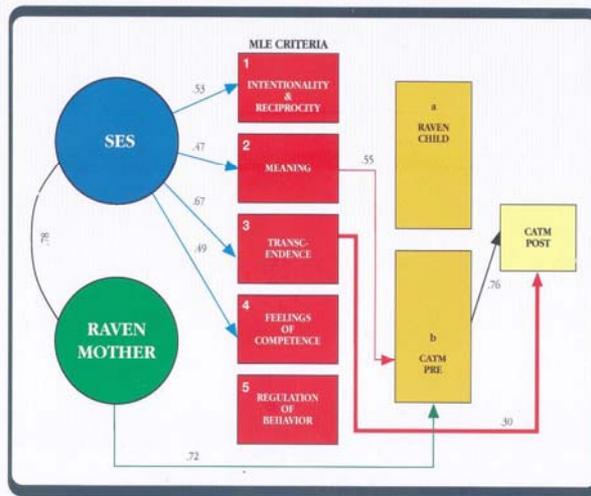


Figure 3. Structural Equation Analysis- Effects of Distal Factors (Mothers' Socioeconomic Level and Intelligence) and Proximal Factors (MLE Strategies) on Children's Cognitive Modifiability (Copied by permission from *International Journal of Cognitive Education and Mediated Learning*, 1, 119-135).

The findings in Figure 3 show that the MLE criteria of Transcendence predicted the CATM Post-teaching score more than did children's static test score (i.e., the CPM administered in a standard way). As can be seen in Figure 3, the MLE criterion of Meaning predicted the Pre-teaching score, whereas the MLE criterion of Transcendence predicted the Post-teaching score. Mediation of Meaning, which involves labeling of information, was crucial for first encounters with information such as the analogies presented to children in the CATM-Pre-teaching phase. Mediation for Transcendence, on the other hand, was found to be important when performance depends on learning of abstract rules, cognitive strategies, and principles such as those taught in the Teaching phase and later tested in the Post-teaching phase. The authors explained the results in that the children whose mothers used high level of mediation for Meaning internalized this mechanism of mediation and therefore performed better on the Pre-teaching phase. Children whose mothers used a high level of mediation for Transcendence internalized this specific mecha-

nism and used it later in other learning contexts. These results support the "specificity" (Wachs, 1992) of the MLE criteria as predictors of cognitive outcomes.

Tzuriel and Weiss (1998) reported similar findings by using a different DA measure - the CITM, for a different sample - older children in grade 2, and a different set of distal factors. A model of distal and proximal factors was constructed to explain causal paths among distal factors (e.g., mothers' acceptance-rejection, and children's personality orientation) and proximal factors (MLE) and between the proximal factors and cognitive modifiability defined by the Post-teaching score of the CITM.

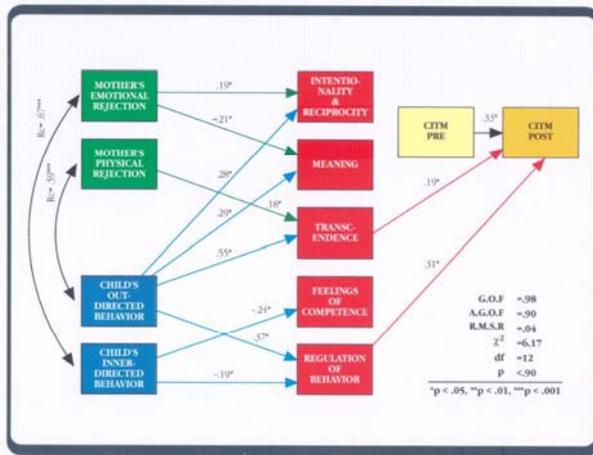


Figure 4. Structural Equation Analysis- Effects of Distal Factors (Mothers' Acceptance/Rejection and Children's Personality Orientation) and Proximal Factors (MLE Strategies) on Children's Cognitive Modifiability (Copied by permission from *Early Development and Parenting*, 7, 79-99.).

The findings in Figure 4 show that MLE strategies of *Transcendence* and *Regulation of Behavior* explained the children's Post-teaching score but *not* the Pre-teaching score. Both MLE criteria reflect a typical mother-child interaction in which the mother is involved in mediating rules and principles (*Transcendence*) and monitoring the flow of the children's behavior (*Regulation*). The findings become even clearer when we compare the MLE criteria

to task analysis of the CITM problems. Successful performance of the CITM problems requires a systematic exploration, planning behavior, hypothetical thinking, applications of cognitive rules, and generalization of principles. These cognitive functions (Feuerstein, et al., 1979) are perceived to be dependent not only on adequate internalization of general mediational processes, but more specifically on self-regulation and application of generalized principles and rules – cognitive processes that correspond to the MLE criteria found to be predictive of cognitive modifiability. It seems that these two MLE components, acquired during normal mother-child interactions, were assimilated by the children and equipped them with the thinking tools and mechanisms that are required later in other tasks and learning settings. When similar mediation for Transcendence and Regulation of Behavior are provided in other learning situations, these children can retrieve their previous mediational experiences, apply them efficiently with different tasks, and modify their cognitive structures.

The overall results of the two SEM analyses reported above were congruent with MLE theory, according to which proximal factors explain individual differences in children's cognitive functioning, whereas distal factors (i.e., SES-level, child's personality, mother's acceptance-rejection of the child) do not have a direct effect on children's cognitive factors, although they do explain some of the proximal factors.

Mother-Child MLE Interactions and Children's Cognitive Modifiability among Children with Learning Difficulties

In several studies the relation between MLE and cognitive modifiability was investigated in samples where the children had learning difficulty (e.g., Bettan & Tzuriel 2007, Tzuriel & Weitz, 2007, 2010, Tzuriel & Shomron, 2019). In contradiction to the MLE theory, in two studies distal factors were found as directly predicting cognitive modifiability. For example, in the Bettan and Tzuriel (2007) study carried out on kindergarten children with ADHD, two MLE strategies (in structured teaching situation) predicted, as expected, cognitive modifiability: mediation for Meaning ($\beta = .26$) and mediation for Transcendence ($\beta = .46$). However, unexpectedly, two distal factors also explained directly the children's cognitive modifiability: Severity of the ADHD ($\beta = -.26$) and mother's socioeconomic level ($\beta = .46$). The meaning of these findings is

that the higher the severity of the child's ADHD and the lower the mother's socioeconomic level, the lower is the cognitive modifiability of the child. Similarly, in a study by Tzuriel and Shomron (2007) on children with learning disability, one distal factor: *Home Observation for Measurement of the Environment* (HOME, Bradley, Caldwell, Rock, Hamrick & Harris, 1988) was found as directly explaining cognitive modifiability ($\beta = .60$) together with a combined score of four MLE strategies ($\beta = .41$). These empirical findings raise the question whether, with children experiencing learning difficulties, the distal factors might also influence directly the child's cognitive modifiability, a finding that contradicts the MLE theory. A possible explanation for these findings might be related to the sample characteristics. It might be that in samples of children with learning difficulties (e.g., ADHD, LD), even the best mediation, given naturally by mothers, is not enough to overcome or "nullify" the strength of the distal factor. In other words, the mothers of children with learning difficulties, who were observed during spontaneous interactions with their children, had no prior training for mediation. *It is plausible to assume that should mothers receive training for higher level of mediation, the effects of the distal factors would be reduced significantly or disappear.* Our findings suggest an elaboration of MLE theory. While in typically developing children distal factors *do not* affect directly cognitive modifiability, as suggested in the theory, in samples of children with learning difficulties, a much higher level of mediation is required to overcome the effects of the distal factors. In other words, in situations where children demonstrate learning or behavioral difficulties, distal factors can directly affect cognitive modifiability. The MLE process must be more powerfully directed toward amelioration of disability when the distal factors are salient.

This specific proposition should be investigated in further research where mothers of children with learning difficulties will be assigned to experimental and control groups. Mothers in the experimental group will receive a program of mediation and be compared with a control group of mothers who do not receive a program. Mother-child MLE interactions should be observed a year later to let the effects of the program internalized and assimilated into the mother-child interactional system. The children should then be tested by cognitive modifiability measures. My expectation is that distal factors will directly affect children's cognitive modifiability in the control group but will be significantly lower or disappear in the experimental group.

Intervention for Peers Mediation and Children's Cognitive Modifiability

Recent research of peer mediation showed that participation in a *Peer Mediation with Young Children (PMYC)* program improved children's MLE strategies (e.g., Shamir & Tzuriel, 2004; Tzuriel & Caspi, 2010; Tzuriel & Shamir, 2010) and enhanced their *cognitive modifiability* (Tzuriel & Shamir, 2007, 2010; Tzuriel & Caspi, 2010) and math performance (Shamir, Tzuriel & Guy, 2007; Shamir, Tzuriel, & Rozen, 2004). Because of space limits, other programs based on the MLE approach are not included in this article and readers are referred to the relevant research literature (e.g., Feuerstein, Rand, Hoffman & Miller, 1980; Greenberg, 1990; Haywood, Brooks, & Burns, 1986, 1992; Samuels, Killip, MacKenzie, & Fagan, 1992; Tzuriel & Eiboshitz, 1992; Tzuriel & George, 2009; Tzuriel, Kaniel, Kanner, & Haywood, 1999; Tzuriel, Kaniel, Zeliger, Friedman, & Haywood, 1998).

The PMYC program is a relatively new peer-assisted learning model that draws on both Vygotsky's (1978) concept of *zone of proximal development* and Feuerstein's *MLE* theory (Feuerstein, et al., 1979). The concept of peer mediation was developed recently (Shamir & Tzuriel, 2004; Shamir, Tzuriel, & Rozen, 2006; Shamir, Tzuriel & Guy 2007; Tzuriel & Caspi 2010; Tzuriel & Shamir, 2007, 2010) following Tzuriel's studies about the effects of mother-child MLE strategies on children's cognitive modifiability (i.e. Tzuriel 1999, 2001). The PMYC program is *a process-oriented* program designed to teach children *how* to mediate effectively irrespective of the mediated content. The PMYC has three main objectives: (a) to enhance a *mediating teaching style* and (b) cognitive modifiability of tutors, and (c) to facilitate performance and learning skills of young children who are mediated by their experienced tutor peers. The principal assumption is that teaching for peer-mediation will both elicit better mediating skills from the tutors and improve cognitive skills in both tutees and tutors. The mediation skills acquired and internalized as a result of the intervention will enable children to apply them in future learning contexts, whether when teaching peers or being exposed to new learning experiences.

The PMYC program is characterized by five main aspects: (a) it combines cognitive and emotional components, (b) it is focused on 'learning how to learn' strategies and meta-cognitive principles, (c) it transcends content domains and contexts of learning, (d) it determines clearly the mediator's status; the mediator's status is higher than the learner's status. The mediator, as

a more experienced person who has learned how to mediate, has an active-modifying role in the interaction and (e) the mediation procedures used are structured and theoretically guided, but contain also creative ways to promote inter-subjectivity (Newson & Newson, 1975). The PMYC has three classical components: *direct teaching*, *demonstration*, and *practice*. Direct teaching includes presentation and explanation of the basic mediated learning principles. Demonstration includes observation and discussion of a didactic movie. The movie demonstrates mediation processes using the mediated learning criteria and specific components (i.e., empathy, respect) for peer interaction in an actual learning event. Practicing of the mediated learning principles with peers is carried out using varied means such as multimedia programs, role-playing, and the use of tasks required for later teaching activities. The PMYC consists of seven lessons (with each lesson lasting for 1 hour) given over a period of 3 weeks. Each lesson includes presentation of a mediation principle, understanding its significance in general and particularly in a peer-mediation situation, and practicing and applying the principles in varied learning situations. The program also includes didactic videotape demonstrations aimed at enhancing internalization of mediation principles, and learning aids (i.e., computer programs, games, posters, stickers with the visual symbols of the principles, and work sheets).

The effects of the PMYC on MLE strategies were reported in a series of studies (Shamir & Tzuriel, 2004; Shamir, Tzuriel, & Rozen, 2006; Shamir, Tzuriel & Guy 2007; Tzuriel & Trabelsi, 2014; Tzuriel & Caspi 2010; Tzuriel & Shamir, 2010). The findings show consistently that children participating in the PMYC program demonstrated higher level of MLE strategies than children in control groups who received a substitute program. In three studies, however, the effects of the PMYC were studied specifically in relation to cognitive modifiability, which is the focus of this paper (Tzuriel & Caspi 2010; Tzuriel & Shamir, 2007, 2010). For example, in Tzuriel and Shamir's (2007) study, Grade 3 mediators participating in the PMYC program (experimental group, $n = 43$) were compared to mediators in a control group ($n = 46$) who received a substitute program. Following the intervention stage, the experimental and control children participated in a peer-mediation condition, which was videotaped for 30 minutes. The mediators were instructed to assist their young counterparts in solving problems based on the operation of *seriation*. All mediators were administered at the end of the program: the Analogies Subtest from the *Cognitive Modifiability Battery* (CMB, Tzuriel 1995,

2000). The Analogies, administered by adult examiners, included Pre-teaching, teaching, and Post-teaching phases for each of the Analogies subscales: Testing and Transfer. The Pre-teaching score was taken as an indicator of the program's effect on solving problems and the Post-teaching score as the mediators' propensity to benefit from adult mediation and consequently improve their analogical performance. Repeated-measures analysis of variance of Treatment by Time (2 x 2) was carried out on each of the Analogies subscales. The findings showed significant interaction of Treatment by Time for the Transfer problems (i.e., more difficult). The interaction portrayed in Figure 5 indicates that the experimental group not only had higher Pre-teaching scores (given after the intervention program) but also showed higher Pre- to Post-teaching improvement than did the control group.

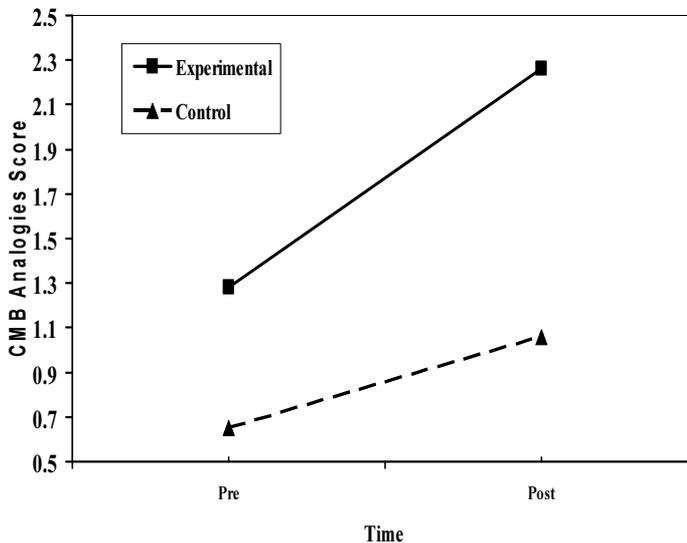


Figure 5. Pre- and Postteaching scores of mediators (Grade 3) on the Analogies Subtest of the *Cognitive Modifiability Battery*— (Transfer Problems) in the experimental and control groups (Copied by permission from *British Journal of Educational Psychology*, 77, 143-165).

This finding supports the expectation of higher cognitive modifiability in the experimental than in the control group. Group differences in the Pre- and Post-teaching phases of the analogies revealed that mediators in the experi-

mental group scored higher than did mediators in the control group in both the Pre-teaching, $t_{(84)} = 2.41$, $p < .05$, and Post-teaching, $t_{(84)} = 3.25$, $p < .01$, phases. These DA findings clearly indicate that mediators in the experimental group internalized the mediation principles and knew how to benefit from mediation given to them in a different context and consequently improved their performance higher than children in the control group. Thus, children who learn how to mediate become not only better mediators but also better learners, as reflected in their cognitive modifiability scores.

A more sophisticated question was asked in a study by Tzuriel and Caspi (2010) involving both mother-child and peers MLE processes. The question was does the PMYC program serve as a compensating factor for lack of mediation within the family? In the first phase of the study mother-child dyads ($n = 100$) were observed interacting in a structured teaching situation. The interaction was then analyzed by the *Observation for Mediation Interaction* (OMI) using five criteria of mediation. The children's sample was then divided into high- and low-mediation (of mothers) groups; each group was randomly assigned into experimental and control groups. The experimental group ($n=49$) received the PMYC program and the control group ($n=51$) received a substitute program. All children were then observed in peers teaching session where they were asked to teach their younger peers some analogy problems. The interaction was analyzed using the OMI, in the same way it was use when the children interacted with their mothers. In addition all mediators were administered a DA measure before and after the intervention: the *Analogies Subtest* from the *Cognitive Modifiability Battery* (CMB, Tzuriel, 1995). The The findings showed that children in the experimental group achieved higher cognitive modifiability in process oriented DA measure, as indicated by higher planning and self-regulation than in the control group. Children in the experimental group showed also higher performance on the CMB Analogies and on mediated learning strategies than children in the control group. As for the main question of this study an intriguing finding revealed that in the experimental group no significant differences were found between children of low- versus high-mediating mothers, $F_{(1,45)} = 1.63$, *ns*. The meaning of this finding is that the PMYC program could act as an "equalizing" factor between children of low-mediating mothers as compared with children of high-mediating mothers. A different pattern of findings was shown however in the control group. As expected, children of high-mediating mothers in the control group showed higher cognitive modifiability as com-

pared with children of low-mediating mothers, $F_{(1,47)} = 5.40, p < .05, \eta^2 = .10$. Simple main effects for each group of mothers' level of mediation (low *versus* high) showed that in the group of low-mediating mothers, cognitive modifiability of children in the experimental group was higher than cognitive modifiability of children in the control group, $F_{(1,45)} = 8.79, p < .01, \eta^2 = .16$. In the group of high-mediating mothers, on the other hand, no significant differences were found between the experimental and control groups, $F_{(1,47)} = .23, ns$. These findings support the idea that a program for peer mediation can serve as a compensating factor in families where children are not given opportunities for qualitative mediation.

The effectiveness of the peer mediation was investigated recently (Trabelsi & Tzuriel, 2014b) with a sample of adolescent students with severe learning disabilities ($n = 110$). The main objective of this study was to examine the differential and combined effects of two programs: The *Peer Mediation with Children-Math* (PMC-Math; Tzuriel & Trabelsi, 2014b) and The *Seria-Think* Program (STP, Tzuriel & Trabelsi, 2014a). The effectiveness of these programs was studied in four domains: (a) self-regulation and planning, (b) mediated learning strategies, (c) math discourse and (d) math performance. Half of the students who were in 9th Grade were assigned the role of mediators ($n = 55$) and half ($n = 55$) who were students in 7th Grade were assigned the role of learners. The intervention included two components: PMC-Math (A) and STP (B). Mediators were assigned randomly to one of four subgroups based on a Salomon-type design (2×2) and received the following components: Group 1- A+B, Group 2- A, Group 3- B, Group 4- none. The PMC-Math was composed of 7 sessions of learning the basic mediated learning experience strategies and the STP was composed of 5 sessions of learning the how to use the *Seria-Think* Instrument. All participants were administered the following tests before and after the intervention: Complex Figure Test, Matching Familiar Figure Test (MFFT), *Seria-Think* Instrument, Mazes (WISC-R), Math Exam. Following the intervention each mediator in 9th grade was assigned randomly to a learner from 7th grade and asked to teach how to solve the *Seria-Think* problems. The teaching (mediation) session was videotaped for 20 minutes and analyzed later by the *Observation of Mediation Interaction* (OMI) for the first five strategies of MLE. The results indicated (a) significant higher pre- to post-intervention improvement of Group 1 over the other three groups in all outcome variables, (b) Groups 2 and 3 showed higher improvements than the control group, and (c) Group 3 who received only the

STP showed better improvements than Group 2 who received the PMC-Math. Group 1 showed the highest mediation strategies followed by Groups 2 and 3 (equal), and Group 4. The importance of this study is in the theoretical and practical understanding of teaching and learning methodologies for development of self-regulation skills of students with learning disability in special education settings.

In Vygotsky's (1978) terms, the peer-mediation experience enabled the mediators to advance from a *lower* zone of proximal development (pre-intervention) to an *upper* zone of proximal development (post-intervention). Later studies by Tzuriel and Shamir (2010) and Tzuriel and Caspi (2010) consistently support the earlier studies showing positive effects of participation in the PMYC on cognitive modifiability.

Discussion and Conclusions

The studies reported above verify commonsense knowledge and theoretical conceptualization about the role of MLE processes in enhancing cognitive modifiability. MLE strategies, exemplified in the spontaneous family interactions, seems to affect the child's ability to benefit from mediation offered within the family context and to generalize to other formal and non-formal situations. One of the intriguing findings consistently emerging in most studies is that mediation for Transcendence (expanding) is the most powerful strategy predicting cognitive modifiability. This strategy has emerged as most powerful in predicting cognitive modifiability in spite of the fact that it was also found as the least frequent strategy and therefore with a limited score range. Mediation for Transcendence reflects the mediator's efforts to modify the abstract abilities of the child and to focus the child on concepts, generalizations, and principles. The DA measures used in all studies reflect also the ability of the child to solve problems requiring abstract concepts and rules.

The findings that distal factors in samples of children with learning difficulties (Bettan & Tzuriel, 2010; Tzuriel & Shomron, 2007) directly predict cognitive modifiability might indicate a need to modify or refine the MLE theory, at least for children with learning difficulties. In typically developing children, distal factors seem *not* to affect directly cognitive modifiability as suggested by the theory; they do affect, however, the MLE processes, which in turn affect cognitive modifiability. In samples of children experiencing se-

vere learning difficulties, the distal factors (adverse conditions) affect directly learning processes and cognitive modifiability. In order to cancel or overcome the adverse conditions effects, much more "robust" mediation efforts should be applied than the usual ones given within the typical parent-child interaction.

The refinement of MLE theory is related to the need to extend the concept of MLE to a more complex transactional-ecological model, taking into account the reciprocal nature of MLE and cognition as well as treating MLE as one component within a holistic framework. This is especially important because of the danger of overextending the presumed influence of MLE and attributing overly many cognitive and non-cognitive effects to MLE. Overgeneralization of MLE theory to explain too many phenomena may bring about only the devaluation of the theory. It is most important now that the effects of MLE are established so as to delineate the conceptual limits of the theory. The term "transactional" rather than "interactional" is meant to emphasize the idea of the mutual effects of MLE and cognitive functioning. Wachs and Plomin (1991) defined interaction as involving different individuals differentially reacting to similar environments, whereas transaction implies effects that are differential both for individuals and environments. Tzuriel (1991) conceptualized interaction as characterized by relative simplicity and transience of effects, whereas the transactional process is dialectically *circular* with a continual change and adjustment of factors. This dialectical circularity poses a real challenge for theory development and methodology, but with recent advances in technology and statistical analyses it can be handled efficiently. We should be aware that there is a possibility that the children's cognitive functioning might influence parental MLE strategies, and that the circular relation depends on broader family, social, and cultural contexts. Similar conceptions have been discussed in Bronfenbrenner's (1979) ecological approach and by Super and Harkness (1986), who proposed also the concept of *developmental niches*. Some evidence for the effects of age, context, and severity of a child's problems, and cultural background has been reported as well (e.g., Klein, 1988; Klein & Aloni, 1993; Tzuriel & Weiss, 1998; Tzuriel & Weitz, 1998; Tzuriel & Eran, 1990). The affective and motivational processes of children and their parents are also very important as prerequisite factors in determining the nature of MLE processes, children's cognitive modifiability, and the nature of their reciprocal effects.

The findings of peer-mediation studies indicate clearly that children in experimental groups participating in the PMYC program showed better mediational teaching style. Recent studies demonstrate that a program for peer mediation can compensate for low level of mediation in the family (Tzuriel & Caspi (2010) and serves as a powerful facilitation of self-regulation and planning of children with severe learning disability (Tzuriel & Trabelsi, 2014a; Trabelsi & Tzuriel, 2014).

An important implication of these studies is that children's MLE strategies could qualitatively and quantitatively be improved beyond the spontaneous developmental process of mediation skills. The enhancement of mediation skills was demonstrated not only with children who participated in the PYMC program, but also was transferred to children who were taught by their qualified peers. The use of the MLE criteria allows us not only to design intervention for peer-mediation, but also to describe the nature of the mediating behaviors used by children during social interactions such as peer learning or play.

The significant findings on the effects of the PMYC program on cognitive modifiability of mediators (Shamir et al., 2006; Shamir, Tzuriel, & Guy, 2007; Tzuriel & Shamir, 2007, 2010; Tzuriel & Caspi, 2010) support our expectations that children who learn how to mediate become not only better mediators (tutors) but also better learners, as reflected in their pre- to post-teaching improvement on various DA measures (see Figure 4). In Vygotsky's (1978) terms, the peer-mediation experience enabled the tutors to advance from a *lower* zone of proximal development to an *upper* zone of proximal development. It should be noted that the problems of the CMB Analogies were novel to all children, so the improvement cannot be attributed to a familiarity factor. Furthermore, the PMYC program does not contain any components that are similar to the tasks used to assess the mediators' cognitive modifiability. The significance of the greater gains of children in the experimental groups should be evaluated in relation to two facts; first, that the administered tests tap a different cognitive skill than those taught in the program, and second, that the standardized tests in most studies failed to reveal the effectiveness of the program. Application of DA as a central evaluation method reveals that the contribution of the cognitive education program was not simply supporting the development of a particular skill practiced during the program; it also involved teaching children *how to benefit from mediation* in a different set-

ting and consequently improve their cognitive performance across other domains.

In further research it will be important to investigate the contribution of the PMYC program or programs developed for enhancement of parents' mediation style as compensatory programs with children coming from low mediating families. It is conceptually important to establish the relative effects of cognitive education programs aimed at developing children's and parents' mediation skills on the children's cognitive modifiability. Development of mediation programs is especially important for parents of children experiencing learning difficulties or parents who, for a variety of reasons lack mediation skills. Further research is also required to study the effects of mediating agents such as siblings, grandparents, and teachers on children's cognitive level.

References

- Belsky, J., Goode, M.K., & Most, R.K. (1980). Maternal stimulation and infant exploratory competence: Cross-sectional, correlational, and experimental analyses. *Child Development, 51*, 1168-1178.
- Berk, L.E. & Spuhl, S.T. (1995). Maternal interaction, private speech, and task performance in preschool children. *Early Childhood Research Quarterly, 10*, 145-169.
- Bornstein, M., H. & Tamis-LeMonda, C. (1990). Activities and interactions of mothers and their first-born infants in the first six months of life. *Child Development, 61*, 1206-1217.
- Bradley, R.H., & Caldwell, B.M. (1984). *Home Observation for Measurement of the Environment*, (HOME) (rev. ed.). Little Rock, AK: University of Arkansas.
- Bronfenbrenner, U. (1979). *The ecology of human development*. Cambridge, MA: Harvard University Press.
- Cristofaro, T.N. & Tamis-LeMonda, C.S. (2012). Mother-child conversations at 36 months and at pre-kindergarten: Relations to children's school readiness, *Journal of Early Childhood Literacy, 12*, 68-97.
- Embretson, S.E. (1992). Measuring and validating cognitive modifiability as ability: A study in the spatial domain. *Journal of Educational Measurement, 29*, 25-50.
- Feuerstein R. & Feuerstein S. (1991). Mediated learning experience: A theoretical review. In R. Feuerstein, P.S. Klein, & A. Tannenbaum (Eds.). *Mediated Learning Experience (MLE)* (pp. 3-52). London: Freund.
- Feuerstein, R., Feuerstein, R. S., Falik, L. H., & Rand, Y. (2002). *The dynamic assessment of cognitive modifiability: The Learning Propensity Assessment Device, Theory, instruments, and techniques*. Jerusalem: ICELP Press.
- Feuerstein, R., Rand, Y. & Hoffman, M.B. (1979). *The dynamic assessment of retarded performers*. Baltimore: University Park Press.
- Feuerstein, R., Rand, Y., Hoffman, M. B., & Miller, R. (1980). *Instrumental Enrichment*. Baltimore, MD: University Park Press.

- Greenberg, K. H. (1990). Mediated learning in the classroom. *International Journal of Cognitive Education and Mediated Learning*, 1, 33-44.
- Haywood, H. C., Brooks, P. H., & Burns, M. S. (1986). Stimulating cognitive development at developmental level: A tested, non-remedial preschool curriculum for preschoolers and older retarded children. In M. Schwebel & C. A. Maher (Eds.), *Facilitating cognitive development: Principles, practices, and programs* (pp. 127-147). New York: Haworth Press.
- Haywood, H. C., Brooks, P. H., & Burns, M. S. (1992). *Bright Start: Cognitive curriculum for young children*. Watertown, MA: Charlesbridge.
- Haywood, H. C., & Lidz, C. S. (2007). *Dynamic assessment in practice: Clinical and educational applications*. New York: Cambridge University Press.
- Haywood, H. C., & Tzuriel, D. (Eds.). (1992). *Interactive assessment*. New York: Springer-Verlag.
- Klein, P. S. (1988). Stability and change in interaction of Israeli mothers and infants. *Infant Behavior and Development*, 11, 55-70.
- Klein, P. S. (1991). Improving the quality of parental interaction with very low birth weight children: A longitudinal study using a mediated learning experience model. *Infant Mental Health*, 12, 321-337.
- Klein, P. S. (Ed.). (1996). *Early intervention: Cross cultural experiences with a mediational approach*. New York: Garland.
- Klein, P. S., & Aloni, S. (1993). Immediate and sustained effects of maternal mediation behaviors on young children. *Journal of Early Intervention*, 17, 1-17.
- Klein, P. S., Weider, S., & Greenspan, S.I. (1987). A theoretical overview and empirical study of mediated learning experience: Prediction of preschool performance from mother-infant interaction patterns. *Infant Mental Health Journal*, 8, 110-129.
- Klein, P.S., Zarur, S., & Feldman, R. (2002). Mediation in a sibling context: The relations of older siblings mediating behaviour and younger siblings task performance. *Infant and Child Development*, 11, 321-333.
- Laosa, L. M. (1980b). Maternal teaching strategies in Chicano and Anglo-American families: The influence of culture and education on maternal behavior. *Child Development*, 51, 759-765.

- Lidz, C.S. (1991). *Practitioners' guide to dynamic assessment*. New York: Guilford Press.
- Lidz, C. S. & Elliott, J. G. (Eds.) (2000). Advances in cognition and educational practice. *Dynamic assessment: Prevailing models and applications*. Oxford: Elsevier.
- Newson, J. & Newson, E. (1975). Intersubjectivity and the transmission of culture: On the social origins of symbolic functioning. *Bulletin of the British Psychological Society*, 28, 437-446.
- Parker, F.L., Boak, A.Y., Griffin, K.W., Ripple, C. & Peay, L. (1999). Parent-child relationship, home learning environment, and school readiness. *School Psychology Review*, 28, 413-425.
- Ramey, C.T., Farran, D.C., & Campbell, F.A. (1979). Predicting IQ from mother-infant interactions. *Child Development*, 50, 804-814.
- Raven, J. C. (1956). *Guide to using the Colored Progressive Matrices, Sets A, Ab, and B*. London: Lewis.
- Remer, R. & Tzurriel, D. (July 2011). The effects of intervention using puppets with kindergarten learning disabled children on teachers mediated learning strategies and children's motivation and emergent literacy. Paper presented at the 11th conference of the International Association for Cognitive Education and Psychology, Boston MA, USA.
- Rodriguez E.T., et al., (2009). The formative role of home literacy experiences across the first three years of life in children from low-income families. *Journal of Applied Developmental Psychology*, 30, 677-94.
- Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development and social context*. London: Oxford University Press.
- Shamir, A., & Tzurriel, D. (2004). Children's mediational teaching style as a function of intervention for cross-age peer-mediation. *School Psychology International*, 25, 58-97.
- Shamir, A., Tzurriel, D. & Guy, R. (2007). Computer-supported collaborative learning: Cognitive effects of a peer mediation intervention. *Journal of Cognitive Education and Psychology*, 6, 373-394.
- Sroufe, L.A. & Waters, E. (1977). Attachment as an organizational construct. *Child Development*, 48, 1184-1199.

- Super, C., & Harkness, S. (1986). The developmental niche: A conceptualization at the interface of society and the individual. *International Journal of Behavioral Development*, 9, 545-570.
- Tamis-LeMonda, C.S., Bornstein, M.H., & Baumwell, L. (2001) Maternal responsiveness and children's achievement of language milestones. *Child Development*, 72, 748-67.
- Trabelsi, G. & Tzuriel, D. (April 2014). The Influence of peer mediation with children (PMC) program on executive functions, mathematical performance and discourse, and mediated learning strategies, among adolescents with learning disabilities. Paper presented at the international conference of To see Beyond Disability: YAI, New York.
- Tzuriel, D. (1992). *The Children's Inferential Thinking Modifiability (CITM) test - Instruction Manual*. School of Education, Bar Ilan University.
- Tzuriel, D. (1995). *The Cognitive Modifiability Battery (CMB): Assessment and Intervention - Instruction Manual*. School of Education. Bar Ilan University.
- Tzuriel, D. (1996). Mother-child mediated learning strategies in free-play and structured situations among low, medium, and high-SES levels. *Child Development and Care*, 126, 57-82.
- Tzuriel, D. (1997). A novel dynamic assessment approach for young Children: Major dimensions and current research. *Educational and Child Psychology*, 14, 83-108.
- Tzuriel, D. (1999). Parent-child mediated learning transactions as determinants of cognitive modifiability: Recent research and future directions, *Genetic, Social, and General Psychology Monographs*, 125, 109-156.
- Tzuriel, D. (2000a). Dynamic assessment of young children: Educational and intervention perspectives. *Educational Psychology Review*, 12, 385-435.
- Tzuriel, D. (2000b). The Cognitive Modifiability Battery: Assessment and Intervention. In C.S. Lidz & J. Elliott (Eds.) *Dynamic Assessment: Prevailing models and applications* (pp. 375-406). New York: Elsevier Science.
- Tzuriel, D. (2001). *Dynamic assessment of young children*. New York: Kluwer Academic/Plenum Press.
- Tzuriel, D. (2002). Dynamic assessment of learning potential. *Encyclopedia of Education (2nd ed.)* J.W. Guthrie (Ed.), (pp. 127-131). New York: McMillan Press.

- Tzuriel, D. (2011a). Mediated learning and cognitive modifiability. *Encyclopedia of Sciences of Learning*. N.M. Seel (Ed.) (pp. 2154-2157). New York: Springer Publishing.
- Tzuriel, D. (2011b). Mediators of learning. *Encyclopedia of Sciences of Learning*. (pp. 2157-2161). N.M. Seel (Ed.) New York: Springer Publishing.
- Tzuriel, D. (2013). Mediated learning experience strategies and cognitive modifiability. *Journal of Cognitive Education and Psychology*, 13, 59-80.
- Tzuriel, D. & Eran, Z. (1990). Inferential cognitive modifiability of Kibbutz young children as a function of mother-child mediated learning experience (MLE) interactions. *International Journal of Cognitive Education and Mediated Learning*, 1, 103-117.
- Tzuriel, D. & Eiboshitz, Y. (1992). A Structured program for visual motor integration (SP-VMI) for preschool children. *Learning and Individual Differences*, 4, 103-124.
- Tzuriel, D. & Ernst, D. (1990). Cognitive modifiability of young children and mother-child mediated learning experience (MLE) interaction in low medium- and high-SES. *International Journal of Cognitive Education and Mediated Learning*, 1, 119-135.
- Tzuriel, D. & George, T. (2009). Improvement of analogical reasoning and academic achievements by the Analogical Reasoning Program (ARP). *Educational and Child Psychology*, 29, 71-93.
- Tzuriel, D. & Gross, A. (February 1992). Achievements in Talmud as a function of teacher's mediational strategies and attitudes towards cognitive modifiability, and students' intellectual skills and motivational orientation. Paper presented at the Third International Conference on Cognitive Education: Models of Cognitive Instruction of the International Association for Cognitive Education. Riverside, CA, USA.
- Tzuriel, D. & Hanuka-Levy, D. (2014). Siblings' mediated learning strategies in families with and without children with intellectual disabilities. *American Journal of Intellectual Disability and Disorders*, 119, 565-588. DOI: 10.1352/1944-7558-119.6.565

- Tzuriel, D., & Hatzir, A. (1999). *The effects of mediational strategies of mothers and fathers and amount of time they spent with their young children on children's cognitive modifiability*. Unpublished manuscript, School of Education, Bar-Ilan University, Ramat Gan, Israel.
- Tzuriel, D., Kaniel, S., Kanner, E., & Haywood, H.C. (1999). The effectiveness of Bright Start program in kindergarten on transfer abilities and academic achievements. *Early Childhood Research Quarterly*, 114, 111-141.
- Tzuriel, D., Kaniel, S., & Yehudai, M. (1994, July). *Mediated learning experience (MLE) interactions among Etheopian immigrant and Israeli-born mothers*. Paper presented at 12th International Congress of the International Association for Cross-Cultural Psychology, Pamplona, Spain.
- Tzuriel, D., Kaniel, S., Zeligler, M., & Friedman, A., & Haywood, H.C. (1998) Effects of the Bright Start program in kindergarten on use of mediated learning strategies and children's cognitive modifiability, *Child Development and Care*, 143, 1-20.
- Tzuriel, D., & Klein, P. S. (1985). Analogical thinking modifiability in disadvantaged, regular, special education and mentally retarded children. *Journal of Abnormal Child Psychology*, 13, 539-552.
- Tzuriel, D. & Shamir, A. (2007). The effects of peer mediation with young children (PMYC) on children's cognitive modifiability. *British Journal of Educational Psychology*, 77, 143-165.
- Tzuriel, D. & Shamir, A. (2010). Mediation strategies and cognitive modifiability in young children as a function of peer mediation with young children (PMYC) program and training in analogies versus math tasks. *Journal of Cognitive Psychology and Education*, 9, 48-72.
- Tzuriel, D. & Shomron, V. (July, 2009). Cognitive modifiability and psychological resilience: The effects of mother-child mediated learning experience (MLE) and home supportiveness among learning disabled children. Paper presented at the 12th International Conference of the International Association for Cognitive Education and Psychology (IACEP), University of Osnabrück, Germany.

- Tzuriel, D. & Rokach, G. (July, 2009). Sibling's mediated learning strategies in Jewish families with many versus few children: The relation to home support and religious orientation and their effects on cognitive modifiability. Paper presented at the 12th International Conference of the International Association for Cognitive Education and Psychology (IACEP), University of Osnabrück, Germany.
- Tzuriel, D. & Trabelsi, G. (2014a). The effects of the Seria-Think Program (STP) on planning, self-regulation and math achievements among Grade 3 Children with Attention Deficit Hyperactivity Disorder (ADHD). In Papadopoulos, T. C., Parrila, R. K., & Kirby, J. R. (Eds.). *Cognition, intelligence, and achievement: A tribute to J. P. Das*. San Diego, CA: Academic Press.
- Tzuriel, D. & Trabelsi, G. (2014b). *The Peer Mediation with Children – Math*. School of Education, Bar Ilan University, Ramat-Gan Israel.
- Tzuriel, D. & Weiss, S. (1998). The effects of mothers' acceptance/rejection attitudes, children's personality and mothers' mediated learning strategies on cognitive modifiability. *Early Development and Parenting*, 7, 79-99.
- Tzuriel, D. & Weitz, A. (1998). Cognitive modifiability as a function of mother-child mediated learning strategies among very low birth weight and normally born children. Unpublished manuscript, School of Education, Bar-Ilan University, Ramat Gan, Israel.
- Valsiner, J. (1988). *Developmental psychology in the Soviet Union*. Brighton: Harvester.
- Vygotsky, L. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.
- Vygotsky, L. (1986). *Thought and language*. Cambridge, MA: The MIT Press.
- Wachs, T. D. (1992). *The nature of nurture*. Newbury Park, CA: Sage.
- Wachs, T. D. & Plomin, R. (1991). *Conceptualization and measurement of organism-environment interaction*. Washington, DC: American Psychological Association.
- Weitz, A. & Tzuriel, D. (July, 2007). The Relationship between mediated learning strategies in mother-child interactions and personality, behavior, temperament, and cognitive skills of 8—9:6 year old children born with very low birth weight. Paper presented at the 11th International Conference of the International Association for Cognitive Education and Psychology (IACEP), University of Tennessee, Knoxville, TN, USA.

- Wertsch, J. V. (1985). *Culture, communication and cognition: Vygotskian perspectives*. London: Cambridge University Press.
- Wood, D. J., Bruner, J., & Ross, G., (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry*, 17, 89-100.