Chapter 3

Mother-Child Mediated Learning Experience Strategies and Children's Cognitive Modifiability: Theoretical and Research Perspectives

David Tzuriel

Additional information is available at the end of the chapter

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Abstract

The focus of this chapter is on the effects of *mediated learning experience* (MLE) interactions on children's *cognitive modifiability*. The MLE theory is presented followed by selected research findings, demonstrating the impact of MLE strategies in mother-child interactions in facilitating cognitive modifiability. Research findings support the effects of distal factors (e.g., socioeconomic status) on MLE processes and the effects of the proximal factors (MLE) on cognitive modifiability. Mediation for Transcendence (expanding) was found consistently as the most powerful strategy predicting cognitive modifiability. Distal factors in samples of children with learning difficulties were found as directly predicting cognitive modifiability. These findings might indicate a need to modify or refine the MLE theory. A few suggestions are offered for future research.

Keywords: mediated learning experience (MLE), cognitive modifiability, dynamic assessment, mother-child interaction

1. Introduction

A growing body of theory and research in the last three decades supports the crucial role of *mediated learning experience* (MLE) strategies and cognitive modifiability [1, 2–5]. In this chapter, the role of MLE strategies in mother-child interactions as a proximal factor of cognitive modifiability is focused and the empirical validation is presented. In the first segment of this chapter, the MLE theory is presented, and in the second segment, selected research findings are demonstrated supporting the crucial role of MLE strategies in facilitating cognitive

modifiability. Finally, the discussion segment deals with suggestions for future research and an integrative summary.

2. MLE and cognitive modifiability: theoretical perspective

MLE processes designate a special quality of interaction between a mediator and a learner [1, 2–5]. In this qualitative interactional process, parents or other socialization agents interject themselves between the information surrounding the child and mediate the information to the developing child. Mediation is carried out usually by modifying the information to the child so that he/she can register and internalize it [6]. Feuerstein et al. [1] conceived the MLE processes as a proximal factor that explains directly cognitive development and cognitive modifiability. *Cognitive modifiability*, which is a key concept of the MLE theory, was defined as the propensity of individuals to learn from new experiences and to change their cognitive structures. Cognitive modifiability is characterized by three main aspects: *permanence*, *pervasiveness*, and *centrality*. Permanence is the tendency of the cognitive change to be durable over time. For example, learning of the concept of number will be durable over time. Pervasiveness is characterized by a process by which a change in one part of the cognitive system affects other parts of the system. For example, learning of analogy in a figural domain will spread to understanding of analogy in a verbal domain. Centrality is characterized by a self-perpetuating process; changes in the cognitive system become autonomous and self-regulating. For example, a child who learns the concept of reversibility will tend to explore it further and apply it creatively in different contexts than the original context in which the concept was acquired.

Feuerstein et al. [1] suggested that "MLE provides the organism with instruments of adaptation and learning in such a way as to enable the individual to use the direct-exposure modality for learning more efficiently and thus become modified" (p. 206).

According to the MLE theory, parents are perceived of as active-modifying mediators that shape child's development. In the mediation process, parents use different strategies (i.e., focusing, providing meaningful stimuli, alerting attention, altering stimulus frequency, ordering events, fluctuating intensity of stimuli, linking novel information to familiar contexts, and regulating the order and timing of information sequence). Adequate mediation refers as well to motivational aspects such as arousing of attention, curiosity, and vigilance, focusing on relevant characteristics of the situation and providing meanings to neutral stimuli. Internalization of MLE processes helps the child in the future to benefit from new experiences. The integrated MLE processes facilitate not only learning from others but also autonomous self-mediation. It should be emphasized that as the child develops self-mediation strategies, the mediator should gradually withdraw from provision of mediation and encourage the child to be more autonomous in the learning process. Satisfactory MLE interactions help the learning individual to develop various cognitive functions and strategies, mental operations (i.e., comparison, analogy, syllogism), metacognitive strategies, cognitive flexibility, and intrinsic motivation. Adequate MLE processes by parents depend on numerous factors such as parents' mediation skills, awareness to the importance of mediation in developing the child's cognitive development, the child's cognitive abilities, need for mastery, emotional factors (e.g., attachment,

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security, trust), behavioral predispositions (e.g., temperament, hyperactivity), characteristics of stimuli (e.g., task complexity, novelty, intensity), and situational conditions (e.g., stress, time pressure). 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 or poor MLE may be derived from either inadequate environmental condition for mediation (i.e., poverty) or inner barriers for acceptance of mediation, which is potentially available (e.g., physical or mental inability of the child to benefit from mediational interactions). In the first case, limited mediation is derived from parents' low educational level, lack of awareness to or knowledge of the importance of mediation, and adverse life events.

Feuerstein's MLE theory is in some respects like Vygotsky's [7, 8] concepts of the *zone of proximal development* and *internalization* and the concept of *scaffolding* [9–12]. 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**). Direct exposure is characterized by unmediated encounters of individuals with stimuli in the environment. In **Figure 1**, the top and bottom arrows from the S (Stimuli) to the O (Organism-learner) represent the direct exposure. The arrows directed from the S to the H (Human) and from the H to the O represent MLE interaction. In MLE, learning is carried out by an experienced adult (i.e., parent, teacher) or peers who interpose themselves between the learner and the environment. In order for the information to be registered efficiently by the learner, the mediator modifies it in various ways. For example, the mediator may change its frequency, reorder its sequence, enhance its intensity, present it in a new context, arouse the child's curiosity, alertness, and perceptual acuity, and improve the cognitive functions required for effective input, processing, and output of information.

As can be seen in **Figure 1**, the mediator not only conveys to the child the external stimuli but also mediates how to respond to others the outcomes of processing and thinking. This phase of mediation is represented by the arrows pointing from the O to R (i.e., from mediator to child's own response). The MLE processes depend not only on parent's adequate mediation but also on children's cognitive strengths and deficiencies, motivational, emotional, and personality factors, behavioral tendencies, task characteristics, and situational conditions. The mediator represented by the H should be flexible and "elastic." He/she should adjust mediation based on the phase of child's phase of learning. Mediation should be enhanced or withdrawn based on the child's difficulty level or progress and improvement as well as on environmental conditions that affect the learning process.

According to the MLE theory, a clear distinction is made between distal and proximal factors of cognitive modifiability. Distal factors are not considered as direct in explaining cognitive

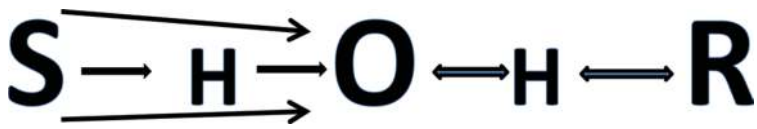

Figure 1. The mediated learning experience (MLE) model (copied by permission from Feuerstein et al. [1]).

modifiability. Examples of distal factors are poverty, socioeconomic status, hereditary factors, and emotional disturbance. They might correlate with cognitive modifiability and have indirect effect through the proximal factor of MLE. MLE interactions are conceived as a *proximal* factor explaining individual differences in learning and cognitive modifiability.

In developing the MLE theory, Feuerstein et al. [1] suggest 12 criteria or strategies; the first three criteria are considered as necessary and sufficient for an interaction to be classified as MLE: *Intentionality and Reciprocity*, *Meaning*, and *Transcendence*. These three strategies are universal and can be found in all cultures. They do not depend on the language modality or content of mediation. They might be expressed by body gestures, face mimics, and verbalization. The other 10 criteria are culturally related, task-dependent, and reflect the mediator's and child's unique characteristics such as cognitive style, motivational orientation, and types of skill and content.

The first five MLE strategies were operationalized and observed in interactions of mother-child (e.g., [2–4, 6, 13–18], peer mediation [19–28], siblings [17, 22, 29], and teachers [30, 31]). These strategies are presented in the following section.

2.1. MLE strategies

a. *Intentionality and Reciprocity* refers to a mediator's deliberate efforts to change a child's attention, awareness, and perception. Mediation for Intentionality alone is inadequate without the child's reciprocity (vocal, verbal, or nonverbal). Intentionality and Reciprocity is observed, for instance, when a caregiver offers a toy to a child or verbally focuses a child's attention to a plant and the child responds to it. This strategy is considered crucial for starting the mediation process and later on for enhancement of other MLE strategies such as feelings of competence and self-regulation.

b. *Mediation of Meaning* is characterized by mediator's behavior that conveys the affective and value-oriented significance of an object or event. It can be expressed verbally ("Wow, how beautiful") by relating it to other events and emphasizing its importance and value ("I received this ring from my mother"). Mediation of Meaning may also be expressed nonverbally by facial expression, tone of voice, and repetitious actions that convey the significance of the object or event. Children experiencing Mediation of Meaning tend to actively attach future meanings to new experiences rather than passively wait for meanings to appear.

c. *Mediation of Transcendence* is characterized by interactions in which the mediator goes beyond the concrete situation or beyond the immediate needs of the child. The mediator tries to reach out for goals that are beyond the specific context or activity. A parent who interacts with his/her child may go beyond the specific experience at a certain time and teach strategies rules and principles (i.e., "draw first the main figure and then the secondary lines") to generalize to other situations. For instance, in a play situation, the parent may mediate the principles of game and generalize them to other situations. Mediation for Transcendence depends on the first two strategies. The combination of all three first

strategies enhances the development of cognitive modifiability and expands the individual's need system.

d. *Mediation of Feelings of Competence* refers to an interaction in which a mediator rewards the child for a successful performance or interprets to the child his/her own success. Mediation of feelings of competence is also carried out when the mediator sequences the task, organizes the environment, and provides occasions to ensure success.

e. *Mediation of Self-regulation* is characterized by interactions in which a mediator helps the child to control behavior by either slowing down or accelerating his/her response to events, depending on task difficulty level. Mediation for self-regulation is expressed most frequently when the mediator helps the child to inhibit impulsivity level by delaying response to a stimulus. Self-regulation is mediated usually by arousing awareness to task characteristics (e.g., analyzing the task components), providing metacognitive strategies and modeling of self-regulation behavior.

3. Dynamic assessment of learning potential

An integrative component of the MLE theory is related to dynamic assessment (DA) of learning potential. DA refers to "an assessment, by an active teaching process, of a child's perception, learning, thinking, and problem solving. The process is aimed at modifying an individual's cognitive function and observing subsequent changes in learning and problem-solving patterns within the testing situation" (p. 6, 2). DA is based on perception of the cognitive system as modifiable beyond barriers of age, etiology, and severity of handicap [1, 2, 32–38]. DA has been motivated by the inadequacy of standardized static tests to provide accurate information about the individual's learning ability, specific deficient functions, metacognitive strategies, mediation strategies that are required for cognitive modifiability, specific learning processes, and specific recommendations for individualized learning plans. DA approach is different from static standardized tests in terms of goals of testing, nature of tasks, test situation, change of test focus from end product to process orientation, and interpretation of results. Cognitive modifiability is measured in most studies by DA, which tap "learning how-to-learn" skills. DA of learning potential is based mainly on Vygotsky's sociocultural theory [7, 8], specifically the *zone of proximal development* concept, Feuerstein's *mediated learning experience* (*MLE*) theory [1] and Tzuriel's DA approach developed in the last four decades [2–5, 35–43]. Unlike *standardized* (*or static*) tests where the examiner presents items to the child and records his/her response without any attempt to intervene, in DA the examiner tries to teach and change the child's performance while observing the amount and quality of changes. The conceptualization behind DA is that it reflects MLE strategies at home more than standardized static measures of intelligence. The MLE strategies used within the DA procedure are more similar to learning processes in other life contexts than do standardized testing methods. They give therefore better indications about learning potential and future changes of cognitive development. For a detailed discussion, the reader is referred to Tzuriel's writings [2, 3, 36–42].

4. MLE and cognitive modifiability: research perspective

The effects of parent-child interaction on cognitive development captured the interest of researchers for several decades [1–8, 14, 19–22, 29, 31, 44–49]. The general hypothesis in studies deriving from the MLE paradigm is that parent-child MLE interactions predict significantly children's cognitive modifiability and that *postteaching* performance on DA is reflecting children's cognitive ability more than *preteaching* performance (i.e., static measure). This hypothesis is based on the idea that adequate parent-child MLE offers children "psychological tools" [7, 8] that serve to expand and differentiate their *zone of proximal development* (ZPD). According to Vygotsky, MLE interactions are more accurate in predicting the upper level of ZPD than static test performance [2]. In the following, the *Observation of Mediation Interaction* scale [13–16] that was used to measure MLE strategies and Tzuriel's DA approach that was used to measure cognitive modifiability are presented. Following these methodological aspects, research that validates the impact of MLE on cognitive modifiability is presented.

4.1. Observation of Mediation Interaction (OMI) scale

Research on MLE processes has been carried out mostly by videotaping of the interaction and analyzing them later by observers using the *Observation of Mediation Interaction* scale (OMI; [14–17]). For instance, when a parent focuses the child's attention on some aspects of a stimulus, it has been coded as *Intentionality* (*focusing*) only if it was *reciprocated* by the child's response. Transcendence (*expanding*) was coded when the mediator tried to generalize a rule, suggest a concept, or a principle that goes beyond the concreteness of the situation. The OMI is based on an interaction "event" that might contain one or more MLE strategies. A basic assumption of the OMI is that MLE processes observed in a seminatural experimental context reflect the spontaneous MLE processes at home; this has been supported in several studies [13–17]. In all studies, dyads of mothers with their children (or peers or siblings) were videotaped in a seminatural context of an adjunct room of the kindergarten, or in the child's home; both places were familiar to children and their mothers. In a free-play condition, sets of games and play materials were placed on the table in a kindergarten room or at home. Mediators were instructed to play in whatever they want with their child for 15 minutes. More specifically, they are instructed to play in a similar way they are used to play at home. In a structured situation, mediators were given a few problems, which they had to teach their child. The tasks in different studies were composed of analogical problems, picture arrangement, and problems requiring logical inference; all tasks *were not* related to the tasks used in the following DA procedure. It should be emphasized that no directions were given as to how to teach the child. The OMI was found as strongly reliable as measured by interrater reliability and as robustly valid in many studies [2–6, 13–22, 29].

4.2. Tzuriel's dynamic assessment approach of learning potential

Tzuriel's DA approach [2–5] with young children is based on both Vygotsky's sociocultural theory and Feuerstein's MLE theory. The assessment approach is characterized by innovations of test materials, assessment procedures adapted for the developmental stages of young

children, clinical and measurement versions of assessment, communication aspects, phases of assessment, and recording and scoring methods.

In all studies reported below, we used a measurement approach according to which pre- and postteaching phases are given without mediation and the child's responses are scored; a short-term mediation phase is given between the tests. In the following, an example of a DA measure of young children, the *Children's Analogical Thinking Modifiability* (CATM; [43]) is presented. For further description of Tzuriel's DA measures, readers are referred to Tzuriel [2–5].

The CATM (see **Figure 2**) is composed of three phases of teaching: preteaching, teaching, and postteaching. Each phase is composed of analogies increasing in level of difficulty. The operation of analogy was chosen as it has been considered as a powerful operation that covers a wide range of cognitive processes and as a principal operation related to problem-solving tasks and academic activities [50–53]. The CATM test is composed of 14 items for each of the preteaching, teaching, and postteaching phases. The test materials include 18 colored blocks used to present and solve the analogies, and problem cards for the examiner. The problems are graduated in level of difficulty. The advanced problems require a relatively higher level of abstraction and cognitive functions such as systematic exploratory behavior and simultaneous consideration of a few sources of information. In item 13, for example (**Figure 2**), the child must compare the colors in the first pair of the problem, grasp the principle of opposite position of colors, apply the same principle in the second pair, and then compare the relations of shape and size in the first pair and apply the same relations in the second pair. As can be seen in **Figure 2**, the relation of colors is opposite in the first pair: **top**-yellow changes to **bottom**-yellow and **bottom**-red changes to **top**-red. The child must apply the rule of opposite colors to the second pair: **top**-blue changes to **bottom**-blue and **bottom**-yellow changes to **top**-yellow. After finding the correct colors, the child can analyze the relations for the other two dimensions of shape and size. In the teaching phase, the child is mediated to (a) search for relevant dimensions required for solution, (b) understand transformational rules of analogy, (c) use systematic exploratory behavior, (d) verbally anticipate the answer, and (d) improve search efficiency. There are two scoring methods: "all-or-none" (e.g., a score of 1 to full answer) or "partial credit" (e.g., a score of 1 for each correct dimension of color, shape, and size).

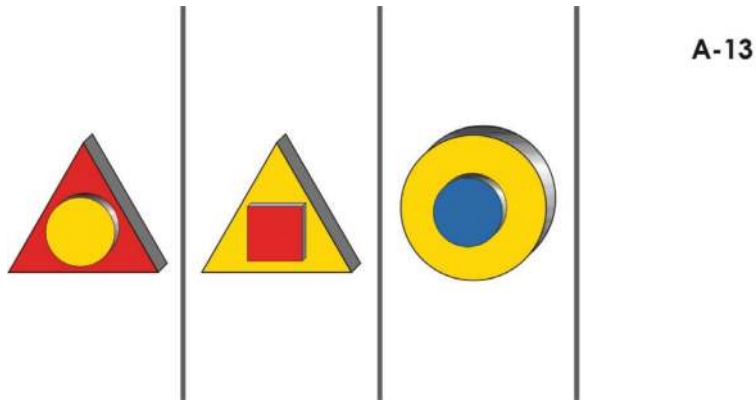

Figure 2. Example problem from the *Children's Analogical Thinking Modifiability* [43] (by permission of the author).

4.3. The effects of MLE strategies on cognitive modifiability

The general hypothesis in studies deriving from the MLE theory is that parent-child MLE is more accurate in predicting the cognitive modifiability of the child (i.e., postteaching score) than a static test score (i.e., preteaching score). This hypothesis is based on Vygotsky's theory [7, 8] that proper mediation affords children "psychological tools" that serve to expand their *zone of proximal development* (ZPD). Therefore, the upper level of ZPD measures would be more accurate as a predicted outcome of MLE interactions than static test performance [2]. In a series of studies carried out at Bar-Ilan University laboratory by Tzuriel [2–5, 38], it was demonstrated that MLE strategies directly explain cognitive modifiability of children as measured by DA instruments. In the following, studies demonstrating the relation between parent-child MLE interactions and cognitive modifiability are presented. Because of space limitation, only two example studies are presented.

The main objective of the studies reported below was to validate the relationship between MLE processes and children's cognitive modifiability and support the main hypothesis that the proximal factor of MLE is a causal factor that explains cognitive modifiability. Another objective was to find out which specific combination of MLE strategies predicts children's cognitive modifiability. A summary of findings is presented in **Table 1**.

A major finding repeated in almost all studies was that children's postteaching scores on DA measures were better predicted by MLE mother-child interactions than by static test scores (or preteaching DA scores). Because of space limitations, only two studied are reported here [20, 21]. The most striking finding emerging from **Table 1** is that in 10 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.

Study 1. In the first study, a sample of kibbutz mother-child dyads (n = 47) was observed in a free-play situation for 20 minutes [20]. The kibbutz young children (22 boys and 25 girls, age range = 4:7–7:8 years) were then administrated the *Raven Colored Progressive Matrices* (RCPM) [54] and the *Children's Inferential Thinking Modifiability* test [40]. Performance on the CITM provides three types of scores: preteaching, postteaching, and gain. The data were analyzed by three stepwise regression analyses, one for each score. In each analysis, the RCPM and MLE-Total scores were assigned as predicting variables. The findings, presented schematically in **Figure 3**, revealed a very interesting pattern of prediction. The preteaching (static) score was predicted only by the RCPM ($R = 0.40$, $p < 0.004$). The postteaching score was predicted by both MLE-Total and RCPM ($R = 0.69$, $p < 0.002$). The gain score was predicted only by MLE-Total score ($R = 0.43$, $p < 0.001$). The interpretation of this progression of prediction was as follows. The preteaching score, which is a static score, was predicted only by the RCPM, which is also a static score. This finding settles with the notion 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 score). The postteaching score is presumably composed of two components: the previously acquired inferential skills (manifested in preteaching performance) and what has been learned as a function of mediation provided in the teaching phase. It is therefore reasonable to assume that the first component (postteaching score) was attributed to the static RCPM score and the second component (postteaching score) to

Study	Grade	Age	n	Sample	Dyad	DA tests	Analysis	MLE strategies
1. Tzuriel and Eran [20]	K	5–6	47	Typical	M-C	CITM	Regression	MLE-Total
2. Tzuriel and Ernst [21]	K	5–6	48	Typical	M-C	CATM	SEM	Transcendence
3. Tzuriel [60]	K	5–6	48	Typical	M-C	CATM	Regression	MLE-Total competence
4. Tzuriel and Weiss [26]	2	7–8	54	Typical	M-C	CITM	SEM	Transcendence regulation
5. Tzuriel and Hatzir [61]	K	5–6	60	Typical	M-C + F-C	CATM CF	Regression	Transcendence intentionality and reciprocity
6. Weitz and Tzuriel [62]	3–4	5–8	56	LBW + NBW	M-C	CATM CF	Regression	Transcendence regulation
7. Tzuriel and Weitz [28]	3–4	9–10	85	LBW + NBW	M-C	CMB CF	Regression	Transcendence
8. Tzuriel and Shomron [25]	2–4	7–10	100	LD	M-C	CMB	SEM	Transcendence
9. Tzuriel and Bettan [27]	K	5–6	72	ADHD	M-C	CMB	SEM	Transcendence
10. Tzuriel and Rokach [31]	3–6	8–12[a]	90	Typical	Siblings	CMB	SEM	Transcendence
11. Tzuriel and Caspi [19]	3	8–9[a]	100	Typical	M-C + Peers	CMB STI	MANOVA Regression	Transcendence
12. Tzuriel, Rotem and Kashy-Rosenbaum [63]	K	5–6	100	Typical	M-C + T-C	CATM	ANOVA Regression SEM	Transcendence

[a]Age of older sibling.

Reading: LBW = low birth weight, NBW = normal birth weight; LD = learning disabled; ADHD = attention deficit hyperactive disorder; SEM = structural equation modeling; 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* (Analogies Subtest); CF = *Complex Figure*; STI = *Seria-Think Instrument*.

Table 1. Studies on MLE strategies and cognitive modifiability: sample characteristics, DA measures, analyses used, and MLE strategies (partially adapted from Tzuriel [5], with permission of the publisher).

the mother-child MLE score. Analysis of the gain score was significantly predicted only by mother-child MLE score. This increasing pattern of progression of prediction 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"* ([2], p. 155).

Study 2. In this study [21], we observed a sample of kindergarten children (n = 48) and their mothers in free-play and structured (teaching) conditions and tested the children with the

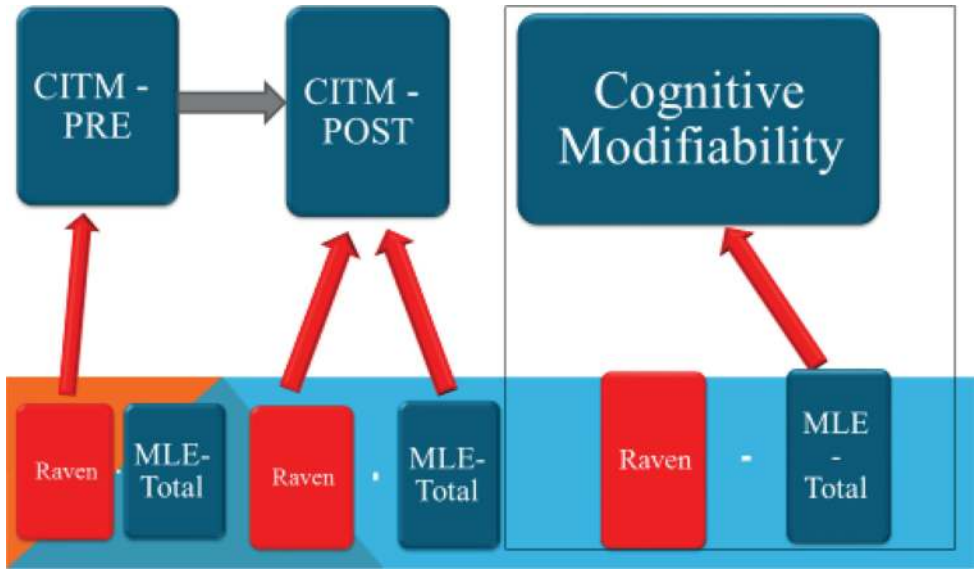

Figure 3. Prediction of CITM preteaching, CITM postteaching, and cognitive modifiability by Raven's score and total MLE score.

CATM test (see above). Mothers' socioeconomic status (SES) and intelligence measured by *Raven's Standard Progressive Matrices* (RSPM) [55] were considered as distal factors, MLE strategies as proximal factors, and CATM postteaching score as indicator of cognitive modifiability. Children's performance on the RCPM and the CATM preteaching scores were introduced as static test scores for comparison with the CATM postteaching score. The findings, analyzed by *structural equation modeling* (SEM, see **Figure 4**), show that the MLE strategy of Transcendence significantly predicted the CATM postteaching score and the MLE strategy of Meaning predicted the preteaching score. The children's RCPM score did not predict or was not predicted by any of the variables. None of the distal factors of mother's SES or intelligence predicted cognitive modifiability (i.e., CATM postteaching). The authors interpreted the findings as supporting the MLE theory regarding the causal effects of distal and proximal factors (MLE) on cognitive modifiability. Furthermore, the contribution of the *specific MLE strategy* could be attributed to the phase of testing. The prediction of CATM preteaching score by mediation of Meaning, which includes labeling of information, was interpreted as signifying the importance of verbal labeling of information in first encounters with analogy problems such as the CATM preteaching problems. On the other hand, the prediction of CATM postteaching score by mediation for Transcendence (expanding) indicates the significance of learning of abstract rules, cognitive strategies, and principles such as those mediated in the teaching phase and later assessed in the postteaching phase. Thus, children whose mothers used high level of mediation for Meaning internalized this mechanism of mediation and therefore performed better on the preteaching phase. Children whose mothers used a high level of mediation for Transcendence internalized this specific mechanism and used it later in other learning contexts. These results support the "specificity" [56] of the MLE strategies as predictors of cognitive outcomes.

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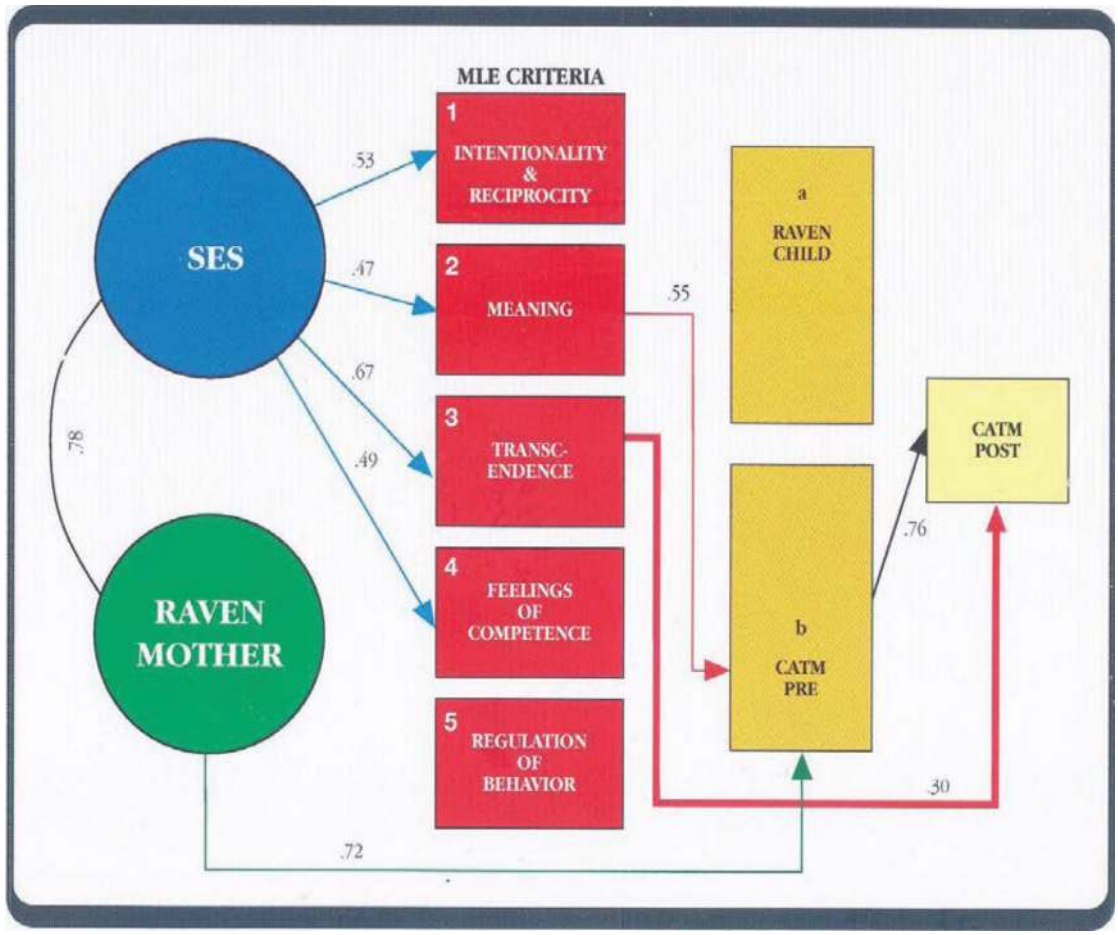

Figure 4. Structural equation model analysis: the effects of distal factors (mothers' socioeconomic level and intelligence) and proximal factors (MLE strategies) on children's cognitive modifiability (copied by permission from Tzuriel and Ernst [21]).

The SEM analysis approach was applied in a series of seven studies [19–22, 29, 31, 25–28]. In all studies, we established the theoretical model of the effects of distal and proximal factors on cognitive modifiability. The overall results of the SEM analyses 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, mother's intelligence, child's personality, mother's acceptance-rejection of the child) do not have a direct effect on children's cognitive modifiability, although they do explain some of the MLE strategies (proximal factor).

In contradiction to the MLE theory, in two studies, distal factors were found as directly predicting cognitive modifiability; the samples in both studies were composed of children with learning and behavioral difficulties. For example, in a study carried out on kindergarten children with ADHD [51], two MLE strategies, Meaning ($\beta = 0.26$) and Transcendence ($\beta = 0.46$), predicted cognitive modifiability. Two distal factors severity of the ADHD ($\beta = -0.26$) and mother's SES level ($\beta = 0.46$) explained directly children's cognitive modifiability; these findings do not correspond

the MLE theory. These findings indicate that the higher the severity of the child's ADHD and the lower the mother's SES level, the lower the cognitive modifiability of the child. Similarly, in Tzuriel and Shomron's [25] study on children with learning disability (LD), one distal factor *Home Environment* (HOME [47]) explained directly children's cognitive modifiability ($\beta = 0.60$) together with a summed score of four MLE strategies ($\beta = 0.41$). These findings indicate that for children experiencing learning difficulties, the distal factors influence directly the child's cognitive modifiability. It is possible to explain these findings by the fact that in samples of children with learning difficulties (e.g., ADHD, LD), even adequate mother-child mediation is not sufficient to overcome or "nullify" the distal factors' strength of predicting children's cognitive modifiability. It should be emphasized that mothers of children with learning difficulties had no prior training for mediation. We assume that training of mothers to use better MLE strategies in their spontaneous interaction with their children would reduce significantly the effects of the distal factors on children's cognitive modifiability. These findings offer an elaboration of the MLE theory. The effects of distal factors on children's cognitive modifiability in samples of typically developing children are not direct (as conceptualized by the theory), whereas in samples of children with learning difficulties, distal factors have direct effects on children's cognitive modifiability unless a more intensive level of mediation is applied. An intensive use of MLE strategies would minimize the effects of the distal factors. Enhancement of MLE strategies is essential to ameliorate the direct effects of distal factors on cognitive modifiability.

This modification of the MLE theory should be investigated in intervention studies where mothers of children with learning difficulties will be trained to use MLE strategies. We suggest that mothers trained to mediate (experimental) would be compared with nontrained mothers and their interactions with their children should be observed a year later after the effects of training are internalized and assimilated into the mother-child interactional system. The children should then be administered DA measures to assess their cognitive modifiability. My hypothesis is that distal factors will directly affect children's cognitive modifiability among nontrained mothers but will be significantly lower or disappear among trained mothers.

5. Discussion and conclusions

The empirical findings of studies on the effects on mother-child MLE strategies on children's cognitive studies support both commonsense knowledge and the MLE theory. MLE strategies used spontaneously in family interactions seem to facilitate the child's ability to benefit from mediation offered within the family context and later to generalize to other formal and nonformal learning situations. An intriguing finding that has emerged consistently in most studies is that cognitive modifiability was predicted most powerfully by mediation for Transcendence (expanding) (**Table 1**). The effect of mediation for Transcendence is articulated in view of the fact that it is the least frequent strategy. Mediation for Transcendence is expressed by the mediator's efforts to focus the child on concepts, generalizations, and principles, thus developing his/her abstract abilities.

The findings that distal factors in samples of children with learning difficulties [25, 27] directly predict children's cognitive modifiability might indicate a need to modify or refine the MLE theory.

The distal factors were found as predictors of the proximal factor of MLE strategies in typically developing children, but they do not predict children's cognitive modifiability. The MLE strategies in turn do predict children's cognitive modifiability. However, in samples of children experiencing learning difficulties, the distal factors (adverse conditions) were found to affect directly children's cognitive modifiability. It was suggested that to cancel or overcome the adverse effects, much more "robust" mediation efforts should be applied. The effects of the distal factors on children's cognitive modifiability would diminish should mothers be trained to mediate.

I suggest refining the MLE theory and extend the concept of MLE to include it within a more complex transactional-ecological model. We should reconsider the reciprocal nature of MLE and cognition within a broader scope of environmental factors, as well as dealing with the MLE processes as one component within a holistic framework. This is especially important because of the menace of overextending the influence of MLE processes and overgeneralizing it to explain too many cognitive and noncognitive phenomena. It is imperative to establish the conceptual limits of MLE theory and delineate its specific effects. The term "transactional" (rather than interactional) is aimed at the idea that MLE processes and cognitive functioning are reciprocal and have mutual effects. Wachs and Plomin [57] distinguish between interaction and transaction. Interaction involves individuals differentially reacting to similar environments, whereas transaction implies effects that are differential for both individuals and environments. A different distinction was suggested by Tzuriel [2, 5]. Interactional process is conceptualized by relative simplicity and transience of effects, whereas a transactional process is dialectically *circular* with a continual change and mutual adjustment of the factors involved. This dialectical circularity poses a real challenge for theory development and methodology, but with recent advances in technology and sophisticated statistical analyses, it can be handled effectively. There is a possibility though that the children's cognitive functioning might influence parent-child MLE strategies and that the circular relation between these factors depends on wider family, social, and cultural contexts. A similar conception has been discussed in Bronfenbrenner's [59] ecological approach and by Super and Harkness [58], who proposed 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 [13–16, 19–22, 25–28]. In addition to cognitive aspects, we should consider children's affective and motivational processes as prerequisite factors in determining the nature of MLE processes and children's cognitive modifiability.

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Author details

David Tzuriel

Address all correspondence to: david.tzuriel@biu.ac.il

School of Education, Bar-Ilan University, Ramat Gan, Israel

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