The effects of mother-child mediated learning strategies on psychological resilience and cognitive modifiability of boys with learning disability

David Tzuriel1* and Vered Shomron1,2

1Bar Ilan University, Ramat Gan, Israel
2Kibbutzim College of Education, Tel Aviv-Yafo, Israel

Background. The theoretical framework of the current study is based on mediated learning experience (MLE) theory, which is similar to the scaffolding concept. The main question of the current study was to what extent mother–child MLE strategies affect psychological resilience and cognitive modifiability of boys with learning disability (LD). Secondary questions were to what extent the home environment, severity of boy’s LD, and mother’s attitude towards her child’s LD affect her MLE strategies and consequently the child’s psychological resilience and cognitive modifiability.

Aims. The main objectives of this study were the following: (a) to investigate the effects of mother–child MLE strategies on psychological resilience and cognitive modifiability among 7- to 10-year-old boys with LD, (b) to study the causal effects of distal factors (i.e., socio-economic status [SES], home environment, severity of child’s LD, mother’s attitude towards LD) and proximal factors (i.e., MLE strategies) on psychological resilience and cognitive modifiability.

Methods. A sample of mother–child dyads (n = 100) were videotaped during a short teaching interaction. All children were boys diagnosed as children with LD. The interaction was analysed for MLE strategies by the Observation of Mediation Interaction scale. Children were administered psychological resilience tests and their cognitive modifiability was measured by dynamic assessment using the Analogies subtest from the Cognitive Modifiability Battery. Home environment was rated by the Home Observation for Measurement of the Environment (HOME), and mothers answered a questionnaire of attitudes towards child’s LD.

Results. The findings showed that mother–child MLE strategies, HOME, and socio-economic level contributed significantly to prediction of psychological resilience (78%) and cognitive modifiability (51%). Psychological resilience was positively correlated with cognitive modifiability (Rc = 0.67). Structural equation modelling analysis supported, in general, the hypotheses about the causal effects of distal and proximal factors of psychological resilience and cognitive modifiability.

Conclusion. The findings validate and extend the MLE theory by showing that mother–child MLE strategies significantly predict psychological resilience and cognitive modifiability among boys with LD. Significant correlation between psychological resilience and cognitive modifiability calls for further research exploring the role of MLE strategies in development of both.

*Correspondence should be addressed to David Tzuriel, School of Education, Bar Ilan University, Ramat Gan, Israel 5290002 (email: David.Tzuriel@biu.ac.il).

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Over the past two decades, researchers have identified a range of emotional and mental health issues that affect children with learning disability (LD) at a higher rate than their peers (e.g., Bender, Rosenkrans, & Crane, 1999; Ofiesh & Mather, 2013; Wallander, Dekker, & Koot, 2006). However, some researchers showed that many individuals with LD demonstrate positive developmental paths and grow up to lead successful lives (e.g., Raskind, Goldberg, Higgins, & Herman, 1999, 2002). Almost all researchers suggest that specific aspects of family functioning may act as a protective buffer in mitigating the adverse effects of LD and enhancing psychological resilience (e.g., Goldstein & Brooks, 2013; Leone, Dorstyn, & Ward, 2016; Luthar & Brown, 2007; Margalit, 2004; Margalit & Ankonina, 1991; Peer & Hillman, 2014; Piers & Duquette, 2016; Rolland & Walsh, 2006; Rutter, 2006; Walsh, 2003, 2006).

Psychological resilience is defined as ‘a dynamic process encompassing positive adaptation within the context of significant adversity’ (Luthar, Cicchetti, & Becker, 2000, p. 543). Resiliency reflects both the relative inner strength of individuals and any external protective processes provided by social systems (e.g., family cohesion, open communication in the family, peers’ positive interactions) in relation to the impact of risks and vulnerabilities (e.g., Masten & Coatsworth, 1998; Werner & Smith, 1992). Walsh (2003) suggested a model of family resilience framework referring to three overarching family functioning domains: belief systems (e.g., spirituality, making meaning of adversity, optimistic perspective); organizational patterns (e.g., supportive interpersonal relationships, effective social networks, economic resources); collaborative communication; and problem-solving. Partial support of this model was reported in a study of mothers of children diagnosed with an autism spectrum disorder, intellectual disability, and specific learning or communication difficulty (Leone et al., 2016). Similar findings were reported by Piers and Duquette (2016) in a qualitative study on students with LD. The ‘ingredients’ for development of psychological resilience included students’ awareness and acceptance of their disability and of themselves as learners, self-advocacy skills they needed to seek out for supports, the ability to set lofty yet attainable goals, perseverance to work towards these goals, and willingness to use available resources.

The premise of the current study is that LD constitutes a risk factor (Ofiesh & Mather, 2013; Vaughn & Elbaum, 1999) and that scaffolding (e.g., Wood, Bruner, & Ross, 1976) or mediated learning experience processes (MLE, Feuerstein, Feuerstein, Falik, & Rand, 2002; Feuerstein, Krasilovsky, & Rand, 1978) within the family system (e.g., Fenning & Baker, 2012) or school system (e.g., Wyman et al., 2010) serve as a protective factor in development of psychological resilience (Tzuriel, 1999). Another premise is that MLE processes significantly facilitate the development of cognitive modifiability (Tzuriel, 1999, 2001, 2013; Tzuriel & Caspi, 2017). 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’ (Tzuriel, 2013, p. 60). Psychological resilience and cognitive modifiability are conceived as intimately related constructs determined by MLE processes.

In the following parts of the introduction, we discuss the school effects on psychological resilience of children with LD, parental attitudes towards child’s LD, the effects of scaffolding in parent–child interactions on cognitive development and psychological resilience of children with LD, the effects of MLE strategies on cognitive modifiability and psychological resilience, the similarities and differences between scaffolding and MLE constructs, and finally the effects of home environment on psychological resilience.
School effects on psychological resilience of children with LD

Children with LD are more vulnerable to adverse developmental outcomes because of the difficulties associated with cognitive impairments (e.g., Maag & Reid, 2006; Montague, Enders, Dietz, Dixon, & Cavendish, 2008; Wilson, Deri Armstrong, Furrie, & Walcot, 2009). Research concerning students with LD shows increased levels of anxiety and depression during the public-school period (e.g., Mugnaini, Lassi, La Malfa, & Albertini, 2009; Nelson & Harwood, 2011; Sideridis, 2007), though for many the clinical symptoms do not reach clinically significant levels (Maag & Reid, 2006; Nelson & Harwood, 2011). Lack of support of children with LD can cause additional processing problems especially with attention, working memory, and executive functioning (Eysenck, Derakshan, Santos, & Calvo, 2007). Because of daily ungratifying experiences, their feelings of competence usually diminish and they gradually lose their psychological resilience. They frequently perceive simple neutral comments of teachers (i.e., ‘can’t read’) as negative and accusatory (Goldstein & Brooks, 2013). These comments can cause disappointment, increase vulnerability, and contribute to feelings of incompetence and inadequacy. Another factor is the feedback they get from peers. They are often humiliated when comparing their academic performance to that of their classmates. They feel very often like impostors worried about exposure, and the wounds caused by early experiences never heal (Salza, 2003; Shessel & Reiff, 1999). They may experience problems with peer acceptance and are more neglected and rejected than typically developing students (Kuhne & Wiener, 2000). Lack of peer acceptance may partially result from perceiving them as having limited interpersonal understanding (Kravetz, Faust, Lipshitz, & Shalhav, 1999; Elliot & McKinnie, 1994; Vaughn & Haager, 1994) and difficulties in comprehending and using language and reading social cues (Morrison & D’Incau, 1997; Voeller, 1991).

Parental attitudes towards child’s LD

Parents’ emotional reactions towards their child’s LD may vary according to severity of the LD, cultural background, knowledge about the disability, belief and religious system, socio-economic status, and other factors. Parents may reveal a myriad of emotional reactions such as denial, guilt, anger, child’s rejection, and depression. Ultimately, parents must accept the child with LD and start developing coping mechanisms. Acceptance requires knowledge about the disability, and communication with the child, other family members and educational agents (Wallace & McLoughlin, 1988). Effective family functioning and family support and involvement were found as essential for successful adaptation of young adults with LD (e.g., Goldberg, Higgins, Raskind, & Herman, 2003; Hartzell & Compton, 1984). In the current study, we focused on mothers’ attitudes towards the child’s LD as reflected in her perception of the (a) difficulties caused to the family well-being, (b) child’s acceptance, and (c) treatment of the disability.

The effects of scaffolding in parent–child interactions on cognitive development and psychological resilience of children with LD

The concept of scaffolding coined first by Wood et al. (1976) is based on Vygotsky’s (1978) theory. Scaffolding refers to supportive strategies adults use to guide children in solving cognitive problems. This concept has been used frequently to describe the kinds of instructional interactions that take place in informal educational contexts, such as parent–child interactions. Parents’ scaffolding of their children’s problem-solving is characterized by providing cognitive support, relocating responsibility to the child when he or she can
manage the task independently, and motivating the child to complete the task (Bruner, 1985; Rogoff, 1990). Scaffolding of children’s problem-solving behaviour at home may affect children’s reasoning and behaviour in the new social contexts of the kindergarten or school. Rogoff and Wertsch (1984) and Stone (1998) developed this concept further in describing an internalization process from other regulation to self-regulation. Successful scaffolding requires establishing ‘intersubjectivity’, or a shared understanding of the task (e.g., Rogoff, 1990). In a recent study on the effects of maternal scaffolding, it was found that the quality of home stimulation and maternal scaffolding mediated the intervention effects on cognitive skills at age 4 (Obradovic, Yousafzai, Finch, & Rasheed, 2016). Maternal scaffolding and mother–child dyadic pleasure each uniquely predicted reduced likelihood of later diagnosis of intellectual disability, beyond the contributions of children’s early developmental level and behavioural functioning (Fenning & Baker, 2012). These two factors were found to determine psychological resilience as reflected in adaptive behaviour. Parental scaffolding was found to be a culturally related behaviour; clear connection was reported between culture and mothers’ selection of scaffolding strategies in relation to the activity type with the child and the child’s level of competence (e.g., Aboud & Akhter, 2011; Kermani & Brenner, 2000).

While most research with children was focused on cognitive outcomes of scaffolding (e.g., Mattanah, Pratt, Cowan, & Cowan, 2005; Pratt & Savoy-Levine, 1998), some research refers as well to non-cognitive behaviours such as children’s behaviour problems, attention, help seeking, work habits, conceptual knowledge, and academic competence (e.g., Stright, Neitzel, Sears, & Hoke-Sinex, 2001). Stright, Herr, and Neitzel (2009) reported a study on maternal scaffolding of children’s problem-solving and children’s adjustment in kindergarten in Hmong families living in the United States. Mothers’ scaffolding of their children’s problem-solving predicted their children’s reasoning skills, conscientiousness, and autonomy the next year in kindergarten. These findings were explained by an internalization model: that is, maternal cognitive support during scaffolding provides a model for the child’s own reasoning. Maternal scaffolding appears as effective in predicting several factors in children with identified developmental delays such as language development (Warren & Brady, 2007), increased independence in everyday activities (Hauser-Cram et al., 1999), better problem-solving (Hauser-Cram, 1996), social–emotional adaptation (Baker, Fenning, Crnic, Baker, & Blacher, 2007; Hauser-Cram et al., 1999), and children’s psychological resilience (Fenning & Baker, 2012).

The effects of MLE strategies on cognitive modifiability
MLE interactions are defined as a process in which parents or other mediators interpose themselves between a child and sources of stimulation and modify the stimuli for the developing child (Feuerstein et al., 1978, 2002). ‘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’ (Feuerstein et al., 1978, p. 206). Parents are conceived of as active-modifying agents in directing and shaping the child’s development. In mediating the world of stimuli to the child, parents may use different strategies (i.e., focusing, alerting the child’s attention, changing the stimulus frequency, order, and intensity, relating it to familiar contexts, regulating the order and timing of its sequence). Adequate mediators relate also to the child’s motivational aspects by arousing the child’s attention, curiosity, and vigilance, focusing him or her on relevant aspects of the situation, and by providing meanings to neutral stimuli. From a cognitive perspective, adequate mediation facilitates development.
of cognitive functions. The MLE processes are gradually internalized by the child and become an integrated mechanism of change in the future. As the child develops internalized self-mediation strategies, the parents gradually withdraw from the situation and allow the child more autonomy in implementing the acquired strategies. Adequate MLE interactions facilitate the development of various cognitive functions, learning sets, mental operations, strategies, reflective thinking, mental flexibility, and need systems. MLE processes within the family are determined by a myriad of factors such as parents’ awareness of the importance of mediation, children’s cognitive abilities, motivational orientation (e.g., intrinsic motivation), emotional needs (e.g., security, trust) behavioural tendencies (e.g., hyperactivity), stimulus characteristics (e.g., task complexity), and situational conditions (e.g., time pressure).

Lack of MLE may be derived from a broad category of lack of environmental opportunities for mediation. In this case, lack of or limited mediation derives from parents’ low educational level, lack of parents’ awareness to the importance of mediation, traumatic or adverse life events, and lack of knowledge and/or sophistication in using MLE strategies. Another broad category is physical or mental inability of the child to benefit from mediational interactions, which are potentially available. For example, children might suffer from inner physical barriers and/or LD that limit them from registering mediation offered to them.

Feuerstein et al. (2002) suggested 12 strategies of MLE. However, only the first five were operationalized in studies of infants and young children (e.g., Klein, 1988; Klein, Weider, & Greenspan, 1987; Litz, 1996; Tzuriel, 1996; Tzuriel, 1999, 2001, 2013; Tzuriel & Eran, 1990; Tzuriel & Ernst, 1990; Tzuriel & Weiss, 1998; Tzuriel & Weitz, 2008) and in studies on peer mediation (e.g., Shamir & Tzuriel, 2004; Tzuriel & Caspi, 2017; Tzuriel & Shamir, 2007; Tzuriel & Shamir 2010) and siblings (e.g., Klein, Zarur, & Feldman, 2003; Tzuriel & Hanuka-Levy, 2014). These MLE strategies are described here briefly. In the current study, we use only the MLE strategies that were empirically operationalized.

a) **Intentionality and Reciprocity** (focusing) is an interaction characterized by efforts of the mediator to create in the child a state of vigilance, and to facilitate an efficient registration of the information (input phase), an adequate processing of the information (elaboration phase), and accurate expression of the outcome (output phase). The reciprocity component is of crucial importance to the quality and continuation of the mediation process as the mediator changes and tunes up the nature of mediation based on the child’s response. Intentionality and reciprocity is observed, for example, when the parent focuses the child’s attention on a specific aspect of a drawing, highlighting its specific features, and sensitively waiting and even modifying the child’s response. An important outcome of intentionality is when the child reciprocates with a relevant response.

b) **Mediation of Meaning** (affecting) refers to interactions in which the mediator emphasizes the significance and value of an object or event, labelling it and expressing interest. This is carried out by expressing affect (‘Wow, how beautiful’) and by pointing to its importance and value (‘I got this present from my late grandpa on our trip’). The significance of a stimulus can be conveyed non-verbally (e.g., facial expression, tone of voice) or verbally (e.g., explaining a current event).

c) **Mediation for Transcendence** (expanding) is characterized by going beyond the concrete context or the immediate needs of the child, by reaching out for principles, rules, and/or goals that are not bound to the ‘here and now’ or the specific and concrete aspects of the situation (e.g., ‘The word “octopus” derives from the Latin
Mediation of transcendence occurs either in spontaneous family contexts (e.g., eating, bathing, playing, fighting) or structured teaching contexts.

d) **Mediation of Feelings of Competence** refers to the mediator’s verbal and non-verbal reward and by attempts to arrange the environment to ensure the children’s success. For example, the mediator may interpret the environment in a manner which conveys successful functioning and reorganize the environment to ensure opportunities for success, to explain the reasons for successes (and failures), and to reward the child for attempts to master the situation and cope with it effectively, even when the outcome is not successful.

e) **Mediation for Self-Regulation of Behaviour** refers to regulation of the child’s responses, depending on the task demands. It is carried out by either inhibiting impulsive tendencies, or by accelerating inefficient slow behaviour. Self-regulation is of critical importance in helping the child register information accurately, in delaying needs for immediate gratification, and pace the inner rhythm of response as a function of task demands. Mediation of regulation of behaviour affects the whole process of mental activity in input, elaboration, and output phases of the mental act.

**The effect of MLE strategies on psychological resilience**

MLE theory encompasses both cognitive and emotional aspects of human development, though it has been focused traditionally on enhancement of cognitive development. In the current study, we extend the MLE theory in a novel way by suggesting the hypothesis that adequate MLE strategies help individuals to develop psychological resilience skills. For example, an internalized mediation for meaning provides children with a tendency to cope with adverse situations by searching for meaningful interpretations of the situation. An internalized mediation for transcendence helps children, confronting negative, chaotic, and baffling events to make attempts to transcend the negative concrete aspects of the event in striving to find rules and order within the confusing chaotic information. Internalized mediation for self-regulation and feelings of competence help children to control impulsive behaviour and develop self-efficacy considered to be an important factor for psychological resilience (e.g., Amitay & Gumpel, 2015). Cognitive modifiability and psychological resilience are conceived as dynamic processes characterizing the individual’s ability to adjust to new situations. Both factors are intrinsically affected by MLE processes, which are a common corresponding factor (Sinnott, 1981).

**The effects of home environment on psychological resilience of children with LD**

Many studies show the effect of home environment on children’s cognitive development (e.g., Murray & Yinling, 2000) and psychological resilience (e.g., Steinberg & Sheffield-Morris, 2001; Ungar, 2012). Coping with LD is related to parents’ awareness of the difficulties of raising up a child with LD, provision of support among family members, encouragement of personal growth, and active coping style (Margalit & Ankonina, 1991). The presence of environmental resources and especially home environment has been repeatedly shown to be crucial for the child’s psychological resilience and cognitive development (e.g., Dyson, 2003; Naglieri, Goldstein, & LeBuffe, 2010; Pearson & Chan, 2003). In the current study, we focus on two main variables: home environment and maternal acceptance of the child’s LD (see above); both are hypothesized to affect psychological resilience and cognitive modifiability of the child with LD.
Scaffolding and MLE strategies: similarities and differences

There are similarities and differences between the conceptual frameworks of scaffolding and MLE. Both derive from theories that emphasize the importance of sociocultural determinants of child development, the crucial role of socialization agents, and rejection of the dichotomy between cognition as a natural process and instruction as a cultural process (Kozulin, 2002). Like the scaffolding concept, in MLE the mediator uses specific strategies (see above) to guide, temporarily, the learner to internalize the information. Once the learner makes progress, and demonstrates autonomous functioning, the mediator withdraws and gives the child space to work independently. According to both approaches, the intervention is dynamic, finely tuned, and adapted to the learner’s ongoing progress and contingent responsivity. The mediation-scaffolding strategies used by the mediator strongly depends upon the task characteristics (e.g., abstraction level), learning context (e.g., level of structure, social-individual), and the learner’s progress (e.g., slow–fast). However, unlike scaffolding concept, MLE theory and its derived formulated strategies are conceived as more comprehensive, detailed, and directed towards operational behavioural referents (see below). Unlike MLE strategies which have been operationalized and used consistently by researchers (Klein, 1996; Lidz, 1991, 1996; Tzuriel, 1999, 2001, 2013), there is no consensus regarding the operationalization of scaffolding (Stone, 1998). For further analysis of the similarities and differences between Vygotsky’s and Feuerstein’s theories, see Kozulin (2002) and Tzuriel (2001).

Method

Sample

The sample was composed of boys (n = 100) with LD and their mothers (n = 100). All children were born in Israel and studied in integrative classes in grades 2 (n = 29), 3 (n = 37), and 4 (n = 34). The sample was drawn from 13 urban schools (age range = 7.1–10.2 years; M = 8.54, SD = 0.83) in the central region of Israel. All children had a formal psychological educational diagnosis of LD and came from inclusive classes in regular schools. Children’s level of intelligence and severity of LD was rated based on portfolios of formal intelligence and psychological-didactic tests given to children to establish their diagnosis (40% of all assessments did not include quantitative results but rather general verbal assessment). To establish standardization of evaluation, we asked two independent experts to rate the children on three scales of intelligence (general, verbal, and performance) and on severity of LD. The inter-rater agreement on these scales ranged between 92% and 100%. The children came from heterogeneous socio-economic backgrounds. Mothers’ education level was as follows: higher education n = 33%, secondary school = 41%, primary school = 26%. Thirty percentage of the mothers had no occupation, 35% had professional occupations, and 35% had simple profession (e.g., janitor).

Measures

Observation of mediated interaction (OMI)

operationalized in terms of mutually exclusive specific behaviours. The five MLE strategies are outlined in the introduction section above.

**Intentionality and Reciprocity** (e.g., focusing) is coded whenever a sequence of acts is directed towards achieving a change in the learner’s perception or response to the environment. This strategy includes three behavioural categories: verbal, non-verbal, and combined (verbal + non-verbal). A verbal behaviour is coded whenever the mediator shows a verbal attempt to catch the learner’s attention, using words or sounds. Non-verbal behaviour is coded whenever there was an action, facial expression, pointing, and body movements (e.g., touching, clapping hands). Combined verbal and non-verbal is coded whenever verbal and non-verbal categories occur simultaneously and coordinated in one action. Reciprocity is determined by clues indicating contact (e.g., eye contact, touching, speaking), motor activity, or any other response from the learner. Behaviours of parents and children are coded in relation to the other’s behaviours and the meaning conveyed through these behaviours. **Mediation for Meaning** (e.g., affect) is coded when a parent labelled an object or event or shows emotional signs (e.g., excitement), or a combination of both. **Mediation for Transcendence** (e.g., expanding) is coded whenever the parent made an attempt to generalize a rule, suggests a concept, or a principle that goes beyond the concreteness of the situation, regardless of the specific content being conveyed. **Mediation for Feelings of Competence** is coded whenever the parent rewarded the child for success, interpreted to the child his or her own success or shows signs of joy for the child’s success or attempt to succeed. **Mediation for Self-Regulation** is coded whenever the parent monitors the child’s behaviour either by sequencing the objects, alerting the child for difficulties, pacing the child’s tempo of behaviour and inhibiting impulsivity. Usually, the interaction is videotaped and analysed later by trained observers. The basis of the OMI system is an interaction ‘event’ that might contain one or more MLE strategies. One of the basic assumptions behind the OMI is that observation of MLE processes in a familiar physical environment context reflects the spontaneous MLE processes at home. This assumption has been supported in several studies (e.g., Klein, 1988; Klein & Aloni, 1993).

The OMI has been used in a wide range of studies (e.g., Isman & Tzuriel, 2008, 2016; Tzuriel & Eran, 1990; Tzuriel & Ernst, 1990; Tzuriel & Weiss, 1998), and satisfactory inter-rater reliabilities are reported on samples of infants and toddlers (e.g., Klein & Aloni, 1993) and on kindergarten and school-age children (e.g., Tzuriel, 1999, 2013; Tzuriel & Hanuka-Levy, 2014). Pearson correlations indicating inter-rater reliabilities of the MLE strategies, based on randomly selected dyads (n = 15) from the present sample, were as follows: intentionality and reciprocity, .91 (p < .001); meaning, .90 (p < .001); transcendence, .95 (p < .001); feelings of competence, .93 (p < .001); and regulation of behaviour, .92 (p < .001).

**Resiliency attitudes and skills profile (RASP)**

Psychological resiliency was examined by the RASP (Wolin & Wolin, 1993), which originally is composed of 65 self-report Likert-type items. The RASP is divided into seven criteria: insight, independence, creativity, humour, initiative, interpersonal relations, and moral values. Following use of the RASP with children demonstrating low academic achievements and difficulties in school adaptation (n = 101), Hurtes and Allen (2001) modified some of the items adapting them to the children’s level of understanding and reduced the original scale to 34 items after a confirmatory factor analysis. They reported Cronbach-alpha reliabilities of .49 to .71 for the different scales and an overall coefficient
of .91 for the total RASP scores. Principal components factor analysis with varimax rotation carried out with the current sample revealed three factors (eigenvalues = 9.70, 9.60, 6.50, respectively) which explained 75.7% of the overall variance. These factors were labelled: Coping with Stressful Situations, Insight, and Self-Regulation; each of the factors explained 28.5%, 28.1%, and 19.1% of the variance, respectively. Three items with factor loadings of <0.40 were eliminated, and the final scale was composed of 31 items. Cronbach-alpha reliability coefficients for the total RASP was .98. Principal component analysis with varimax rotation carried out on the three scale scores revealed one factor. The item number and distribution data are presented in Appendix.

**Analogy subtest (AN) from the cognitive modifiability battery (CMB)**

The CMB (Tzuriel, 1995, Tzuriel, 2000) is a dynamic assessment (DA) instrument designed for kindergartners to fourth graders. It is composed of seven subtests, each addressed to a different area of cognitive functioning. The AN is constructed of a plate with four wooden squares (‘Windows’) arranged in a 2 × 2 pattern, a set of coloured blocks, and a series of problems for each of the test’s phases. The blocks are placed by the examiner in three of the open ‘Windows’ on the plate, and the child is asked to complete the analogy in the last open ‘Window’.

All analogies are based on four dimensions: colour, height, number, and position; the combination of some or all creates several levels of task difficulty. The pre-teaching phase serves as a baseline for the modifiability of the child’s analogical thinking. In the teaching phase, the child is taught strategies such as systematic exploratory behaviour, transformational rules of analogy, self-regulation, simultaneous consideration of several sources of information, and efficient performance (i.e., balance between accuracy and rapidity). The child’s performance in the post-teaching phase indicates the extent to which the child benefited from the teaching given by the examiner and the level of cognitive modifiability.

The AN includes two main levels of difficulty: test items (easy) and transfer items (difficult). The transfer problems are ‘distant’ from the test items in terms of their complexity (use of several dimensions, in each window, use of new principles). The purpose of the transfer problems is to examine the degree to which the examinee internalizes the analogy principles and using them in relatively novel problems. Examples of analogies are depicted in Figure 1.

Each of the test and transfer items is composed of three sets of problems, designed for pre-teaching, teaching, and post-teaching phases. In the current study, we used the measurement/research version of administration (Tzuriel, 2000, 2001) according to which teaching is given only in the teaching phase. The AN subtest includes a preliminary–baseline phase in which the examiner familiarizes the child with the main dimensions of the test and explains the basic rules of solving analogies (i.e., A:B:: C:D).

Scoring of the AN is carried out by giving each correctly solved problem a score of 1; the maximal score for the easy and difficult problems was 14 and 6, respectively. Cronbach-alpha reliabilities reported by Tzuriel (2000) were .80 and .85 for pre- and post-teaching phases, respectively. The CMB has been validated in several studies in the UK (e.g., Lauchlan & Elliott, 2001) and in Israel (Passig, Tzuriel, & Eshel-Kedmi, 2016; Tzuriel, 2000; Tzuriel, Bengio, & Kashy-Rosenbaum, 2011; Tzuriel & Shamir, 2007) and significantly predicting reading comprehension (Tzuriel, 2000).
Home observation for measurement of the environment (HOME)

The HOME (Bradley, Caldwell, Rock, Hamrick, & Harris, 1988) was designed to measure various aspects of social support, both emotional and cognitive, given to the children aged 6–10 in their homes. The measure is composed of 5 subscales: Encouraging mature behaviour, Emotional climate, Enhancing growth, Active stimulation, and Physical environment. The HOME items are filled out by the observer either based on observations or after interviewing the parents. Principal component factor analysis using the current sample ($n = 100$) showed only six factors, which explain 69% of the total variance: Parental emotional and verbal response (15.2%), Encouragement of mature behaviour (13.8%), Affective climate (12.9%), Cultivation of growth (11.7%), Active provision of stimulation (8.7%), and Physical aspects of the environment (6.4%). Items with loadings of $<.40$ were deleted from the final scale. The reported reliabilities of the HOME, based on a sample of typically developing children ($n = 124$) at the age of 6–10 years, ranged in different subscales from .52 to .80. The reliability for the total scale was .91 (Bradley et al., 1988). The reliabilities of the HOME subscales based on the current sample ranged from .63 to .72 with a reliability of .90 for the whole scale.

Mother’s attitudes towards severity of LD

The mother’s attitude towards severity of her child with LD was examined by Brener’s (1973) questionnaire adapted in the current study for children with LD. The original questionnaire, constructed for mothers of children with Down’s syndrome and children with neurological damage, is composed of 30 sentences to be rated on a 5-point Likert-type scale. The questionnaire is composed of three subscales: Family well-being, Acceptance of disability, and Treatment of disability. The adaptation was carried out by changing the specific terms (e.g., LD instead of Down’s syndrome) and by deleting items found with low inter-item reliability. Based on the current sample, we deleted four items found with low reliability. The Cronbach-alpha reliability coefficient for the three subscales was .96, .94, and .79, respectively, and for the whole questionnaire, it was .96.

Figure 1. Examples of test and transfer analogies from the cognitive modifiability battery (CMB, Tzuriel, 1995, Tzuriel, 2000).
Severity of LD index
The severity of the learning disability index was based on the psychological diagnostic records of the children. The psychological reports were given to three expert judges who rated them according to the criteria of severity (e.g., gap between verbal and performance scales, gap between school achievements and tests performance) and extensiveness of the disability. Extensiveness was determined by eight areas of disability: reading and writing, graphic tasks, math computations, attention and concentration, hyperactivity, dyspraxia, social, and emotional problems. Each area was rated on a 3-point Likert-type scale. The reliability of the index was examined by the level of fitness among the three judges. The findings revealed that the level of agreement for the severity and extensiveness was 94% and 92%, respectively.

Children’s inferential thinking modifiability
The Children’s Inferential Thinking Modifiability test (CITM, Tzuriel, 1990, 2001) is originally aimed at assessing young children’s ability to solve inferential problems, but in the current study we used it as a teaching tool in the mother–child interactions. Each problem is composed of a set of houses with different coloured roofs at a top of a page (see Figure 2). At the bottom of the page, there are three or four rows (‘sentences’); each containing part of the solution. Each row presents information about the possible location of pictures (cards) in houses. The rules are that in each row the objects in the left should enter the houses with patchworks to the right. The order of coloured houses in each row are identical to that on the top of the page. The child is instructed to place cards with pictures into the appropriate houses at the top of the page. To solve the problem, the child must compare the ‘sentences’ and infer for each picture to which house it should go. The child has first to encode the information in each row and then to compare the rows for the common objects and houses. The task requires systematic exploratory behaviour, control of impulsivity, spontaneous comparative behaviour, planning, inferential-hypothetical (‘iffy’) thinking, and simultaneous consideration of several sources of information. The CITM tasks were used previously as a tool to tap peer-mediation strategies and were proved as efficient in eliciting mediational behaviours (Tzuriel & Caspi, 2017).

Procedure
Mother–child interactions were carried out in a structured mother–child teaching situation using the CITM tasks. Each mother was first taught by the examiner how to solve the CITM problems and then was asked to teach her child several problems. No instructions were given as to how to teach the child. A video camera was placed at one corner of the room and focused on a prearranged area of a table and two chairs where the mother and her child were invited to sit. The mother and child were told that the study is about ‘how mothers and children learn together’. The same person who remained in the background, without interfering with the situation, carried out the videotaping for each study in all cases. Each teaching session was videotaped for 20 min and analysed later by an independent observer using the OMI.

To establish inter-rater reliability, two raters observed 20 cases (20 min each) together and pausing the tape after each interaction (verbal or non-verbal) for rating. The interaction was then rated independently for the presence or absence of each mediation strategy before proceeding to the next interaction. The behavioural referents for each strategy are mutually exclusive with no overlap among them (Klein et al., 1987). The
length of each interaction varied from 2 to 5 s, depending on the specific behaviour. For example, an interaction indicating focusing may have taken 2 s while an interaction indicating transcendence would take usually longer (4–6 s)—if the explanation of a rule is involved. The total frequency with which each mediation behaviour occurred across all interactions in the session was then calculated. Both observers were trained for 30 hr in rating mother–child interactions; training included theoretical understanding of the MLE strategies and mostly observing and analysing videotapes depicting mother–child interactions. At the end of training, the observers reach almost perfect agreement on all the behavioural referents of each strategy. Cronbach-alpha reliabilities are reported above. The rest of the cases were rated by one observer. Following the videotaping session, each child was administered the AN and the RASP tests. Finally, all families were visited at their homes by a trained observer who rated them on the HOME questionnaire and mothers answered the Mother’s Attitudes towards Severity of LD questionnaire. The data were analysed by hierarchical regression analysis and structural equation modelling analysis.

Results

Prediction of psychological resilience and cognitive modifiability by MLE strategies, mother’s attitudes towards the child’s LD, and HOME

Our first hypothesis was that MLE strategies would significantly predict psychological resilience and cognitive modifiability of children with LD beyond the variance

Figure 2. Example problem from the children’s inferential thinking modifiability test (CITM, Tzuriel, 1990).
contributed by variables such as the child’s intelligence level, age, SES, and severity of the LD. Our second hypothesis was that mother’s attitudes towards LD of her child and environmental support (HOME) would significantly predict children’s psychological resilience and cognitive modifiability. To test our hypotheses, we carried out a three-step hierarchical linear regression analysis. In Step I, the variables of intelligence level, age, socio-economic status, and severity of the LD were introduced. In Step II, we introduced the five MLE strategies, and in Step III, we introduced the mother’s attitudes towards LD of her child and a general HOME score. The regression model was applied separately to the two outcome variables: psychological resilience and cognitive modifiability.

**Prediction of psychological resilience**

As can be seen in Table 1, the overall model explains 78% of the variance in psychological resilience. Step I variables explained 41% of the variance in psychological resilience, Step II variables added significantly 24% to the variance, and Step III variables added significantly 13% to the variance. It is interesting to note that in Step III the effect of age becomes significant ($\beta = .14$) and that the effect of SES decreases consistently and linearly from Step I to Step III, as evidenced in the $\beta$ values ($.55 > .38 > .19$). The findings in Step III indicate that two MLE strategies have emerged as significant variables predicting psychological resilience: Intentionality and reciprocity ($\beta = -.21$) and Self-Regulation ($\beta = .26$).

**Prediction of cognitive modifiability**

As can be seen in Table 2, the overall model explains 50% of the variance in cognitive modifiability. Step I variables explain 21% of the variance in cognitive modifiability, Step II variables added significantly 17% to the variance, and Step III variables added significantly 12% to the variance. It should be noted that in Step III the combination of significant predicting MLE strategies that have emerged is as follows: Meaning ($\beta = .23$), Transcendence ($\beta = .20$), and Regulation of Behaviour ($\beta = .18$). The effect of SES decreases consistently from Step I to Step III, as evidenced in the $\beta$ values ($.42 > .27 > .07$).

**Structural equation modelling**

One of the objectives of the current study was to examine the empirical validity of the theoretical model of prediction of psychological resilience and cognitive modifiability of children with LD by distal and proximal factors. The empirical validity was examined by a structural equation modelling (SEM) approach using the AMOS program (Arbuckle, 2003; Curran & Hussong, 2003). The SEM has three main advantages: (a) It allows designing complex models with intermediate variables and latent constructs; (b) It allows inferring causal relations among variables without having to use experimental designs. The nature of the variables involved in testing the theory is not always given to experimental manipulations, and the accumulated effects that several variables have on outcome variables are not easily given to manipulation simultaneously; (c) the holistic approach used in SEM contributes to understanding of the conceptual whole more than the sum of fragmentary separate analyses (Jöreskog & Sorbom, 1986; Raykov, Tomer, & Nesselroad, 1991).

In the current study, we examined the causal relations between the exogenic and endogenic factors (Jöreskog & Sorbom, 1986) and the effects of both on the outcome
measures of psychological resilience and cognitive modifiability. The exogenic variables were the environmental support (i.e., total HOME score) and mother’s attitudes towards the LD of her child. The endogenic factors were mother–child MLE strategies. To simplify the model and lower the ratio of number of paths/number of subjects, we used a combined score of four MLE strategies: Meaning, Transcendence, Feelings of Competence, and Regulation of Behaviour (MLE-TOT). The MLE strategy of Intentionality and Reciprocity was separated from the other strategies based on previous studies indicating negative significant correlation with cognitive scores (Tzuriel & Weitz, 2008) and being predicted by mothers’ emotional rejection of the child and child’s acting out (e.g., aggression) behaviour (Tzuriel & Weiss, 1998). This strategy is considered by clinicians as

<table>
<thead>
<tr>
<th>Variables</th>
<th>Step 1 (β)</th>
<th>Step 2 (β)</th>
<th>Step 3 (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligence level</td>
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<td>.06</td>
<td>−.03</td>
</tr>
<tr>
<td>Age</td>
<td>.08</td>
<td>.05</td>
<td>.14*</td>
</tr>
<tr>
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<td>.19*</td>
</tr>
<tr>
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<td>−.03</td>
<td>−.01</td>
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<td></td>
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</tr>
<tr>
<td>Intentionality &amp; reciprocity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meaning</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Transcendence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feelings of competence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regulation of behaviour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother’s attitudes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOME</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| | Step 1 (β) | Step 2 (β) | Step 3 (β) |
| | .41*** | .65*** | .78*** |
| R² | | | |
| Δ R² | .41*** | .24*** | .13*** |

Note. *p < .05, **p < .01, ***p < .001.

Table 2. Prediction of cognitive modifiability by MLE strategies, mother’s attitudes, and HOME

<table>
<thead>
<tr>
<th>Variables</th>
<th>Step 1 (β)</th>
<th>Step 2 (β)</th>
<th>Step 3 (β)</th>
</tr>
</thead>
<tbody>
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<td>.01</td>
<td>−.12</td>
</tr>
<tr>
<td>Age</td>
<td>−.02</td>
<td>−.03</td>
<td>−.09</td>
</tr>
<tr>
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<td>.27***</td>
<td>.07</td>
</tr>
<tr>
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<td>.04</td>
<td>.06</td>
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<tr>
<td>MLE strategies</td>
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<td></td>
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<tr>
<td>Intentionality &amp; reciprocity</td>
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<td></td>
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<tr>
<td>Meaning</td>
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<td>Transcendence</td>
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<tr>
<td>Feelings of competence</td>
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<tr>
<td>Regulation of behaviour</td>
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<tr>
<td>Mother’s attitudes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOME</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| | Step 1 (β) | Step 2 (β) | Step 3 (β) |
| | .21*** | .38*** | .50*** |
| R² | | | |
| Δ R² | .21*** | .17*** | .12*** |

Note. *p < .05, **p < .01, ***p < .001.
a kind of preparatory strategy carried out to introduce the child to other MLE strategies. In a recent study, it was reported that expert clinicians rated this strategy as the lowest in predicting cognitive modifiability. The findings of the SEM analysis are presented in Figure 3.

As can be seen in Figure 3, the distal exogenic factor of Home Environment explains positively the combined MLE-TOT score ($\beta = .48$) and negatively the Intentionality and Reciprocity strategy ($\beta = -.42$). Home Environment (distal), unexpectedly, explains directly the two outcome measures of Psychological Resilience ($\beta = .48$) and Cognitive Modifiability ($\beta = .60$). Mother’s Attitude (distal) explains the MLE-TOT score ($\beta = .27$) and unexpectedly explained directly Psychological Resilience ($\beta = .26$). The MLE-TOT variable, as expected, explains directly Psychological Resilience ($\beta = .18$) and Cognitive Modifiability ($\beta = .41$), whereas the Intentionality and Reciprocity strategy explain negatively Psychological Resilience (-.18). It is interesting to note that Home Environment was positively related to Mother’s Attitude ($\beta = .45$), MLE-TOT was negatively related to Intentionality and Reciprocity ($\beta = -.27$), and Psychological Resilience was positively related to Cognitive Modifiability ($\beta = .28$).

The relation between psychological resilience and cognitive modifiability

The relation between psychological resilience and cognitive modifiability was examined also by canonical correlation (Figure 4). For each subscale of the CMB analogies, we created a cognitive modifiability index (CMI) based on the post-teaching score after

![Figure 3. Structural equation analysis: the effects of exogenic and endogenic variables on psychological resiliency and cognitive modifiability. *$p < .05$, **$p < .01$, ***$p < .001$.](image-url)
controlling the pre-teaching score. The CMI was computed by means of regression analysis in which the residual post-teaching score was extracted after controlling for the pre-teaching score which was used as a covariate. This procedure is considered to be a better measure reflecting change than a simple gain score, which has the disadvantage of a possible ceiling effect and regression to the mean effect (Embretson, 1992). As can be seen in Figure 4, the canonical correlation found between the two variables is .67 ($p < .001$). It is important to note that all subscales of the Psychological Resilience and CMI contributed significantly to the overall correlation.

**Figure 4.** Canonical correlation of psychological resilience with cognitive modifiability subscales. ***$p < .001$.**

**Discussion**

The findings of this study clearly support our expectations that mother–child MLE strategies predict psychological resilience (Table 1) and cognitive modifiability (Table 2) beyond the variance contributed by children’s intelligence level, age, SES, and severity of LD. The high prediction of psychological resilience (78%) and cognitive modifiability (50%) confirms our expectations as regards the role of MLE strategies and home environment for the development of psychological resilience and cognitive modifiability. These findings coincide with previous findings on the role of mother–child MLE strategies as determinant of children’s cognitive modifiability (Tzuriel, 2013; Tzuriel & Eran, 1990; Tzuriel & Ernst, 1990; Tzuriel & Weiss, 1998; Tzuriel & Weitz, 2008). The novelty of the current study, however, is in extending the MLE theory to include the effects of MLE interactions on psychological resilience and in the relation between psychological resilience and cognitive modifiability.

The hierarchical regression analysis of psychological resilience showed that two MLE strategies have emerged as significant predictors: Intentionality and Reciprocity ($\beta = -.22$) and Regulation of Behaviour ($\beta = .26$). Other variables that have emerged as significant were Mother’s Attitudes Towards LD ($\beta = .28$) and HOME ($\beta = .44$). The findings confirm our expectations that children whose mothers demonstrate high level of mediation for Regulation of Behaviour, express positive attitudes towards their child’s LD, and provide rich home environment have children with higher level of psychological resilience. These findings coincide with theoretical conceptualization of the role of self-
regulation as a key intrapersonal factor or ability that appears to increase overall resilience (Reivich & Shatte, 2002). As a matter of fact, impaired self-control has been found as a risk of many disorders presenting with unruly or undesirable behaviour – hyperactivity, attention deficit, and impulse disorders (Strayhom, 2002), and the ability to control oneself is perceived as a protective factor enhancing psychological resilience (Chen & Taylor, 2008). Our findings correspond with earlier findings that a sense of control (e.g., perseverance to work towards goals despite challenges and the willingness to use available resources) has emerged consistently as helping students manage their LD (Hutchinson, Freeman, Stoch, & Chan, 2002; Gerber, Ginsberg, & Reiff, 1992; Kolb & Hanley-Maxwell, 2003; Piers & Duquette, 2016; Raskind et al., 2002).

The negative prediction of psychological resilience by Intentionality and Reciprocity (focusing) might reflect the child’s severity of disability and the consequent need of the mother to overcome the difficulty by providing higher level of focusing before moving on to other mediation strategies (i.e., Meaning, Transcendence, Feelings of Competence and Regulation of Behaviour). Similar findings were reported on a sample of children (n = 40) 5–8 years old who were born with very low birthweight (Tzuriel & Weitz, 2008). Intentionality and Reciprocity were found as negatively predicting cognitive modifiability of the child. The explanation for that finding was that with children showing learning difficulties the amount of focusing is negatively related to their cognitive modifiability; focusing is considered as a basic preparatory strategy that paves the way for more essential MLE strategies. The higher the difficulties of the child, the higher is the amount of focusing given by the mother.

The prediction of cognitive modifiability (Table 2) indicates, as expected, that three MLE strategies have emerged as significantly predicting cognitive modifiability, after controlling for intelligence level, age, SES, and severity of LD: Mediation for Meaning ($\beta = .23$), Transcendence ($\beta = .20$), and Regulation of Behaviour ($\beta = .18$). The strongest predicting variable, however, was HOME ($\beta = .53$). In previous studies on mother–child MLE strategies and children’s cognitive modifiability, it was found that mediation for Transcendence (expanding) is the most powerful strategy predicting cognitive modifiability. This strategy has emerged as most powerful in predicting cognitive modifiability even though it was 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 focus on concepts, generalizations, and principles. The DA measures used in all studies (as in the current study) reflect also the ability of the child to solve problems requiring abstract concepts and rules. Thus, children in families that provide a rich home environment and qualitative MLE strategies of Meaning, Transcendence and Regulation of Behaviour benefit from strategies that enhance ‘learning-to-learn’ skills and consequently develop a high level of cognitive modifiability.

The SEM analysis findings (Figure 3) supports further our expectations by showing that psychological resilience was predicted directly by Intentionality and Reciprocity ($\beta = -.18$), Mothers’ Attitude Towards Child’s LD ($\beta = .26$), an aggregate score of MLE Strategies ($\beta = .18$), and Home Environment ($\beta = .48$). These findings support our expectation that MLE strategies serve as buffer mechanisms that help in mitigating the negative effects of stress caused by LD of children. In accordance with earlier findings, the current findings show that the quality of parent–child interactions, the emotional home climate, and positive stimulation within the family are crucial for development of psychological resilience of children with LD (e.g., Goldstein & Goldstein, 1998).

The SEM findings raise the question whether in children experiencing learning difficulties, the distal factors 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 special needs (e.g., LD, ADHD, ID), even the best mediation, given naturally by mothers, is not enough to overcome or ‘nullify’ the strength of the distal factors. 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 these mothers receive training for higher level of mediation, the effects of the distal factors would be reduced significantly or even disappear. Another possible comparison, requiring further investigation, would be testing our hypotheses on a group of typically developing (TD) children as compared with children with LD. We would expect to see the direct effects of distal factors only on mediation strategies in the LD group but not in the TD group.

Our findings suggest an innovative elaboration of MLE theory. Although in TD 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 behavioural difficulties, distal factors can directly affect cognitive modifiability. The MLE process must be more powerfully directed towards 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 would be assigned to experimental and control groups. Mothers in the experimental group would receive a programme of mediation and be compared with a control group of mothers receiving an alternate programme. Mother–child MLE interactions could be observed a year later to assure that the effects of the programme are internalized and assimilated into the mother–child interactional system. The children should then be tested by DA measures to reveal their cognitive modifiability. Our 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.

The canonical correlation between psychological resilience and cognitive modifiability (Figure 4) confirms our hypothesis that the mechanisms of cognitive change have much in common with the personality mechanisms of psychological resilience. Both factors require openness to experience, flexibility, accessibility to mediation, tolerance to frustrations, and optimistic view of self in adverse situation. This finding connecting cognitive and emotional-motivational-personality domain, however, is innovative and requires further research with different clinical groups. In further research, it is suggested to apply an experimental longitudinal approach where mothers receive an intervention programme to develop their MLE strategies and to assess their children’s psychological resilience and cognitive modifiability across the years. A comparative approach should also be applied to mothers of children with varied mental and cognitive difficulties.

**Conclusion**

The current study shows that MLE strategies in mother–child interaction in a sample of children with LD, as well as a rich home environment, are probably critical components in preparing children to acquire mechanisms necessary for psychological resilience and cognitive modifiability and that these two domains are intimately related, probably because they share similar personality mechanisms.
References


Arbuckle, J. L. (2003). Amos 5.0 update to the amos user’s guide. Chicago, IL: Small Waters Corporation, SPSS.


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### Appendix : Item number and distribution statistics of the resiliency attitudes and skills profile (RASP)

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<tr>
<th>Scale</th>
<th>Items</th>
<th>Number of items</th>
<th>M</th>
<th>SD</th>
<th>Skewness</th>
<th>Mean score range</th>
<th>Possible mean score range</th>
<th>C.V.</th>
<th>Eigenvalue</th>
<th>% of explained variance</th>
<th>Cronbach-alpha reliability coefficient</th>
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<td>28.5</td>
<td>.95</td>
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<td>1.14</td>
<td>-.22</td>
<td>1.4–4.9</td>
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