

## Mother–child joint writing and storybook reading and their effects on kindergartners' literacy: an intervention study

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**Abstract** This study assessed the effects of three different intervention programs on low-SES mother–child joint activities and on their kindergarten-age children's progress in early literacy and language. Parents in three groups (119 mothers, 5 fathers) were coached to mediate child learning, respectively, in: interactive storybook reading, writing, or visuomotor skills. A group-specific workshop was followed by 7 weeks of tri-weekly structured dyadic interactions and weekly tutorial home visits. A fourth group (control) received no intervention. Results showed implementation success: Mothers coached in interactive storybook reading or writing mediation improved in the coached activity from pretest to immediate posttest and to delayed posttest. Interactive storybook reading improved less for older than younger children, whereas writing mediation improved more for older than younger children. No transfer emerged from one activity to the other: Coaching on reading had no effect on writing or visuomotor skills, and coaching of writing had an effect only on writing. Children's alphabetic skills were enhanced in the writing mediation-coached group, whereas linguistic competencies, unexpectedly, were not enhanced in the interactive storybook reading-coached group. The significance of writing mediation as a dyadic activity promoting literacy is emphasized.

**Keywords** Storybook reading · Joint writing · Alphabetic skills · Linguistic competencies · Home intervention · Kindergartners · Low SES · Mother–child interaction

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## Introduction

Early literacy and language provide the infrastructure for acquisition of reading and writing in school (National Early Literacy Panel (NELP), 2008). This conclusion derives primarily from studies showing how preschoolers' literacy and language correspond with later acquisition of reading and spelling in school (Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004). Moreover, research demonstrated that preschool- or kindergarten-based interventions promoting early literacy or language contributed to later reading and spelling acquisition as well as to later language development in school (Vellutino & Scanlon, 2001).

The goal of this study was to assess the effects of intervention programs aiming to improve the quality of joint parent-child activities, and the differential effects of improved joint activities on their kindergarten-age children's early literacy and language. Parents, including mostly mothers, were coached in performing one of three joint activities with their children: writing, reading storybooks, or fine visuomotor skill activities. Then, they engaged their children in the coached joint activities 3 times per week, for 7 weeks. Maternal writing mediation and maternal storybook reading were measured before and after intervention to assess the interventions' effects on maternal performance. Children were compared on gains in alphabetic skills and linguistic competencies due to improvement in these joint activities.

### Low-SES mothers: significant target for enhancement

Families deriving from low socioeconomic strata were targeted because children growing up in poverty lag behind their counterparts in early literacy and language (e.g., Dickinson & Snow, 1987), as well as reading and spelling acquisition and language growth in school (Duncan & Seymour, 2000; Korat & Levin, 2001). Intervention studies in low-SES preschools or kindergartens have often been carried out by research assistants. Our study targeted parents, who are the first teachers of their children (Britto, Brooks-Gunn, & Griffin, 2006). Parents hold primary responsibility for their children's wellbeing and development, and are motivated to promote their children's present and future welfare. Helping parents realize that they are capable of assisting their child to prepare for schooling, and specifically coaching parents in guiding their children's learning, may broaden their conception of parental roles and parenting styles. Encouraging low-SES parents to take on the role of guiding their children's learning is an ambitious endeavor because of their relatively limited educational resources and their competing duties and stressors.

### Storybook reading and joint writing

Children and parents can share a variety of activities that potentially enhance language and literacy: storybook reading, joint writing, recognizing environmental print, playing with letters, rhyming games, and watching educational TV programs. Nevertheless, most studies in this domain have focused on joint storybook reading. Reviews of decades of research on the relations between amount of storybook reading

and the development of language and literacy led to the conclusion that this relationship is reliable (Bus, van IJzendoorn, & Pellegrini, 1995; Scarborough & Dobrich, 1994). Yet, a large amount of the variance in children's achievements remains unexplained. Among the many possible explanatory factors, the contribution of other parent-child joint activities to children's language and literacy merit exploration.

Aram and Levin (2002) contrasted two major types of joint parent-child activities, storybook reading and parental mediation of writing, and studied their contribution to early literacy and language in preschoolers. They found that the frequency of joint storybook reading explained significant variance in children's verbal abilities (per teacher rankings) after partialling out home literacy and maternal mediation in joint writing. Maternal mediation of writing consistently explained substantial variance in children's alphabetic skills (i.e., invented spelling, word writing and recognition, and phonological awareness), after partialling out home literacy and storybook reading. Hood, Conlon, and Andrews (2008) studied how parental teaching of print to kindergartners (i.e., writing names and identifying letters/words) on the one hand and storybook reading on the other were connected to children's literacy. Parental teaching of print was independently related to letter-word identification scores in kindergarten and to reading and spelling in grades 1 and 2, whereas storybook reading was independently related to vocabulary in grade 1. These findings extended those obtained by Sénéchal and LeFevre (2002). Taken together, the studies indicate that storybook reading is connected to linguistic competencies, mainly to vocabulary, whereas joint writing and other print-oriented activities are connected to alphabetic skills.

### Storybook reading and writing mediation: intervention programs in preschools

Aram and Biron (2004) demonstrated that two different programs of joint activities for an adult with small groups of children enhanced different child achievements in preschools serving low-SES populations. In the storybook reading program, trained graduate students read stories interactively, and in the writing program, they mediated writing. Pretest-posttest comparisons showed that children in the writing program surpassed children in the reading program on invented spelling, alliteration, rhyming, and orthographic awareness. In contrast with expectations, the children in the reading program did not outperform the writing group on vocabulary, listening comprehension, or concepts of print, but they did outscore the control group.

### Intervention programs' effects on maternal writing mediation and interactive storybook reading

No study thus far has examined improvement of parental mediation of writing due to intervention. However, several studies have analyzed the changes that occurred in mother-child verbal interactivity during storybook reading following interventions. In these studies, trained mothers were asked to read storybooks interactively several times a week for 4–12 weeks (across studies). Reading sessions at pretest and posttest(s) were videotaped or audiotaped, and the frequencies of maternal use of

strategies supporting or reducing dialogues were assessed. Results showed that, in general, strategies supporting dialogues increased from pretest to the immediate posttest (Blom-Hoffman, O'Neil-Pirozzi, Volpe, Cutting, & Bissinger, 2006; Briesch, Chafouleas, Lebel, & Blom-Hoffman, 2008; Crain-Thoreson & Dale, 1999; Huebner, 2000; Huebner & Meltzoff, 2005; Whitehurst et al., 1988), whereas strategies reducing dialogues decreased (Crain-Thoreson & Dale, 1999; Huebner, 2000; Huebner & Meltzoff, 2005). At the delayed posttest (2.5–6.0 months later across studies), the frequency of dialogic strategies slightly decreased but often did not differ from its heightened level at the immediate posttest (Blom-Hoffman et al., 2006; Briesch et al., 2008; Huebner & Meltzoff, 2005).

### Enhanced writing mediation and interactive storybook reading: effects on early literacy

Remember that no study thus far has investigated improvement of parental mediation of writing due to intervention. Interactive reading was found to enhance children's vocabulary more than regular reading, in a meta-analysis (Mol, Bus, de Jong, & Smeets, 2008). However, the contribution of interactive versus regular reading decreased with the child's age, appearing as strong for 2–3 year olds ( $d = 0.50$ ), and as negligible for 4–5 year olds ( $d = 0.14$ ). The authors explained that older children do not depend on parental interactive reading, because they are better able to process the text, to trace their own limitations in story comprehension, and to ask questions when in need of clarification. Further, the contribution of interactive reading to children's vocabulary emerged as strong for children recruited from middle to high SES ( $d = 0.53$ ), but not from low SES ( $d = 0.13$ ). Mol and her colleagues suggested that mothers with low education may not be able to carry out interactive reading at the required level, or that their children may find it difficult to respond to open-ended questions or to questions that require inferencing.

The limited value of interactive reading to kindergartners from poor families is disappointing, because these children are in special need of linguistic enrichment as a major asset preparing them for the subsequent first grade of school (van Kleeck, 2008). Our study used intervention programs for low-SES mothers of kindergartners, aiming to improve interactive reading as well as writing mediation and, thereby promoting children's language and literacy.

### Guiding mothers in mediated learning: transfer across skills

Efficient maternal mediation includes scaffolding at a challenging but not frustrating level, sensitivity to the child's competence and perspective, encouragement of active participation on the part of the child, and assistance in alerting the child to his/her metacognitive processes (Feuerstein, 1998; Vygotsky, 1978). We examined whether mediation of writing or interactive reading is a specific skill that can be taught only by clarifying the specific strategies used for these activities, or whether mothers exposed to the general principles of mediated learning and who have been trained to mediate in one domain can generalize these skills to mediate learning in another domain. This kind of transfer, conceptualized as a high-road transfer,

requires learning of abstract principles and applying them mindfully to a new context (Salomon & Perkins, 1989).

Transfer of training in writing mediation to caregivers' other activities has never been studied before. Transfer of training of parental interactive storybook reading has rarely been examined (Dale, Crain-Thoreson, Notari-Syverson, & Cole, 1996). Mothers of 3–6 year olds with language delays were trained to enhance their children's linguistic functioning in two separate training programs. One program trained a group of mothers to read picture books interactively, and the other group was trained to hold interactive conversations while playing with toys. Results showed that the training affected mother–child interactions in the trained context: Mothers trained to read interactively increased their frequency of interactive reading, whereas mothers trained in conversations during toy play increased their frequency of verbal interactions during toy play. Notably, no transfer emerged from one activity to the other.

In the current study, participating mothers were divided into four groups: storybook reading mediation, writing mediation, visuomotor mediation, and a control group (no mediation). The three mediation groups were instructed in mediated learning principles, applied thereafter to only one of the three different dyadic parent–child activities. In the reading group, mothers were guided on how to promote their children's linguistic competencies through interactive reading of storybooks. In the writing group, mothers received instruction in how to promote their children's early literacy skills through writing words and learning alphabetic skills. In the visuomotor skills group, mothers received guidance in how to enhance their children's fine visuomotor skills through drawing, painting, cutting, gluing, and so forth.

The joint activity promoting visuomotor skills was chosen for a control because these skills are related to some extent to school readiness, which is important for our cohort (Johnson, Gallagher, Cook, & Wong, 1995). Moreover, promoting these skills in kindergartners or first-grade beginners was found to contribute to early schooling (Ratzon, Efraim, & Bart, 2007). By using this group, we could derive stronger conclusions concerning the transfer of mediation skills from one joint activity to another.

### Major questions of the current study

- (1a) To what extent does training of low-SES mothers to read interactively with their 5–6 year olds effectively increase interactive reading, as measured at immediate and delayed posttests?
- (1b) To what extent does training of such mothers to mediate writing effectively increase level of writing mediation, as measured at immediate and delayed posttests?
- (2a) To what extent does training in mediated learning practices, as applied to interactive storybook reading or to visuomotor skill activities, transfer to joint writing?
- (2b) To what extent does training in mediated learning practices, as applied to joint writing or to visuomotor skill activities, transfer to interactive reading?

- (3a) Does improved interactive reading in the reading group relative to the other groups (measured at posttest) predict children's progress on linguistic competencies?
- (3b) Does improved writing mediation in the writing group relative to the other groups (measured at posttest) predict children's progress on alphabetic skills?

## Method

### Participants

Participants were 124 mother–child dyads recruited from low-SES neighborhoods in the Tel Aviv metropolitan area. Seven additional dyads were excluded from analyses because the videotape of either their joint reading or joint writing in the posttest was incomprehensible or inaccessible. This attrition rate (7/131) is considered low. Both mothers and fathers were invited to participate, but 119 mothers and 5 fathers participated in the study. Hence, we refer to the caregivers as mothers.

Mean age of the 124 children (50 boys, 74 girls) at pretest was 5;4 years;months (SD = 0.35). Mothers' and fathers' mean ages were 33;7 (SD = 5;7) and 36;7 (SD = 5;7), respectively. Maternal education, measured on a 5-point scale, ranged from not finishing high school (9% of mothers, 24% of fathers) to graduating from college/university (11% of mothers, 6% of fathers). This education level is low by Israeli standards, where 43% of the population graduates from college or university (the Israel Central Bureau of Statistics, 2006). The four groups of dyads (reading, writing, visuomotor, and control) did not differ statistically from each other on any demographic parameter.

### The three intervention programs and the control group

In the reading group, mothers were guided on how to promote their children's linguistic competencies through interactive reading of storybooks. In the writing mediation group, mothers received instruction in how to promote their children's early literacy skills through scaffolding them in alphabetic skills, including writing words. In the visuomotor skills mediation group, mothers received guidance in how to enhance their children's fine visuo-motor skills through scaffolding them in processes of drawing, painting, cutting, gluing, following lines, coloring, etc. Thereafter, the mothers applied what they learned to their children. The mothers in the control group were not provided with the entire program but the initial workshops were supplied to those who wished, after the study ended.

### *Initial workshop*

Each program started with a workshop attended by 15–20 mothers. To recruit a sample of about 30 mothers per program, each workshop was repeated twice, in 2 consecutive weeks, by the authors and two assistants.

The three workshops shared the same structure and referred to the following eight issues in fixed order: (1) First we discussed the role of school readiness and maternal contribution in this arena. (2) Next we presented the principles underlying high quality mediation (e.g., the importance of dialogue; of maternal sensitivity to the child's perspective, attention span, and zone of proximal development; of helping the child become aware of metacognitive processes; of indicating to the child his/her progress in solving the problem). Up to this point, the three workshops were the same. From here on, the three shared the same structure but different activity contents. (3) We next discussed the development and significance of success in schooling for the specific target domain. In the reading mediation group, the domain was vocabulary and reading comprehension; in the writing group it was alphabetic skills and writing; and in the visuo-motor group it was fine visuo-motor skills. (4) The mothers were now divided into small groups to discuss their children's performance, home practice, and maternal mediation in the target domain. (5) A 10-min film screening then introduced mothers to short mediation scenes illustrating principles of high-quality mediation specific to the target domain. (6) We next specified mothers' role in the program: to engage their child three times per week, for 7 weeks, in activities designed by the researchers. We informed them that a tutor would meet them weekly in their home; discuss the child's products, the progress made, and the difficulties encountered; and provide the tasks for the coming week. (7) We then displayed the materials for use during the 7 weeks of intervention. We explained that mothers would receive these materials during home visits and that they would remain their own property. (8) Mothers received materials and tasks for the first week, along with guidance on how to apply them in interacting with their child.

### *Joint home activities*

The joint mother-child activities took place three times per week. In the interactive reading group, the mother read a new storybook to the child each week, encountering each book three times (over 1 week) and asking parallel sets of questions across books. Printed stickers pasted on different pages provided the questions to be asked the child before, during, or after book reading. Mothers were guided to use the questions sensitively, by adjusting the questions to the child's needs. Open-ended questions focusing on text comprehension or on word meaning were frequent. A few questions referred to print or to story grammar.

In the writing training group, each week the dyad jointly wrote lists of words and played a new game using novel magnetic cards from a commercial kit. Materials included tasks pertaining to spelling words (e.g., writing words that begin with a specific sound; writing a list of peers) as well as a kit that included boards of letters and small boxes with magnetic cards of letters and pictures for games practicing letter knowledge, phonological awareness, word spelling, and word recognition (Rosenberg, 2004). Each week a small box with a new game was supplied and applied in that week. For instance, one game focused on pairing pictures whose labels started or ended with the same phoneme or letter.

In the visuomotor skills group, each week's activity involved playing with one type of game followed by drawing. Mothers were taught how to enhance their

children's fine visuomotor skills through scaffolding them in processes of drawing, painting, cutting, gluing, following lines, coloring, etc. This group's materials included seven booklets or boxes with educational games relevant to fine motor skills, such as mazes, coloring shapes, and cutting and gluing models.

Activities for each session were planned to last for approximately 30 min in the different groups. The actual duration of mother–child interaction per session was determined by the dyadic activity, and was not recorded.

### *Home visits*

A graduate trained student visited the mother and the child at home each week over the 7 weeks, for about half an hour. The goals of visits were to summarize the training experiences of the last week, collect the last week's products, introduce the tasks for the coming week, promote maternal level of training, and solve emerging problems. The tutors then devoted about 5 min to illustrating how to work with the child and observed the mother guiding the dyadic interaction for another 5 min.

The tutors also confirmed and documented extent of implementation—whether all tasks were completed during the past three weekly sessions. Almost all mothers reported that all sessions were completed and that the tasks were engaging and productive. The tutors checked maternal reports by discussing the tasks and observing children's products (e.g., written lists, completed mazes).

### *Assessments of joint interaction and child literacy*

Data were collected in three domains—interactive reading, mediation of writing, and child literacy (alphabetic skills and linguistic competencies)—at three time points: pretest, immediate posttest, and delayed posttest.

### *Mother–child reading interaction*

Three books were used for assessment, one per time point, drawn from a Dutch series translated into Hebrew (Velthuijs, 2000). These books were chosen because they were age-appropriate and well matched to each other (22 pages each, sharing author, illustrator, protagonists, etc.). These books included no stickers, so the dialogues between the mother and the child were self-initiated.

The interactions were videotaped, and the dyadic dialogues were transcribed and were coded for two measures: category and maternal behavior. Dialogues were defined as questions or comments made by one party that received either a verbal or physical reply (e.g., pointing with a finger) from the other party. Only a few dialogues were excluded from analysis because they pertained to issues irrelevant to the targeted dyadic storybook reading activity (e.g., child answers the phone: “Who is this? We’re in a meeting....” Mother: “Edva, hang up the phone, okay?”).

**Dialogue category** To code each dialogue for category, coders were trained to assess whether the dyads' questions or comments were classified as: (a) 1 of 6 categories relating to the book's story or illustrations (recall, completion, illustration,



wh questions, word meaning, or distancing; see Huebner & Meltzoff, 2005; Whitehurst et al., 1988); (b) 1 of 4 categories relating to print or alphabetic skills (counting words/letters, naming or sounding letters, isolating sounds or rhyming, or print recognition); or (c) 1 of 6 categories relating to story grammar (summary, characters, protagonist, problem, solution, or lesson). Descriptions of the 16 categories and examples taken from mother–child dialogues appear in “Appendix A”.

Each dialogue was coded as one category only. When a dialogue could be coded as more than one category, coding was determined by a pre-fixed criterion. For instance, a “who question” about a story character was coded as a “wh question” if it appeared throughout the book reading, but was coded as a “character” if it appeared after reading the story as part of discussing the story grammar.

**Enhancing dialogues** Each dialogue was also scored for its inclusion of each of four maternal behaviors: scaffolding, elaboration, praise, and correction. A dialogue that included each of these maternal behaviors per book reading was scored 1 (behavior present) or 0 (behavior absent), and the four total scores were transformed into Z scores. The mean Z scores served as the number of *enhancing dialogues*. Descriptions and examples of maternal scaffolding, elaboration, praise, and correction appear in “Appendix B”.

**Coders** Two graduate students shared the coding of 381 reading–interaction protocols (127 children in three phases: pretest, immediate posttest, and delayed posttest). They were blind to any information concerning the dyad. Following a few training sessions for learning to use the key, 36 protocols (from the four groups and the three phases) were chosen randomly to measure coding reliability. Reliabilities were measured by correlations between the scores given independently by the two coders and by *t*-tests between their mean scores. Correlations were computed between coders on number of mother- and child-initiated dialogues per reading. Correlations were also computed between coders on number of dialogues with scaffolds, elaborations, praise, or corrections. Finally, correlations were computed for dialogues on story and illustrations, print, or story grammar. All correlations between coders’ scores were highly significant, with a mean correlation of  $M = 0.96$ , and a range of 0.90–1.00. All *t*-tests between coders’ scores on individual protocols were non-significant.

### *Maternal writing mediation*

Videotapes of mothers guiding their children in a writing task served as a basis for measuring the quality of maternal writing mediation. The mother and child were presented with four stimuli cards, each of which displayed drawings of two objects, along with four blank cards. The child was asked to write the names of each pair of illustrated objects on a separate blank card. Altogether, the four word pairs contained most of the Hebrew alphabet. Different words, generally matched in letters and syllabic structures, were written in the pretest, in the immediate posttest, and in the delayed posttest. The mother was asked to help her child as she deemed

fit, and no further instructions were given. Each session was videotaped, transcribed, and coded according to two coding keys: *grapho-phonemic* and *printing* mediation.

**Grapho-phonemic mediation** This ordinal scale reflected how the mother guided her child to achieve the most complete and independent mental process possible for segmenting a word into its sounds and orally retrieving the required letter name for each sound, when attempting to represent that word in writing (Aram & Levin, 2001, 2002). Mediation of each letter received a separate score because mothers used different strategies for different letters in the same word. The 10-point ordinal scale used appears in the upper part of “Appendix C”. The average across all the letters for the eight words on this ordinal scale served as the *grapho-phonemic* mediation score. Cronbach alpha reliabilities on pretest, immediate posttest, and delayed posttest, respectively, were:  $\alpha = 0.97, 0.95, \text{ and } 0.96$ .

**Printing mediation** This scale reflected how the mother encouraged and guided her child to achieve the most independent process possible for graphically producing the written letter. The printed production of each letter received a separate score along the 9-point ordinal scale that appears in the lower part of “Appendix C”. The average score across letters for the eight words served as the *printing* mediation score. Cronbach alpha reliabilities on pretest, immediate posttest, and delayed posttest, respectively, were:  $\alpha = 0.96, 0.92, \text{ and } 0.96$ .

Coding was carried out by four independent graduate students. Interjudge reliability was measured on 170 letters in the pretest, 165 in the immediate posttest, and 145 in the delayed posttest, retrieved from randomly selected protocols. Mean percentage of agreement on *grapho-phonemic* mediation was 80% and on *printing* mediation was 92%.

### *Children's performance*

Children were tested individually in their kindergartens on 11 tasks: 6 alphabetic skills and 5 linguistic competencies.

**Alphabetic skills** The six tasks measuring alphabetic skills were used in previous studies.

**Naming letters** Children received a set of cards presenting all 27 Hebrew letters and 5 pictures of objects, and were asked to name them. Presentation was in a scrambled order that changed across children. Responses to the first three letters received corrective feedback. The score for letter naming was the percentage of letters named correctly (e.g., Treiman, Levin, & Kessler, 2007). Cronbach alpha reliabilities on pretest, immediate posttest, and delayed posttest, respectively, were:  $\alpha = 0.95, 0.92, \text{ and } 0.91$ .

**Sounding letters** The same 32-card set, presented in a scrambled order, was used to ask children to provide the sound that each letter stands for. Responses to the first three letters received corrective feedback, with the required phoneme. The score for sounding letters was the percentage of letters represented with correct phonemic

sounds (see Levin, Shatil-Carmon, & Asif-Rave, 2005). Cronbach alpha reliabilities on the three phases respectively were:  $\alpha = 0.95, 0.96$ , and  $0.96$ .

*Isolating initial sounds in words* Children listened to 16 spoken words with a CVC structure and were asked to provide the initial phoneme. These 16 phonemes comprise all the consonantal sounds acceptable in the initial position in Hebrew words. Words were presented in two sequences, almost equally balanced across children: from top to bottom or vice versa. Responses to the first three words received corrective feedback (Share & Blum, 2005). Cronbach alpha reliabilities on the three phases respectively were:  $\alpha = 0.96, 0.95$ , and  $0.95$ .

*Reporting words' initial letter names* Children listened to a different set of 16 spoken words with a CVC structure and were asked to report the initial letter name. Words were presented in two sequences, almost equally balanced across children: from top to bottom, or vice versa. Responses to the first three words received corrective feedback. The score was the percentage of initial letters correctly named or named by homophonous letters (e.g., the letter *kaf* instead of the correct letter *kuf* for the word *kir* [wall]), because children of this age range are unable to tell which of two homophonous letters is correct (see Levin, 2007). Cronbach alpha reliabilities on the three phases respectively were:  $\alpha = 0.92, 0.86$ , and  $0.88$ .

*Word recognition* Children received a pair of cards placed side by side on the table, each displaying a drawing. Then the children were handed two cards consecutively, each displaying a printed word and were asked to match each printed word with its drawing. Children received three different sets of word pairs, one set at each of three testing phases. No corrective feedback was supplied. The score was the percentage of word-drawing pairs matched correctly (see Aram & Levin, 2002). Cronbach alpha reliabilities on the three phases respectively were:  $\alpha = 0.70, 0.74$ , and  $0.70$ .

*Word spelling* Children were asked to write out each of the eight words used in the word recognition task, prompted by drawings. Scores for each letter that the child had to spell were as follows: A correct letter scored 3 points, a homophonous letter (or medial instead of final letter, differing in shape on 5 Hebrew letters) scored 2 points, and an incorrect letter or no letter scored 0. The score was the percentage of points out of the maximum possible points (see Levin, 2007). Cronbach alpha reliabilities on the three phases respectively were:  $\alpha = 0.97, 0.97$ , and  $0.96$ .

**Linguistic competencies** The five tasks measuring linguistic competencies were standardized tests.

*Receptive vocabulary* In the Peabody vocabulary test, adapted to Hebrew (Solberg & Nevo, 1979), children were asked to choose the appropriate drawing for the spoken lexical item, and the score was the percentage of items answered correctly. Cronbach alpha reliabilities on the three phases respectively were:  $\alpha = 0.75, 0.72$ , and  $0.73$ .

*Expressive vocabulary* An antonym test developed and standardized on Israeli children (Peyser, Shimborsky, Wolf, & Hazany, 1995) included 18 lexical items presented in ascending order of difficulty. Children were asked to say “the

opposite” (e.g., to answer “short” for the item “tall”). The score was the percentage of correct responses. Cronbach alpha reliabilities on the three phases respectively were:  $\alpha = 0.72$ ,  $0.72$ , and  $0.71$ .

**Definition test** This test assessed children’s competency in providing appropriately communicative, syntactically well-designed, rich, and specific definitions of words. The test, developed in English (Snow, Cancino, Gonzalez, & Shriberg 1989), underwent adaptation to Hebrew (Aram & Levin, 2004). The test included 14 lexical items (e.g., bicycle) presented in a fixed order, and children were asked to explain their meaning: “What is a...?” Each of the 14 definitions was scored according to Snow et al.’s (1989) scale on six categories: definitional features, functional features, examples, descriptive features, synonyms, comparisons, and communicative adequacy. The sum of children’s scores on all six categories for all 14 nouns served as the *definitions* score. This score was transformed into a percentage score, out of the maximum points gained in this cohort. The inter-item reliability was  $\alpha = 0.91$ ,  $0.94$ , and  $0.94$ .

**Listening comprehension of sentences/story** The two tests measuring listening comprehension were excluded from further analyses owing to their low internal reliabilities. On *Listening comprehension of sentences*, reliabilities were  $\alpha = 0.42$ ,  $0.44$ , and  $0.40$ , and on *Listening comprehension of story* they were:  $\alpha = 0.37$ ,  $0.42$ , and  $0.44$ . Low reliabilities may have resulted because these tests were adopted from a standardized screening measure for reading-spelling disability, tested by *reading comprehension* among grade-school beginners in Israel (Shatil & Nevo, 2007). We used this adaptation because, to the best of our knowledge, no standardized listening comprehension test was available in Hebrew.

## Procedure

Mothers were distributed into the three mediation groups and control group as follows. First, all mothers were invited by their children’s kindergarten teacher to participate in an 8-week intervention aiming to promote school readiness, which would include a workshop and three sessions of videotaping of mother–child interaction at home. To begin, mothers in the intervention groups chose one of six proposed dates to participate in the 3-h opening workshop, without knowledge that the workshops differed by content (two workshops each were randomly assigned to the three mediation groups—reading, writing, or visuomotor skills). The authors and two research assistants gave each workshop. Mothers in the control group were told that after being videotaped with their child three times and completing the research measures, they would attend a workshop on school readiness.

Data collection (for interactive reading, mediation of writing, and alphabetic skills and linguistic competencies) occurred in three phases for the each of the three mediation groups. The pretest took place up to 2–3 weeks prior to the opening workshop. The immediate posttest was carried out 7–8 weeks later, a few days after termination of the intervention. The delayed posttest was conducted 2.5 months after the immediate posttest. Mother–child joint reading and writing were assessed at home. Children’s testing took place in their kindergartens.

## Results

### Differential effects of the interventions on mother–child interactive reading

Prior to the intervention, the mean number of dialogues initiated by the mother was rather low ( $M = 4.35$ ) in a book including 22 pages. Almost all those (98%) referred to the book's story or illustrations, and the rest referred to the print or to story grammar. The child initiated fewer dialogues than the mother ( $M = 1.64$ ), and practically all of them related to the story or illustrations. Out of all pretest dialogues initiated by the mother or the child, about 18% included maternal scaffolds, 36% included maternal elaborations, 80% included maternal praise, and 12% included maternal corrections. These scores, transformed into Z scores, were summed up and composed the number of *enhancing dialogues*.

Table 1 (upper section on joint reading) presents the mean scores on characteristics of dyadic reading by group and phase. Table 2 (upper section) presents the results of two-way ANOVAs of these scores, with 4 (group: reading, writing, visuomotor, control) by 3 (phase: pretest, immediate posttest, delayed posttest), with phase assessed by repeated measures.

Analyses of the three characteristics—number of maternally initiated dialogues, number of child-initiated dialogues, and Z score of enhancing dialogues—revealed a significant interaction of group by phase. To illuminate the source of the interactions, we carried out Bonferroni comparisons, taking into account the number of comparisons. Comparing the groups in each phase showed that at the pretest, no group differed from each other on any of the characteristics, implying that the groups were well matched. On the immediate posttest, the storybook reading group significantly surpassed all other groups on all characteristics. The three other groups—writing, visuomotor skills, and control—were statistically indistinguishable. On the delayed posttest, the storybook reading group outperformed all other groups on number of mother-initiated dialogues and on enhancing dialogues, but not on number of child-initiated dialogues, and the three other groups were again statistically indistinguishable.

In the storybook reading group, dyadic reading increased substantially and significantly on all three characteristics from pretest to the immediate posttest. It declined significantly from the immediate to the delayed posttest only on number of child-initiated dialogues. Consequently, the dyadic reading group remained significantly higher on the delayed posttest than on the pretest regarding its number of mother-initiated dialogues and enhancing dialogues. In contrast, in the three other groups (writing, visuomotor, and control) the characteristics of dyadic reading remained statistically indistinguishable between the three phases.

Almost all the dialogues initiated by mothers or children in the pretest pertained to the story or illustrations. Guiding mothers on storybook reading mediation significantly increased their questions or comments on this topic as well as on topics that they regularly neglect—print and story grammar. Nevertheless, dialogues on print and story grammar remained marginal and were not examined further.

**Table 1** Means (and SDs) of storybook reading, writing mediation, and children's literacy, as a function of intervention group and phase ( $N = 124$ )

Group	Phase		
	Pretest <i>M</i> (SD)	Immediate posttest <i>M</i> (SD)	Delayed posttest <i>M</i> (SD)
<b>Joint reading</b>			
Total no. of mother-initiated dialogues			
Reading mediation	4.71 (6.49)	15.14 (13.16)	9.94 (8.48)
Writing mediation	3.97 (3.60)	5.22 (5.52)	3.56 (4.65)
Visuomotor skills mediation	5.77 (5.49)	7.93 (7.98)	4.83 (4.85)
No mediation	2.74 (5.65)	3.33 (4.03)	1.56 (2.06)
Total no. of child-initiated dialogues			
Reading mediation	1.66 (2.61)	4.14 (6.18)	1.00 (1.55)
Writing mediation	1.66 (3.56)	1.91 (1.99)	1.13 (1.74)
Visuomotor skills mediation	2.17 (2.29)	1.90 (2.82)	1.07 (1.70)
No mediation	1.00 (2.24)	1.26 (2.64)	0.85 (1.97)
Total no. of enhancing dialogues ( <i>Z</i> score) <sup>a</sup>			
Reading mediation	0.35 (4.90)	3.02 (5.33)	2.77 (5.08)
Writing mediation	-0.72 (1.29)	-1.47 (1.29)	-1.23 (1.33)
Visuomotor skills mediation	1.12 (4.90)	-0.64 (2.19)	-0.53 (2.28)
No mediation	-0.84 (2.28)	-1.47 (1.57)	-1.55 (1.74)
<b>Joint writing</b>			
Mean score on grapho-phonemic mediation			
Reading mediation	5.29 (1.62)	6.06 (1.85)	6.56 (1.34)
Writing mediation	5.40 (1.25)	7.52 (0.57)	7.74 (0.70)
Visuomotor skills mediation	5.14 (1.52)	6.06 (1.85)	6.52 (1.63)
No mediation	5.40 (1.81)	6.42 (1.68)	6.66 (1.83)
Mean score on printing mediation			
Reading mediation	6.46 (2.55)	7.27 (2.07)	8.27 (1.30)
Writing mediation	6.52 (2.30)	8.92 (0.18)	8.92 (0.12)
Visuomotor skills mediation	6.44 (2.45)	7.50 (2.36)	8.13 (1.70)
No mediation	6.79 (2.44)	8.04 (1.84)	8.05 (1.66)
<b>Children's literacy performance</b>			
Mean percentage score on alphabetic skills			
Reading mediation	35.19 (20.67)	56.44 (24.42)	62.63 (21.70)
Writing mediation	36.54 (25.15)	70.17 (23.19)	69.62 (23.33)
Visuomotor skills mediation	34.96 (19.21)	56.14 (24.04)	62.79 (24.11)
No mediation	47.72 (25.37)	61.08 (24.02)	65.95 (23.25)
Mean percentage score on linguistic competencies			
Reading mediation	41.09 (10.74)	43.19 (9.65)	51.41 (13.64)
Writing mediation	42.52 (9.13)	43.35 (9.48)	51.05 (10.64)
Visuomotor skills mediation	40.50 (9.29)	41.48 (9.24)	49.38 (9.98)
No mediation	40.16 (12.99)	39.53 (11.92)	50.13 (11.49)

<sup>a</sup> Dialogues including maternal scaffolding, elaboration, reinforcement, and/or correction

**Table 2** Statistics of 2-way ANOVAs of phase by group, and Bonferroni post-hoc comparisons on storybook reading, writing mediation, and children's literacy ( $N = 124$ )

Measure	Phase <i>F</i> (2, 240)	Group <i>F</i> (3, 120)	Interaction <i>F</i> (6, 240)	$\eta^2$ (Interaction)	Comparison of groups		
					Pretest	Immediate posttest	Delayed posttest
Joint reading							
No. of mother-initiated dialogues	17.06***	11.35***	6.91***	0.147	NS	R > W, V, C	R > W, M, C
No. of child-initiated dialogues	8.93***	1.65	3.08**	0.072	NS	R > W, V, C	NS
No. of enhancing dialogues	0.09	12.22***	6.22***	0.134	NS	R > W, V, C	R > W, V, C
Joint writing							
Mean grapho-phonemic mediation score	113.75***	3.57*	4.90***	0.109	NS	W > R, V, C	W > R, V, C
Mean printing mediation score	62.35***	1.71	2.91**	0.068	NS	W > R, V	NS
Child literacy							
Mean alphabetic skills (%)	302.76***	1.24	7.84***	0.164	C > W, R, V	W > R, V, C	W > R
Mean linguistic competency (%)	139.43***	0.56	0.57	NS	NS	–	–

R reading group, W writing group, V visuo-motor group, C control group

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

### Regression analyses of joint reading

Note that all the following regression analyses used the three models described below. Model 1 included child's age, maternal education, pretest scores, and group; Model 2 added two-way interactions—group by child's age, group by maternal education, and child's age by maternal education; and Model 3 added a three-way interaction—group by child's age by maternal education. Simultaneous regression analyses were used so that the unique effect of each predictor was measured after controlling for all the rest. All the regression tables present results of Model 1. For brevity, the very few significant interactions are described in the text.

To predict each characteristic of interactive reading during the immediate and delayed posttests, four predictors were used: the child's age, maternal education, performance in pretest on the predicted characteristics (autoregression), and group. The previously cited analyses indicated that an increase in interactivity during storybook reading due to the intervention emerged only in the storybook reading group. Therefore, to assess group effect, we compared the storybook reading group to the three other groups combined (writing, visuomotor, and control). We tested autoregression: whether those dyads who were more interactive during the pretest continued to be more interactive following the intervention on the predicted characteristics. Over and above testing the major hypothesis, whether group

predicted posttest scores, we explored whether group interacted with child's age and/or maternal education in predicting posttests.

**Immediate posttest** Results of the regressions (for Model 1) predicting the immediate posttest on joint reading appear in the upper part of Table 3. Pretest scores and group had significant effects on all three dialogue scores at the immediate posttest. Age had an effect on immediate posttest scores only in number of mother-initiated dialogues: Mothers initiated more dialogues with younger than with older children.

No significant two-way interactions appeared (Model 2). Only one-three-way interaction emerged (Model 3)—of group by child's age by maternal education—that added to the prediction of *enhancing dialogues*. This interaction reflected that in the reading group, among dyads where mothers had lower education, enhancing dialogues decreased with the child's age. These mothers used more enhancing dialogues for younger than for older children,  $b = 2.34$ ,  $t(115) = 3.32$ ,  $p < 0.01$ . No such effect was found for mothers with higher education in the reading group or for mothers with higher or with lower education in the other groups combined.

In sum, the three models combined explained 44%, 22%, and 53% of the variance, respectively, in mother-initiated dialogues, child-initiated dialogues, and enhancing dialogues.

**Delayed posttest** Results of the regressions predicting the delayed posttest (for Model 1) appear in the upper part of Table 4. Pretest characteristics had effects on all three joint reading scores at the delayed posttest. Group had considerable effects both on number of mother-initiated dialogues and on maternal enhancing dialogues, but not on number of child-initiated dialogues.

Model 2 added a two-way interaction of group by age on enhancing dialogues. This interaction indicated that in the reading group, mothers used more enhancing dialogues in reading for younger than for older children,  $b = -1.43$ ,  $t(116) = 2.44$ ,  $p < 0.05$ . No such trend appeared in all other groups combined. No three-way interactions added to the prediction of delayed posttest scores (Model 3).

In sum, the three models combined explained 34%, 23%, and 35% of the variance, respectively, in mother-initiated dialogues, child-initiated dialogues, and enhancing dialogues.

#### Differential effects of the interventions on mother–child joint writing

Prior to the intervention, the mean score of maternal grapho-phonemic mediation was 5.31 (out of 10) across the groups. This score indicates that when guiding their children in writing words the mean level of mediation amounted to dictating letter by letter. The printing guidance mean score was 6.50 (out of 9), showing that prior to the intervention when helping their child to produce letters mothers' mean level amounted to reminding their children of the shape of the required letter by mentioning another similar letter or shape.

The middle section of Table 1 presents the mean scores on maternal mediation of writing by group and phase, and the middle section of Table 2 presents the results of



**Table 3** Summary of simultaneous multiple regression for the prediction of interactive reading joint writing and child's literacy in the immediate posttest ( $N = 124$ )

	B	SE B	$\beta$	$t$
<b>Joint reading</b>				
No. of mother-initiated dialogues (MID)				
Child's age	-1.538	0.710	-0.158	-2.17*
Maternal education	-0.362	0.694	-0.037	-0.052
Pretest no. of MID	0.729	0.130	0.409	5.63***
Group: R vs. W + V+C	8.844	1.532	0.410	5.77***
No. of child-initiated dialogues (CID)				
Child's age	-0.024	0.341	-0.006	-0.07
Maternal education	-0.170	0.349	-0.042	-0.49
Pretest no. of CID	0.445	0.127	0.304	3.51***
Group: R vs. W + V+C	2.447	0.755	0.275	3.24**
No. of enhancing dialogues (ED)				
Child's age	-0.350	0.250	-0.095	-1.40
Maternal education	0.094	0.249	0.026	-0.38
Pretest no. of ED	3.906	0.548	0.478	7.13***
Group: R vs. W + V+C	0.474	0.073	0.442	6.52***
<b>Joint writing</b>				
Mean score of maternal grapho-phonemic mediation (MGPM)				
Child's age	0.066	0.104	0.040	0.63
Maternal education	-0.030	0.102	-0.018	-0.30
Pretest MGPM mean score	0.685	0.066	0.642	10.34***
Group: W vs. R + V+C	1.238	0.234	0.331	5.28***
Mean score of maternal printing mediation (MPM)				
Child's age	-0.003	0.139	-0.001	-0.02
Maternal education	-0.147	0.133	-0.077	-1.10
Pretest MPM mean score	0.449	0.056	0.567	7.99***
Group: W vs. R + V+C	1.380	0.308	0.317	4.48***
<b>Child literacy<sup>a</sup></b>				
Mean percentage score on alphabetic skills (AS)				
Child's age	0.398	1.312	0.017	0.30
Maternal education	1.329	1.261	0.056	1.05
Pretest AS percentage score	0.789	0.056	0.767	14.13***
Group: W vs. R + V+C	15.091	2.891	0.279	5.22***

R reading, W writing, V visuomotor skills, C control

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

<sup>a</sup> Linguistic competency scale was not analyzed by regressions, as noted in the text

the two-way 4 (group) by 3 (phase) ANOVAs of these scores, with phase assessed by repeated measures. Analyses of maternal grapho-phonemic mediation and of printing mediation revealed a significant interaction of group by phase. Comparing the groups in each phase showed that on the pretests, no group differed from each

**Table 4** Summary of simultaneous multiple regression for the prediction of interactive reading and joint writing and child's literacy in the delayed posttest ( $N = 124$ )

	B	SE B	$\beta$	$t$
<b>Joint reading</b>				
No. of mother-initiated dialogues (MID)				
Child's age	-1.067	0.504	-0.165	-2.12*
Maternal education	-0.260	0.492	-0.040	-0.058
Pretest no. of MID	0.319	0.092	0.270	3.48***
Group: R vs. W + V+C	6.147	1.087	0.430	5.66***
No. of child-initiated dialogues (CID)				
Child's age	0.057	0.140	0.033	0.41
Maternal education	0.045	0.143	0.026	0.31
Pretest no. of CID	0.293	0.052	0.468	5.63***
Group: R vs. W + V+C	0.023	0.310	-0.006	-0.07
No. of enhancing dialogues (ED)				
Child's age	-0.406	0.276	-0.114	-1.47
Maternal education	0.019	0.275	-0.005	-0.07
Pretest no. of ED	3.639	0.605	0.463	6.02***
Group: R vs. W + V+C	0.230	0.080	0.223	2.86**
<b>Joint writing</b>				
Mean score of maternal grapho-phonemic mediation (MGPM)				
Child's age	0.047	0.111	0.032	0.42
Maternal education	0.044	0.107	0.030	0.41
Pretest MGPM mean score	0.685	0.066	0.642	10.34***
Group: W vs. R + V+C	1.143	0.247	0.338	4.62***
Mean score of maternal printing mediation (MPM)				
Child's age	0.036	0.111	0.027	0.33
Maternal education	0.066	0.107	0.048	0.62
Pretest MPM mean score	0.259	0.045	0.459	5.75***
Group: W vs. R + V+C	0.747	0.246	0.241	3.03**
<b>Child literacy<sup>a</sup></b>				
Mean percentage score on alphabetic skills (AS)				
Child's age	0.203	1.390	0.009	0.15
Maternal education	0.777	1.335	0.034	0.58
Pretest AS percentage score	0.740	0.059	0.757	12.51***
Group: W vs. R + V+C	7.265	3.062	0.141	2.37*

R reading, W writing, V visuomotor skills, C control

\*  $p < 0.05$ ; \*\*\*  $p < 0.001$

<sup>a</sup> Linguistic competency scale was not analyzed by regressions, as noted in the text

other either on grapho-phonemic or on printing mediation. On the immediate posttest, the writing mediation group significantly surpassed all other groups on both measures of mediation (except on one case—see Table 2). The three other

groups—reading, visuomotor skills, and control—were statistically indistinguishable. On the delayed posttest, likewise, the writing mediation group outperformed all other groups on grapho-phonemic mediation, and the three other groups were again statistically indistinguishable. However, on the printing mediation task, none of the four groups differed significantly from each other.

Maternal grapho-phonemic mediation increased substantially and significantly on all groups, from pretest to the immediate posttest, and did not significantly change further from the immediate to the delayed posttest. Still, on all groups, maternal grapho-phonemic mediation remained significantly higher on the delayed posttest than on the pretest. Maternal printing mediation increased from pretest to the immediate posttest in the writing and the control groups, but not in the reading and visuomotor groups. No group increased significantly in maternal printing mediation from the immediate to the delayed posttests, but all four groups were significantly higher on the delayed posttest than on the pretest.

In sum, the writing group surpassed the other groups on grapho-phonemic mediation, both immediately after termination of the intervention and a few months later. On printing mediation, the advantage of the writing group over other groups appeared to be significant only immediately after the intervention. Later on, the groups retained their higher scores, but the difference between groups did not reach significance. This finding may have stemmed from a ceiling effect.

### *Regression analyses of writing mediation*

Four predictors were used: the child's age, maternal education, performance in pretest on the predicted characteristics (autoregression), and group. The previously cited analyses indicated that an increase in writing mediation due to the intervention emerged only in the joint writing group. Therefore, to assess group effect, we compared the writing group to the three other groups combined (reading, visuomotor, and control).

**Immediate posttest** Results of the regressions predicting the immediate posttest appear in Table 3. Pretest scores and group had effects on grapho-phonemic mediation and on printing mediation.

On the grapho-phonemic mediation, a significant two-way interaction of child's age and maternal education was moderated by a significant three-way interaction of child's age, maternal education and group,  $\beta = -0.177$ ,  $t = -2.22$ ,  $p < 0.03$ . This interaction reflected that mothers in the writing group provided a higher grapho-phonemic mediation at the immediate posttest than in the other groups combined, irrespective of child's age. In contrast, in the three groups combined (reading, visuomotor, and control) mothers with higher education provided higher grapho-phonemic mediation to older than to younger children. Mothers with lower education in the three groups combined provided low grapho-phonemic mediation irrespective of the child's age.

On printing mediation, a significant two-way interaction of group by child's age emerged,  $\beta = 0.039$ ,  $t = -2.16$ ,  $p < 0.04$ . This interaction can be viewed as negligible. It stemmed from the following: Printing mediation decreased

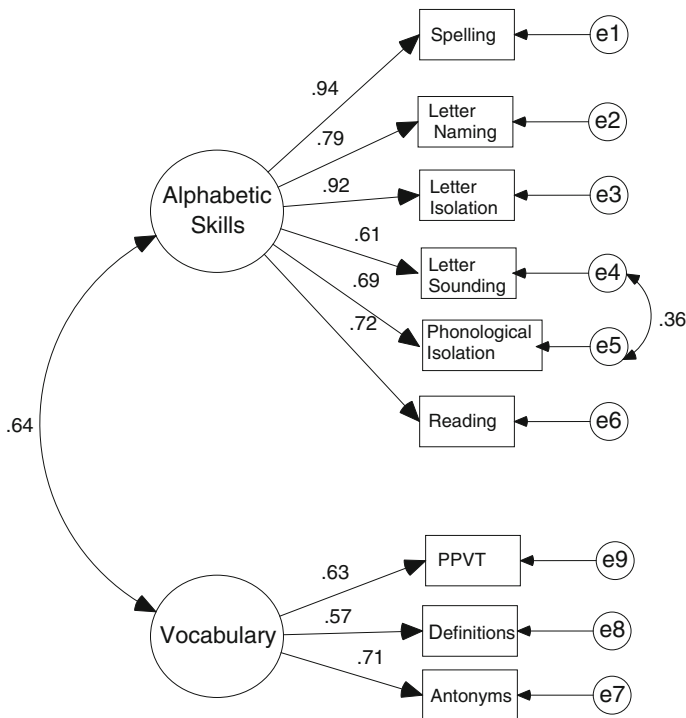
non-significantly with child's age among the writing group, and increased non-significantly among the other groups combined.

In sum, the three models combined explained 60% of the variance in maternal grapho-phonemic mediation and 47% of the variance in printing mediation.

**Delayed posttest** Results of the regressions predicting the delayed posttest appear in Table 4. Pretest characteristics and group had significant effects on both delayed posttest scores. No significant interactions appeared either for grapho-phonemic or printing mediation. In sum, the three models combined explained 40% of the variance in grapho-phonemic mediation and 30% of the variance in printing mediation.

### Children's performance: confirmatory factor analysis

We attempted to confirm whether the nine administered tests of child literacy measured the two expected factors: alphabetic skills (six tests) and linguistic competencies (three tests). We added an expected relation between the two alphabetic tests that required responding with an isolated phoneme: the phoneme isolation of words and the letter sounding, which in Hebrew amounts to isolating the initial phoneme of the letter name. Structural equation modeling was carried out by AMOS on the pretest scores. Results are displayed in Fig. 1. The analysis showed a



**Fig. 1** Results of confirmatory factor analysis of child literacy analyzed by structural equation modeling (AMOS) for the total sample ( $N = 124$ )

good fit of the model to the data:  $\chi^2 = 30.23$ ,  $df = 25$ ,  $p = 0.22$ , Goodness of fit index—GFI = 0.95, Comparative fit index—CFI = 0.99, and Root mean square error of approximation—RMSEA = 0.041. These results support the hypothesis that the tests measured two factors: Six measured one factor pertaining to alphabetic skills, and three measured another factor relating to linguistic competencies.

Two composite scores were formed. The *alphabetic skills* composite score was created by averaging the percentage scores on six tests. The Cronbach internal reliabilities across these tests were high on pretest, immediate posttest, and delayed posttest, respectively:  $\alpha = 0.91$ ,  $0.92$ , and  $0.92$ . The *linguistic competencies* composite score was created by averaging the percentage scores on three tests. The reliabilities across these tests were satisfactory:  $\alpha = 0.67$ ,  $0.76$ , and  $0.67$ .

### Differential effects of the interventions on children's performance

Table 1 (bottom section) presents the mean scores on alphabetic skills and linguistic competencies by group and phase. Table 2 (bottom section) presents the results of two-way 4 (group) by 3 (phase) ANOVAs of these scores, with phase assessed by repeated measures.

The analysis of alphabetic skills revealed a significant interaction of group by phase, but no such interaction appeared on linguistic competencies. To illuminate the source of the interaction on alphabetic skills we carried out Bonferroni comparisons. Unexpectedly, at the pretest, the control group outperformed all other groups. To control for this difference, we analyzed progress scores from pretest to the immediate posttest (i.e., immediate posttest minus pretest score), from the immediate to the delayed posttest (i.e., delayed posttest minus immediate posttest), and from pretest to the delayed posttest (i.e., delayed posttest minus pretest score). The groups were compared on progress scores by one-way ANOVAs. The growth in alphabetic skills from pretest to the immediate posttest was significantly higher on the writing group than on each of the other groups, which did not differ from each other,  $F(3,124) = 11.92$ ,  $p < 0.001$ ,  $\eta^2 = 0.230$ . The overall growth from pretest to the delayed posttest remained significantly higher on the writing group than on the control group,  $F(3,124) = 4.84$ ,  $p < 0.01$ ,  $\eta^2 = 0.108$ .

On linguistic competencies, all groups improved gradually from pretest to the immediate posttest (except on the control group) and all groups improved thereafter to the delayed posttest, so that the scores were significantly higher on the delayed posttest than on the pretest. However, group by phase interaction was not significant.

In sum, on alphabetic skills children in the writing group surpassed the rest. On linguistic competencies all groups improved with time, but the interventions had no effect on this growth.

### Regression analyses of children's alphabetic skills

Simultaneous regression analyses were conducted on children's alphabetic skills. No such analysis was carried out on linguistic competencies because intervention had no effect on this score, as shown by the lack of a significant group by phase

interaction effect. Four predictors were used: the child's age, maternal education, alphabetic pretest score, and group. The previously cited analyses indicated that the alphabetic skills improved due to the intervention only in the joint writing group. Therefore, to assess the group effect, we compared the writing group to the three other groups combined (reading, visuomotor, and control). Tables 3 and 4 (bottom part) present Model 1 of the regression analysis. No interaction added to the prediction of alphabetic skills at the immediate or at the delayed posttests.

Pretest alphabetic scores and group—writing group versus the rest—had significant effects on the immediate and on the delayed alphabetic scores. In sum, the three models combined explained 69% of the variance in immediate alphabetic scores, and 61% of the variance in delayed alphabetic scores.

## Discussion

### Interactive reading and writing mediation: implementation and transfer

The first goal of this study was to explore whether guiding low-SES mothers to mediate learning in one joint activity would directly affect the same activity as well as be transferred to another joint activity. We focused on two activities: interactive reading and writing mediation. We expected that coaching mothers in reading storybooks interactively would improve reading quality more than coaching them in other joint activities like writing or visuomotor skills. In the same vein, we expected that guiding mothers to mediate writing would improve their quality of writing mediation more than guiding them in interactive reading or visuomotor skills. Moreover, we investigated transfer effects, to determine whether guiding mothers in some other joint activity would contribute to interactive storybook reading on the one hand, and to writing mediation on the other hand, more than would no intervention.

Results were consistent for both types of activities. Coaching mothers on each activity had impressive effects on the targeted activity only. In other words, implementation of each program succeeded, but mothers did not generalize the learned principles of mediation to the other non-coached joint activities. The failure of transfer will be discussed later.

The effects of reading intervention on interactive reading were remarkable in the context of the habitual storybook reading characteristics demonstrated among these low-SES mothers before intervention. Reading characteristics in the pretest were similar to those that appeared in the literature that has mainly addressed younger children and higher or mixed SES populations. First, the literature indicates that in habitual storybook reading mothers rarely engage the child (Huebner & Meltzoff, 2005). Likewise, we found that the number of dialogues initiated by mothers was relatively low, with the mean number around four. Second, the amount of maternally initiated dialogues during habitual reading is known to vary substantially across mothers (Briesch et al., 2008; Curenton, Craig, & Flanigan, 2008; Yaden, 2003). Indeed, the number of dialogues initiated by the current sample of mothers varied greatly, ranging from no dialogues during the entire reading to more than one

per page. Third, mothers are known to usually contribute more to the discourse during reading than do their children (Curenton et al.). Similarly, the current mothers contributed about three times more dialogues than did their children. Finally, as noted in the text, mothers initiated dialogues during reading that focused almost entirely on the story and illustrations and often ignored the print and story grammar. Overlooking of print, even when the children are kindergartners on the verge of starting school the next year, may stem from the possible distractive effect it may have on the ongoing processing of the story. Ignoring story grammar may reflect mothers' limited comprehension that the particular text is a materialization of a general scheme of narrative that can help in text comprehension.

Coaching mothers in interactive reading enhanced their reading quality in both the immediate and the delayed posttests. In the immediate posttest, mothers tripled the number of dialogues they initiated and doubled the number of enhancing dialogues, thereby greatly increasing their children's discourse during reading. Remarkably, the children themselves initiated more dialogues—asking questions, demanding clarifications—2.5 times more after the intervention. In the delayed posttest, 2.5 months after the intervention, mothers' interactive reading skills (initiating dialogues and providing enhancing dialogues) slightly decreased but sustained their heightened level relative to the pretest. However, the children did not maintain their high level of initiating dialogues, although they continued to participate in dialogues initiated by their mothers. These results corroborate previous findings on delayed posttests for trained interactive reading (Huebner & Meltzoff, 2005).

Writing mediation improved significantly from pretest to the immediate posttest, and furthermore sustained its higher level thereafter, in the delayed posttest, in all four groups. Nonetheless, writing mediation level in the writing group at the immediate and the delayed posttests surpassed its level in the other three groups, who were indistinguishable.

A prominent difference emerged between the effects on interactive reading and on writing mediation in the respective groups coached in these activities. Among mothers coached in writing mediation, the variances of maternal writing mediation decreased remarkably in the two posttests relatively to the pretest, but not in the other three groups. No such variance decrease occurred among mothers coached on interactive reading at the posttests relatively to the pretest (see Table 1). Such a sustained high variance in interactivity following intervention was also found in a previous study (Huebner & Meltzoff, 2005). The decrease in variance in the writing group implies that most mothers in the writing group learned to mediate writing on a similarly high level, approaching a ceiling effect.

No parallel success appeared on interactive reading, and this deserves consideration. To involve the child in an ongoing series of challenging dialogues while reading a story aloud to the child is a demanding task. It requires attending simultaneously to the story being read, to the difficulties it can pose to the listening child, and to the opportunities the text offers for enhancing the child's language and story comprehension. Mothers may differ either in their ability to perform such a demanding task or in their motivation to cope with it persistently.

### Why transfer failed to occur

The expectation was refuted that guiding mothers in other joint activities would improve interactive storybook reading or writing mediation, relatively to the control group (no intervention). This lack of transfer coincides with a previous finding showing no transfer from enriched conversation in toy play to interactive reading among children with language impairments (Dale et al., 1996). However, the theoretical understanding and educational profit to be gained from studying transfer to interactive reading justify deeper scrutiny of this issue. In general terms, the rich literature shows that transfer of training is a highly regarded but not very common outcome of training, with the reasons not being entirely clear (Salomon & Perkins, 1989).

The explanations for lack of transfer to interactive reading on the one hand, and to writing mediation on the other hand, may differ. Many mothers who were not trained to read interactively were in the habit of reading storybooks to their children (as indicated in maternal reports), and this may account for the resistance of storybook reading interactivity to change. Further, parents have been found to view storybook reading as a context for bonding with the child and a time of enjoyment, more than as a context for learning (Audet, Evans, Williamson, & Reynolds, 2008). Therefore, unless parents endorse the view that storybook reading is a teaching–learning opportunity, and are encouraged to read interactively and guided in how to do so, parents may be unaware of other ways of reading that might be productive.

High level writing mediation requires understanding of the process of inventing spellings of words: segmenting the word into abstract sound units, connecting each unit to a letter based on its name or sound, and printing the letter. This is quite a different process from that carried out by a mastered speller who already employs word-specific orthographic knowledge. Therefore, mothers who did not participate in the writing intervention and specifically learn to mediate writing may not be aware of the process required from the child while inventing spelling. Further, mothers having little experience of joint writing with their children may not be aware of their children's relevant knowledge, and may suffice with dictating the required letters—a rather mediocre mediation.

### Pretest–posttest continuity, child's age, and maternal education

Two predictors emerged consistently as predominant in regressions predicting interactive reading and writing mediation in the immediate and the delayed posttests: First, pretest scores uniquely predicted posttests scores, implying that mothers who surpassed their counterparts prior to the intervention continued to outdo them following the intervention at both posttest intervals. In the same vein, mothers who prior to the intervention scored higher than their counterparts on writing mediation continued to surpass them in the two posttests. These findings show that individual differences between mothers were not eliminated by intervention effects, when intervention effects (as well as other predictors) were controlled. Secondly, group uniquely predicted interactive reading and writing mediation: Mothers coached on one activity surpassed the rest on that activity, even after controlling for all other predictors.



A recent meta-analysis showed that children's age and maternal education had effects on children's vocabulary growth due to interactive reading relative to regular reading (Mol et al., 2008). Referring to age, the effect of interactive reading on children's vocabulary has been found to decrease with children's age, from 2–3 to 4–6 years old, becoming negligible in the older samples. The authors suggest that older children perhaps need less parental interactive reading, becoming better able to monitor story comprehension and ask questions on their own.

Our cohort was older than most samples studied thus far, as it included only kindergartners, with a mean age of 5;4. Still, the age effect reported above was partially supported in our analyses: In the immediate posttest, those mothers with low education who were coached on interactive reading initiated more enhancing dialogues in reading to younger than to older children. In the delayed posttest, all mothers coached on interactive reading (irrespective of their education) initiated more enhancing dialogues in reading to younger than to older children. These findings suggest that maternal interactive reading tends to decline when children get older, as mothers possibly believe that their children need less assistance (DeTemple, 2001), and this belief seems to be held more by mothers of lower education (among our low-SES mothers).

Note that parents tend to overestimate their preschoolers' early literacy (Hiebert & Adams, 1987), so that mothers may be unaware that their children need assistance during storybook reading. In addition, mothers with lower education, within a sample of low-SES mothers, may have greater difficulty in crafting challenging questions that would lead to high-quality discourse, including scaffolds and elaborations, for older children.

The effect of age on maternal writing mediation was diametrically different than the picture portrayed above. Mothers in the writing group provided high grapho-phonemic mediation in the posttests, irrespective of the child's age. Mothers in the three groups combined (reading, visuomotor, and control) provided higher grapho-phonemic mediation to older than to younger children. Possibly these mothers increased their level of mediation in response to children's growth in alphabetic skills and invented spelling. No clear effects emerged of children's age or maternal education on maternal printing.

### Effects on children's alphabetic skills and linguistic competencies

A major question of this study was whether due to the intervention programs, enhanced writing mediation in the writing group would promote children's alphabetic skills, whereas enhanced interactive storybook reading in the reading group would promote children's vocabulary. Such differential effects of joint writing as opposed to storybook reading gained support in correlative studies (Aram & Levin, 2002; Hood et al., 2008; Sénéchal & LeFevre, 2002). However, in a single intervention study, implemented in small groups of kindergartners, joint writing did enhance alphabetic skills more than interactive storybook reading, but interactive reading failed to enhance children's linguistic competencies more than joint writing (Aram & Biron, 2004).

Results of the current study are in line with the findings of Aram and Biron (2004). Maternal mediation of writing was found to be the most productive activity in enhancing alphabetic skills, as measured by letter knowledge, phonological awareness, word spelling, and decoding, but maternal interactive storybook reading failed to promote linguistic competencies, as measured by receptive and expressive vocabulary and the word definition test.

In general, alphabetic skills appeared as substantially more malleable to promotion than linguistic competencies. From pretest to the immediate posttest, alphabetic skills improved by 90% in the writing mediation group and by 30% in the control group. Linguistic competencies, in comparison, improved by only 5% in the joint reading group and not at all in the control group (see Table 1). The discrepancy between these volumes of change can be explained by the different nature of these domains that is exhibited in their testing. Alphabetic skills, particularly letter knowledge and phonological awareness, are rather specific skills referring to a closed class of knowledge. In most alphabetic languages, the number of letters that the child has to remember by shape, name, and sound is less than 30 (in Hebrew: 27). The number of phonemes to which the child should become sensitive is also quite limited (in Hebrew less than 20 consonantal phonemes). Assessment of these skills practically measures the entire knowledge base (within the constraints of the specific task). In contrast, expressive and receptive vocabulary, as well as learning to define concepts (the linguistic skills measured here) are broad competencies that grow for years. Their assessment involves only a limited sample, assumed to be representative, of the entire knowledge base. For instance, PPVT measured understanding of about 60 items, which is a very small sample of kindergartners' receptive vocabulary. Naturally, this characteristic of linguistic competency allows for only gross assessment of the construct.

Hence, in intervention studies that are limited in time, gains are difficult to capture using general tests that do not measure the particular items targeted by mediated reading. Had we assessed vocabulary improvement by using words that the parents read or discussed with the child during interactive book reading, the chances would have increased for finding substantial benefits in the joint reading group, relative to the other groups (Aram, 2006).

In this study, joint writing that involves parental mediation appeared to be an efficient practice for promoting alphabetic skills, which are important for reading and writing acquisition. However, joint writing is often considered by parents to be a school-like activity and thus unsuitable for parent–child joint entertainment. In contrast, joint reading is viewed by many children, parents, and educators as engaging. These differential conceptions could be culturally transformed by motivating children to learn the alphabetic code. This could be done by introducing entertaining games for such learning, like writing friends' names on birthday invitations, making a grocery list, or writing a note to grandmother. According to our impression, most dyads in the current study enjoyed writing together as well as learning skills related to writing—letter knowledge, word segmentation, and grapho-phonemic awareness. In a recent study (Levin & Ehri, 2009), kindergartners, particularly those advanced on letter knowledge, learned on their own to recognize and spell many of their classmates' names, displayed in the classroom, without any encouragement on the part of their teachers.

This study calls for analyzing differential effects of other parent–child joint activities. After all, parents spend long hours playing with their young children, and possible contributions of this natural activity can be knowledgeably used to advance children’s cognitive and literate development.

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#### Appendix A Descriptions and examples of categories coded for mother–child dialogues

Category	Description	Example
Questions or comments on story or illustration		
Completion	Mother (M) starts a word/phrase from the text to encourage Child (C) to complete it verbatim	M: (in a rising elongated intonation that requests completion) “ <i>Frog in a very special...</i> ” C: Day
Recall	M asks a question that requires recalling a piece of recently-mentioned information (in the last 1–3 sentences)	M: “ <i>Help! It’s a ghost! Screamed all three friends. And then they saw that it was a rabbit.</i> ” Whom did they see? C (points at the rabbit)
Illustration	M or C refers to the illustration, asking who and what questions	C: Mommy, that’s the sea (points at the illustration) M: That’s the sky. It looks like a sea C: That’s the sea M: You know what? Maybe it’s the sea, because frogs are going into the water. Maybe it is the sky
Wh question	M or C asks a ‘who,’ ‘what,’ ‘which,’ ‘where,’ ‘when,’ ‘why,’ or ‘how’ question	M: “... <i>And he landed on the river ... At least he had a soft landing.</i> ” Why did he have a soft landing? C: Because he landed on water
Word/phrase meaning	M or C asks about the meaning of a word or an idiomatic phrase	M: “ <i>Rabbit, may I borrow a book from you?</i> ” What is “borrowing a book?” C: Taking a book from you M: Right. And then what do you do? C (perplexed expression) M: Return the book C (nods)
Distancing	M or C asks a question or produces a comment that connects the text to the C’s own experiences or general knowledge	M: “ <i>And they cuddled in bed. The frog warmed up beside the duck, and was no longer afraid.</i> ” Do you do that sometimes? When you are scared, do you come to sleep with Mommy and Daddy sometimes? C (nods)

**Appendix A** continued

Category	Description	Example
Questions or comments on print or alphabetic skills		
Counting words/ letters	M asks the C to count words uttered in a phrase and map each onto a printed word, or to count letters in printed words	<p>M: How many words are in the book's title— “(A) <i>frog</i> is (a) <i>frog</i>?”</p> <p>C: Three (correct in Hebrew)</p> <p>M: How do you know that there are three words?</p> <p>C: Because I see the space</p>
Naming or sounding letters	M asks C to name letters or, rarely, to produce their sounds	<p>M: (points to the printed word) Do you know any letters in the word “<i>frog</i>?”</p> <p>Which letters do you know?</p> <p>C (names all letters correctly)</p>
Isolating sounds or rhyming	M asks C to isolate the initial or final sound of an uttered word or to trace/produce a rhyme	<p>M: What is the first sound in “frog” [tsfarde'a]?</p> <p>C: tsfa</p> <p>M: Listen carefully, ts... farde'a</p> <p>C: ts</p>
Print recognition or decoding	M asks C to recognize (or, rarely, to attack) a printed word/phrase	<p>M: “<i>He went to visit the rabbit.</i>” Where do you see the word “rabbit” again? Show me another one</p> <p>C: (points) This one</p>
Questions or comments on story grammar		
Summary	M asks C to succinctly reproduce the storyline from memory	<p>M: Tell me what you remember from the book. C: I remember that the frog ... that he is the best. But then the duck flew and he also wanted to fly, but then the pig also wanted to make cakes, and then he (the frog) did not, he wanted to make a cake too and he didn't succeed because the cake burned</p>
Characters	M asks who the characters were	<p>M: Now, Tom, which characters are in the book besides the frog?</p> <p>C: A rabbit</p> <p>M: Who else?</p> <p>C: A duck</p>
Protagonist	M asks who the protagonist was and how the C made that decision	<p>M: Shirley, who is the main character?</p> <p>C: The frog</p> <p>M: True. The frog with the pants. And why is he the main character?</p> <p>C: Because he was at the beginning, in the sides, and at the end</p> <p>M: Right. Instead of saying at the beginning, in the sides, and at the end, what do we say?</p> <p>C: In every place</p> <p>M: Throughout the...</p> <p>C: Story</p>

**Appendix A** continued

Category	Description	Example
Problem	M asks what the protagonist's major problem was	M: What was his problem? C: And then he solved it M: Right. But what was the problem? C: That he couldn't fly and couldn't read and couldn't swim
Solution	M asks how the problem was resolved	M: How did he solve the problem that he didn't know this and that and that? C: The rabbit helped him
Lesson	M asks C what s/he has learned from the story	M: What did you learn from the story? C: That each one has something else M: Something else that he is good at. And he must be happy with what he has... Do you understand that, Shirley? We shouldn't look at others...

Italics in the examples indicate passages read from the storybook

**Appendix B** Descriptions and examples of maternal behaviors coded for mother-child enhancing dialogues

Maternal behavior	Description	Example
Scaffolding	Mother (M) accepts Child's (C's) response as wrong or unsatisfactory, and attempts to lead C to the correct response	M: " <i>Rabbit, may I borrow a book from you?</i> " What's "borrow a book?" C: Take a book from you M: Right. And what should be done later? C: Ah... (facial expression of "I don't know") M: Give back the book. Right? C: (nods) M: This is what we call "borrow a book."
Elaboration	M accepts C's response as correct but leads C to elaborate on it, or provides an elaboration	M: " <i>He floated in the air just like a true bird. But then his wings were torn and he fell down like a stone... At least he had a soft landing.</i> " Why did he have a soft landing? C: Because he landed on water M: Right. And what if he would have landed on the ground? C (facial expression of "I don't know") M: Would it hurt? C (nods) M: More than in the water? C (nods)

**Appendix B** continued

Maternal behavior	Description	Example
Praise	M responds with confirmation of C's response or praise for C	M: " <i>A frog is a frog.</i> " How many words do we have? C: Three (correct in Hebrew) M: Very nice
Correction	M corrects C's response	M asks: Which of these letters do you know? C (names a series of letters correctly, but then names one letter incorrectly) M: Lori, this is <b>tet</b> . It resembles <b>lamed</b> but it is <b>tet</b>

Italics in the examples indicate passages read from the storybook

**Appendix C** Scores and descriptions of maternal grapho-phonemic and printing mediation scales (ordinal)

Score	Description
<b>Grapho-phonemic mediation</b>	
1	Mother (M) refers to the word as a whole without helping Child (C) write it
2	M says the whole word and then either writes it down or writes it as a model for C to copy
3	M refers to the word as a sequence of sounds, uttering the sequence and then write the word herself or as a model for C to copy
4	M refers to the word as a sequence of letters, uttering letter names, writing the whole word herself, or as a model for C to copy
5	M dictates letter names or letter sounds, one by one
6	M says the word, retrieves a phonological unit (syllable, subsyllable, or phoneme) and immediately dictates the required letter name
7	M says the word, segments it into phonological units, and encourages/helps C to link a unit with a letter name
8	M says the word, encourages/helps C to segment the word into phonological units and to link a unit with a letter name
9	M encourages C to go through the whole process of saying the word, segmenting it into its sounds, and retrieving a letter independently while supporting C along the steps
10	M actively monitors C while C writes the letters independently, intervening when C asks for help or makes a mistake
<b>Printing mediation</b>	
1	M writes the letter on her own
2	M holds C's hand and produces the letter together with C
3	M uses marks to shape the letter and guides C in following the marks
4	M writes the letter for C to copy or shows the letter written elsewhere
5	M produces the shape of the letter in the air or on the table, without leaving signs, and encourages C to follow this lead
6	M reminds C of the shape of the letter by mentioning another similar letter or shape (e.g., " <b>hej</b> is like <b>rejsh</b> with a little mark")

## Appendix C continued

Score	Description
7	M encourages/helps C to retrieve a letter by reminding C of a word with that letter (e.g., “This is <b>shin</b> like in <b>Shaxar</b> [child’s name]”)
8	M encourages/helps C to discover the letter shape independently
9	M watches C writing the letter, and monitors and supports when required

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