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# Efficacy of an Early Intervention Program for At-Risk Preschool Boys: A Two-Group Control Study

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## KEY WORDS

- activities of daily living
- child, preschool
- early intervention (education)
- program evaluation
- risk factors
- socioeconomic factors

**OBJECTIVE.** We report the results of a preschool-based multidisciplinary intervention program.

**METHOD.** This study took place in two educational settings and included 81 preschool boys from unique cultural backgrounds and of low social economic status (SES). The settings were randomly assigned to an intervention or control group. In the intervention group, boys identified as at risk for or with developmental delays received 8 mo. of intervention through a monitoring model. Additionally, a collaborative consultation model was used with all participants. Performance skills (visual–motor integration, motor, and cognitive) and performance and participation in preschool activities were evaluated at pretest and posttest.

**RESULTS.** At termination of intervention, all children in the intervention group scored significantly better than control children on most performance skills and more fully participated in preschool activities.

**CONCLUSION.** A multidisciplinary preschool early intervention program appears to assist children of low SES with improving their performance skills, and participation in preschool activities.

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In the past decade, participation has become one of the most important outcome measures of medical and educational interventions because of its presumed impact on a person's health and quality of life. The basic assumption of the *International Classification of Functioning, Disability and Health* (World Health Organization, 2001) and of basic models in occupational therapy (e.g., Christiansen, Baum, & Bass Haugen, 2004; Dunn, Brown, & Youngstrom, 2003) is that performance and participation in daily life activities are a result of the transaction among individual abilities, the tasks or activities, and the environment within which the person performs the activities. Similarly, Bronfenbrenner's (1979) Ecological Model of Child Development stresses that children's development is influenced by the quality of the relationships between the environment and the children. This perspective is supported by studies showing that children of low socioeconomic status (SES) had, or were at risk for, motor, cognitive, or social developmental delays affecting their school performance (Mansour et al., 2003; Marr, Cermak, Cohn, & Henderson, 2003). Studies have also shown that children from various countries and cultures differed with respect to the sequence and speed of their sensory–motor (Venetsanou & Kambas, 2010) and cognitive (Katz, Kizony, & Parush, 2002) development. One explanation for these findings is that the social codes and values of a specific culture may affect its members' practices in raising and educating their children (Rower-Striar, 1999).

On the basis of ecological developmental theories (e.g., Dunn et al., 2003), early intervention programs have been developed with the purpose of identifying children at risk for developmental delays and providing the necessary educational, health, and social services (Stephen & Tauber, 2001). These programs have often been provided by multidisciplinary teams and carried out

in the children's natural environment (homes or educational systems; Shonekoff & Meisels, 2000). Although studies have shown that early intervention programs may be effective in preventing accumulation and deterioration of existing difficulties (e.g., Reynolds, Temple, & Ou, 2003), only a few have examined the programs' efficacy in improving children's participation in educational settings (e.g., Case-Smith, 1998).

School-based occupational therapists who are involved in early intervention programs often focus on developing children's occupations and basic skills (e.g., motor, perceptual, cognitive; Stephen & Tauber, 2001). School-based occupational therapy goals are usually achieved by applying direct or indirect intervention methods or a combination of both (Weintraub & Kovshi, 2004). Direct intervention is commonly provided in one-to-one sessions or in small groups outside of the classroom (referred to as *pull-out sessions*); direct intervention alone may often not promote teacher involvement or the transference of intervention gains in the classroom (Kemmis & Dunn, 1996).

By contrast, indirect intervention methods usually address the occupational needs of several children in one classroom and require collaborative teamwork. Together, team members define the children's needs and determine the intervention program (Bundy, 1995). One such indirect method is called *monitoring*: In this method, an occupational therapist develops an individual or group intervention program and then guides another staff member in its implementation. Monitoring is appropriate when a child's educational needs require routine and consistent practice beyond therapy sessions (Dunn, 1990). A second indirect method is called *collaborative consultation*, in which team members jointly determine the needs of a child or class, set educational or intervention goals, and develop an intervention program (Villeneuve, 2009).

Several studies have examined the efficacy of direct and indirect intervention methods (for a review, see Sayers, 2008). Most studies compared one kind of method (usually direct intervention) to another (usually indirect intervention) and demonstrated that both methods are effective in improving children's performance and have no significant differences in outcomes (Sayers, 2008). Sayers (2008), however, suggested that the consultation method is essential for ensuring carryover of gains into the child's classroom. Moreover, on the basis of studies that compared blended intervention methods (e.g., direct intervention and monitoring compared with direct intervention and collaboration), Sayers reported that blended methods allow therapists to tailor intervention to each student's individual needs. Few studies, how-

ever, have examined the efficacy of blended intervention methods.

This study focused on preschool boys in Israeli ultra-orthodox (IUO) educational settings. These settings were selected because of the unique cultural characteristics of this population and because most families are from low SES by choice; many of the IUO families, who make up 10% of the Israeli population, are large; the fathers usually study in religious higher educational settings (*yeshivas*) and do not work, and the mothers are homemakers (Gurevich & Cohen-Castro, 2004). To preserve their customs and lifestyles, the IUO families have a separate educational system (Grilak, 2002); boys and girls study in separate settings. The boys' curriculum focuses mostly on religious studies (Erhard & Erhard-Weiss, 2007) and offers few opportunities for play and physical activities. This practice often places the children at risk for developmental delays (Marr et al., 2003). Recently, as a result of studies emphasizing the importance of physical activities (Shmueli & Tamir, 2007) and changes in welfare legislation in Israel, sectors of the IUO community have been more receptive to modifying their educational curriculum and to consulting professionals who are not part of their community (Yafe, 2007).

These changes led leaders of one IUO community to approach us and request development of an intervention program that would meet their children's needs, consider the unique cultural characteristics of their community, and be implemented in the educational setting. In developing the intervention program, we had to consider several factors. First, on the basis of a pilot study (Golos, Sarid, Weill, Yochman, & Weintraub, 2010), we found that a high percentage of the IUO boys (71.4%) were identified as at risk for or having a developmental delay in one or more developmental area (e.g., motor, cognitive). In addition, our limited budget allowed for an occupational therapist and a developmental aide to each work only 1 day (5 hr) per week.

Several assumptions guided our intervention. First, on the basis of educational-ecological models, we assumed that the intervention would be most effective if implemented in the children's classroom (Reynolds et al., 2003). Second, to meet the children's unique and complex needs, a multidisciplinary team was required. We further assumed that to improve children's participation in daily activities (rather than improve only specific skills), each intervention model (i.e., monitoring or collaborative consultation) alone was not sufficient. Instead, we believed that combining intervention models (Sayers, 2008) would allow us to best address the children's unique difficulties (by monitoring) and facilitate transfer

of newly learned skills to the classroom (through collaborative consultation).

The purpose of this study was to evaluate the efficacy of a multidisciplinary and multimodel early intervention program in improving children's performance skills and participation in preschool activities. The research questions were (1) would the performance of and participation in daily activities of preschool boys identified as at risk for or having delays significantly improve after intervention and (2) would the participating children's performance be significantly better than that of children in a control group?

## Method

### *Research Design*

The study took place in two IUO educational settings in a city in central Israel between September 2006 and June 2008. We used a pretest–posttest, two-group control study design. The groups, which were from two different educational settings (see Participant Selection section) were selected through a convenience sample but were randomly assigned to an intervention or control group. The children in both settings were from the same cultural and SES background. The study was approved by the Hebrew University ethics committee (institutional review board). All parents provided consent for their children's participation.

### *Instruments*

We used the assessments described in the sections that follow to measure performance skills and serve as the criteria for identifying the children at risk in the specific area.

*Developmental Test of Visual–Motor Integration.* The Developmental Test of Visual–Motor Integration (VMI; Beery, 2004) is a standardized measure of visual–motor integration in which children between ages 2 and 18 copy geometric shapes of increasing difficulty. Raw scores are converted to standard scores. Reliability measures of the VMI meet accepted criteria (interrater reliability = .94, test–retest reliability = .87, and internal consistency reliability = .88). In this study, we used only the VMI subscale, which served as a criterion for inclusion in the graphomotor monitoring group (see the “Procedure” section).

*Movement Assessment Battery for Children.* The Movement Assessment Battery for Children (M–ABC; Henderson & Sugden, 1992) is a norm-referenced measure that evaluates manual dexterity, ball, and balance skills in children between ages 4 and 12 yr (low scores mean better performance). The M–ABC has sound

reliability: Minimum test–retest reliability at any age is .75, and interrater reliability is .70. Concurrent validity is adequate: An 80% agreement between the M–ABC and the Bruininks–Oseretsky Test of Motor Performance (Bruininks, 1978) was found (Henderson & Sugden, 1992). The M–ABC served as a criterion for inclusion of the manual dexterity and gross motor monitoring groups (see the “Procedure” section).

*Miller Assessment for Preschoolers.* The Miller Assessment for Preschoolers (MAP; Miller, 1988) was designed as a screening instrument to identify preschool children with mild to moderate developmental delays. Raw scores are converted into percentile rank scores, which also converted to performance index scores (*normal*, *suspected for a delay*, and *delayed*). Interrater (.84–.99), internal (.79–.82), and test–retest reliabilities (total score = .81) were found to be high. Studies have also shown good content, criterion, and construct validity. Our study included two of the five subscales: Complex Tasks and Nonverbal Abilities. Together they served as a criterion for inclusion in the cognitive monitoring group (see the “Procedure” section).

### *Performance and Participation in Daily Activities*

The Structured Preschool Observation (SPO; Golos, Yochman, & Weintraub, 2006) is a 24-item structured observation based on a measure developed for preschool children in the general education setting (Goldhirsch, Wagner, & Vinokour, 2002). We adapted it for the IUO educational settings. The SPO evaluates performance and participation in different areas of daily activities in the preschool setting (“washes hands,” “engages in make-believe play,” “performs paper-and-pencil activities,” “initiates contact with peers”). Participation is measured using a 5-point Likert scale on which 1 = *never participates* and 5 = *always participates*. Performance level is measured using a 6-point Likert scale on which 1 = *avoids the activity* and 6 = *very successful*. Internal consistency of the SPO on both scales was found to be high (Cronbach's  $\alpha$  = .944 and .948, respectively). In addition, moderate and significant correlations were found between teachers and occupational therapists in relation to participation and performance ( $r$ s = .51 and .60,  $p$ s < .001, respectively). In this study, the SPO was completed by an occupational therapist (Anat Golos) who was not involved in intervention administration.

### *Participant Selection*

The participants were selected from two IUO educational settings in the same city. Children were from the same cultural and SES background. The two settings were

randomly assigned to an intervention or a control group. In each setting, all preschool boys participated except for those who received occupational therapy in the community during the study period and those whose parents did not grant permission to participate in the study.

### *Procedure*

The study included three phases: (1) pretesting and identification of the children at risk or with delays, (2) administration of the intervention program, and (3) posttesting.

*Pretest.* On the basis of the assessments' results, we identified the children who, according to one or more of the assessments, were found to be at risk for or had a developmental delay (i.e., received a score 1 standard deviation or more below the mean or were defined as "delayed" or "suspected for a delay" according to the assessment's criteria). Typically developing children performed as expected or above their age group. The identified children were then assigned to a monitoring group according to their area or areas of difficulty.

*Intervention Program.* The intervention program was carried out between November and June of the school year (over 8 mo) and included several components. First, using the monitoring model, we provided small-group (3–5 children) intervention for the children at risk or with delays in four areas: (1) manual dexterity, (2) gross motor (ball and balance) skills, (3) graphomotor skills, and (4) cognitive skills (see Sections 1 and 2 of the Appendix). A pediatric occupational therapist who was not involved in pretesting developed separate protocols for each of the four monitoring groups in the study group and guided the developmental aide (who was a graduate of a 2-yr program for aides in preschool educational settings), twice a month for 30 min, in implementing the different protocols. Each protocol included 10–12 sessions, and groups met for 30 min/wk; each protocol was implemented 2 or 3 times.

Bimonthly collaborative consultation sessions took place between the teacher, who had an undergraduate degree, and the occupational therapist who guided the aide. During these meetings, collaborators planned the intervention goals and program for the entire class, in coordination with the activities practiced in the monitoring groups, including graphomotor activities (e.g., coloring within lines), manual dexterity (e.g., cutting), and gross motor activities (e.g., jumping, hopping, balance exercises, ball games; see Section 3 of the Appendix). The purpose was to enhance children's performance and participation in different occupational areas (e.g., basic skills, play, education). The therapist modeled applica-

tion of the intervention program, and the teacher continued the program during the week.

The consultation and monitoring sessions were documented using forms for the purpose of determining treatment fidelity. Finally, teachers of the intervention and control groups participated in four advanced, 20-hr training sessions provided by various specialists (i.e., an occupational therapist, speech therapist, and an educational counselor) at the beginning of the school year. The training focused on improving teachers' knowledge in various developmental areas.

### *Data Collection*

Data were collected at the beginning (pretest) and end (posttest) of the school year using the same assessment battery. All data were collected by the same pediatric occupational therapists, who were trained in the assessment battery administration and were blinded to participants' assignment to the intervention or the control group.

### *Data Analysis*

We performed analyses using SPSS Version 15 (SPSS, Inc., Chicago). For each outcome measure, we calculated a difference mean score ( $d$  score; posttest–pretest). In comparing the entire class of intervention and control groups, we performed separate one-way analyses of variance for each measure, except for the MAP. Non-parametric tests were used for the children at risk or with delays and for analysis of the MAP scores (an ordinal scale) using a Mann–Whitney  $U$  test. Significance level was set at .05.

## **Results**

On the basis of results of a pilot study ( $n = 28$ ) we conducted before this study (Golos et al., 2010), a power analysis (Cohen, 1988; Uitenbroek, 1997) with a desired power of .90 at a significance level of .05 (using an estimated effect size of .74) indicated that a minimum sample size of 22 was required for each participant group.

This study included an intervention and a control group. In the intervention group, 27 of the 31 boys in one classroom participated; 3 boys were excluded because they received occupational therapy in the community during the study period, and 1 child was not granted permission by his parents to participate. The control group included 54 boys from two classrooms ( $n_s = 30$  and 24, respectively).

The children attended school 6 days per wk from 8:00 a.m. to 1:00 p.m. Children's age in the intervention and control groups (means [ $M$ ] = 51.15 and 52.00 mo,

standard deviations [*SD*] = 3.98 and 4.16, respectively) and the mean number of children in their family were similar (*Ms* = 4.38 and 4.22, *SDs* = 1.61 and 1.80, respectively). Additionally, the percentage of parents who did not work outside the home in each group was similar (in the intervention group, 42% of fathers and 50% of mothers did not work; in the control group, 72% of fathers and 28% of mothers did not work).

Distribution of each study group (at risk or with delays vs. typically developing) on the basis of their pretest scores on the criteria measures is presented in Table 1. As can be seen, both the intervention and the control groups had a high percentage of children at risk or with delays (68.5% in the intervention group; 85.2% in the control group). The highest percentages were found in relation to gross motor (ball, 24.1% in the intervention group and 51.9% in the control group; balance skills, 25.9% in the intervention group and 33.3% in the control group) and cognitive skills (complex task, 44.4% in the intervention group and 46.3% in the control group). Yet, in some areas the intervention and control groups differed with respect to the percentage of children at risk or with delays in a specific area (e.g., manual dexterity or VMI). Therefore, we controlled for these differences by using *d* scores when comparing the two groups.

### Comparison Between Children At Risk or With Delays

For each monitoring group, we compared the *d* score of the specific group's assessment scores with that of the children at risk or with delays in the control group, who would have been included in that specific monitoring group if they had been in the intervention group (Table 2).

**Table 1. Distribution of Participants: At Risk of or With Delays (Intervention Group) and Typically Developing (Control Group)**

Criteria Measures	Intervention Group, <i>n</i> = 27		Control Group, <i>n</i> = 54	
	AR, <i>n</i> (%)	TD, <i>n</i> (%)	AR, <i>n</i> (%)	TD, <i>n</i> (%)
VMI, <i>n</i> (%)	8 (29.6)	19 (70.4)	5 (9.3)	49 (90.7)
M-ABC				
Manual dexterity	12 (44.4)	15 (55.6)	4 (7.4)	50 (92.6)
Ball skills	14 (51.9)	13 (48.1)	13 (24.1)	41 (75.9)
Balance skills	9 (33.3)	18 (66.7)	14 (25.9)	40 (74.1)
MAP				
Complex tasks	12 (44.4)	14 (51.9)	25 (46.3)	23 (42.7)
Nonverbal	4 (16.0)	21 (84.0)	7 (13.7)	44 (86.3)
General	23 (85.2)	4 (14.8)	37 (68.5)	17 (31.5)

*Note.* Children may have been identified as at risk for or with delays in more than one area; therefore, the totals in the General criteria calculations do not represent the sum of all areas. Because some values in the MAP scores are missing, the sum of the *ns* do not reach the total *N*. AR = children at risk of or with delays; TD = typically developing children; VMI = Developmental Test of Visual Motor Integration; M-ABC = Movement Assessment Battery for Children; MAP = Miller Assessment for Preschoolers.

Results showed that the intervention group scored significantly higher than the control group with respect to graphomotor and cognitive skills. We found no significant differences, however, between the two study groups with respect to the other skills. In addition, we found that among all children who participated in at least one monitoring group, the intervention group scored significantly higher than the control group with regard to the children's participation.

### Comparison Among All Children

Next, we examined the intervention's impact on the entire class (including the typically developing children, who were exposed only to the collaborative consultation model), with respect to both their skills and their performance and participation in daily activities. As can be seen in Table 3, the intervention group scored significantly higher than the control group in most performance skills including cognitive tasks (complex task-MAP; *Z* = -2.668, *p* = .008) and participation and performance (SPO), with a large effect size ( $\eta > 0.14$  in all). By contrast, we found no significant differences between the groups on the ball and nonverbal index (MAP).

Finally, we examined the clinical significance of the study's results by comparing the study groups (intervention and control) with respect to the percentage of children who were identified as being at risk or with delays at pretest and at posttest. As shown in Table 4, we found that the intervention group showed a decrease in the percentage of children at risk or with delays pretest to posttest and a small increase in the control group. Further analysis showed that in the intervention group, the percentage of children at risk or with delays decreased from pretest to posttest in most performance skills, compared with the control group: graphomotor group, manual dexterity, ball skills, and complex tasks of cognitive skills. Only in balance skills and the nonverbal index of cognitive skills did the percentage of children at risk or with delays in the intervention group increase.

## Discussion

On the basis of ecological developmental theories (e.g., Bronfenbrenner, 1979), early intervention programs often focus on identifying children at risk for developmental delays and providing necessary services (Case-Smith, 1998). Our study examined the effects of a school-based multidisciplinary and multimodel intervention program among preschool boys in an IUO educational setting. This study population was of specific interest not only because it is of low SES but also because of it has unique

**Table 2. Comparison of Performance Skills Between the Children At Risk or With Delays in Each of the Monitoring Groups by Study Group**

Monitoring Group	Intervention Group, <i>n</i> = 27			Control Group, <i>n</i> = 49			<i>Z</i>	<i>p</i>
	Pretest	Posttest	<i>d</i>	Pretest	Posttest	<i>d</i>		
VMI: Graphomotor							-2.565	.01
<i>M</i>	81.38	105.13	23.75	81.60	92.60	11.00		
<i>SD</i>	1.30	7.02	7.52	3.72	4.93	5.85		
M-ABC								
Manual dexterity							-0.973	.331
<i>M</i>	8.79	1.88	-6.92	8.75	4.38	-4.38		
<i>SD</i>	1.68	2.23	3.04	0.87	2.98	3.57		
Ball skills							-1.107	.268
<i>M</i>	3.93	2.14	-1.79	4.00	3.61	-0.39		
<i>SD</i>	1.27	2.25	2.52	1.41	2.53	2.63		
Balance skills							-3.286	.001
<i>M</i>	8.83	3.61	-5.22	7.36	7.18	-0.18		
<i>SD</i>	3.12	3.29	3.15	2.28	2.98	3.33		
MAP: Cognitive								
Complex tasks							-3.580	.000
<i>M</i>	0.54	2.00	1.46	0.88	1.16	0.28		
<i>SD</i>	0.66	0.00	0.66	0.60	0.90	0.94		
Nonverbal							-0.746	.455
<i>M</i>	1.83	1.75	-0.08	1.68	1.72	0.04		
<i>SD</i>	0.39	0.45	0.51	0.48	0.61	0.73		

*Note.* *d* score = posttest score minus pretest score. The VMI served as criteria for the graphomotor monitoring group (intervention, *n* = 8; control, *n* = 5); the M-ABC served as criteria for the manual dexterity (intervention, *n* = 12; control, *n* = 4), ball (intervention, *n* = 14; control, *n* = 13), and balance (intervention, *n* = 9; control, *n* = 14) monitoring groups (low scores mean better performance); and the MAP (complex tasks and nonverbal index) served as the criteria for the cognitive monitoring group (intervention, *n* = 13; control, *n* = 25). *M* = mean; *SD* = standard deviation; VMI = Developmental Test of Visual Motor Integration; M-ABC = Movement Assessment Battery for Children; MAP = Miller Assessment for Preschoolers.

cultural values that stress spirituality (e.g., religious studies) over physical activities and needs and affect its educational curriculum.

Our first finding was that even though the preschool boys who were receiving occupational therapy in the community were excluded, >70% of the children were found to be at risk for or with delays, especially in gross motor and cognitive skills. This finding supports the results of previous studies (e.g., Mansour et al., 2003) indicating that children of low SES may be at risk for developmental delays. Our results also showed that, similar to findings in earlier studies (e.g., Dunn, 1990; Ratzon et al., 2009; Sayers, 2008), our intervention was effective in improving skills and performance and participation in the preschool daily activities of both the children at risk of or with delays and the entire class.

### Performance Skills

Further analysis of the data indicated that our results varied with respect to different developmental areas. We noted improvement in graphomotor skills and in complex cognitive skills. The intervention group improved significantly more than the control group, both among children at risk for or with delays and the entire class. From a clinical perspective, these results indicated that at

termination of the intervention none of the boys were found to be at risk in terms of their graphomotor skills and cognitive skills. We also noted a significant improvement in the intervention group's manual dexterity skills (i.e., lower *d* scores). These results coincide with those of previous studies finding that school-based occupational therapy intervention that focused on improving visual-motor (Ratzon et al., 2009) and fine motor skills (Case-Smith, 2000) may be effective. Specifically, it appears that extra practice of paper-and-pencil activities, stressing accuracy and eye-hand coordination, assisted in improving these boys' performance.

The improvement in all performance skills of the children at risk for or with delays was better in the intervention group than in the control group, but the difference was significant only in relation to the Balance subscale (i.e., lower *d* scores), perhaps because the groups were too small to reach significance. Support for this hypothesis can be found in the fact that when comparing all classes, the intervention group performed significantly better than the control group on all but the Ball subscale. From a clinical point of view, the results indicated that >20% of the children who were found to be at risk or with delays in at least one area of performance skills scored in the normal range after intervention. These

**Table 3. Comparison of Skills and Performance and Participation in Daily Activities of All Children**

Criteria Measures	Intervention Group, <i>n</i> = 27			Control Group, <i>n</i> = 49			<i>F</i> ( <i>df</i> )	<i>p</i>	$\eta$
	Pretest	Posttest	<i>d</i>	Pretest	Posttest	<i>d</i>			
VMI							13.74 (1,73)	.000	.158
<i>M</i>	97.15	107.48	10.33	100.17	100.65	0.48			
<i>SD</i>	12.69	7.11	12.04	12.06	10.55	10.46			
M-ABC							18.75 (1,58)	.000	.244
Total									
<i>M</i>	13.70	8.00	-5.70	9.04	10.76	1.72			
<i>SD</i>	5.86	5.45	5.87	4.33	6.46	5.67			
Manual dexterity							16.19 (1,65)	.000	.199
<i>M</i>	5.90	1.96	-3.94	3.46	3.21	-0.25			
<i>SD</i>	3.36	2.44	3.71	2.39	2.89	3.59			
Ball skills							3.81 (1,59)	.055	.560
<i>M</i>	2.84	2.00	-0.84	2.10	2.57	0.47			
<i>SD</i>	1.68	1.89	2.46	1.76	2.71	2.77			
Balance skills							4.23 (1,59)	.044	.706
<i>M</i>	4.91	3.78	-1.13	4.22	4.97	0.75			
<i>SD</i>	3.92	3.27	4.35	3.15	3.30	2.80			
SPO									
Participation							94.41 (1,72)	.000	.567
<i>M</i>	3.73	4.60	0.87	4.03	4.10	0.07			
<i>SD</i>	0.31	0.19	0.26	0.29	0.37	0.37			
Performance							92.88 (1,72)	.000	.563
<i>M</i>	4.66	5.75	1.09	5.19	5.30	0.11			
<i>SD</i>	0.41	0.21	0.34	0.43	0.42	0.45			

Note. *M* = mean; *SD* = standard deviation; *df* = degrees of freedom; VMI = Developmental Test of Visual Motor Integration; M-ABC = Movement Assessment Battery for Children; SPO = Structured Preschool Observation.

results support previous findings showing that directed practice of specific skills was effective in improving children's sensory-motor abilities (Venetsanou & Kambas, 2010). In our study, however, improvement in gross motor skills was seen in fewer boys than was improvement in graphomotor skills and complex cognitive tasks. A possible explanation is that the teachers found it easier to incorporate paper-and-pencil activities into the classroom routine than gross motor activities, which were less familiar to them and also required a more profound change in curriculum and values (i.e., placing more emphasis on physical activities and needs than on spirituality).

Finally, the study groups did not differ significantly with respect to the nonverbal index of cognitive skills. A possible explanation is that at pretest, children in the intervention group scored significantly higher than those in the control group. Thus, children in the intervention group may have already realized most of their potential in this area, given the fact that IUO educational settings often encourage cognitive development.

### Performance and Participation

Our results showed that the intervention program also improved the children's performance and participation in the preschool's daily activities. Similar to findings of other studies

(see Venetsanou & Kambas, 2010), the developmental delays our study population exhibited appeared to be the result of environmental factors (i.e., low SES and cultural values and practices). Thus, practicing developmentally appropriate motor and cognitive skills may have a positive effect on children's ability to participate in various daily activities (Mansour et al., 2003; Marr et al., 2003).

### Limitations and Future Research

This study has several limitations that lead to suggestions for future studies. Our study focused on children from one

**Table 4. At-Risk or Delayed Children in Each Group at Pretest and Posttest**

Performance Skills (Assessment)	Intervention Group (%), <i>n</i> = 27		Control Group (%), <i>n</i> = 49	
	Pretest	Posttest	Pretest	Posttest
General	85.2	51.9	68.2	68.5
Graphomotor (VMI)	29.6	0.0	9.8	4.0
Manual dexterity (M-ABC)	46.1	7.6	8.9	13.7
Ball skills (M-ABC)	57.6	34.6	31.8	39.2
Balance skills (M-ABC)	37.5	42.3	41.5	49.0
Complex tasks (MAP)	41.1	0.0	52.1	36.0
Nonverbal (MAP)	8.0	16.0	15.7	13.7

Note. VMI = Developmental Test of Visual Motor Integration; M-ABC = Movement Assessment Battery for Children; MAP = Miller Assessment for Preschoolers.

IUO community who have unique cultural characteristics. Although studies have shown that intervention programs may improve the development of children from low SES and various cultural backgrounds (Venetsanou & Kambas, 2010), we must establish that our intervention program will be effective in other cultures. This study should also be repeated with IUO girls. Examining the intervention's long-term effects is also important. These recommendations are being evaluated. Finally, given that the developmental delays of many of the children in our study were based on environmental factors, future studies should include parents as part of the intervention program.

## Conclusions

This study's results indicate that an intervention program for preschool children at risk for or with developmental delays as a result of environmental deprivation or cultural beliefs, administered in the children's educational setting, may be effective in improving their performance and participation in preschool daily activities. Moreover, a multidisciplinary team in which occupational therapists and educational staff work together and contributes their unique knowledge may facilitate the ability to address children's needs, specifically the needs of children at risk or with delays. Finally, teachers' training, in itself, is probably not sufficient to improve the performance of children at risk. The two intervention models (monitoring and collaborative consultation) seem to complement each other in that they enable both improvement in the children's skills and enhancement of their performance and participation in daily activities. ▲

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