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# Effectiveness of Responsive Teaching With Children With Down Syndrome

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## Abstract

A randomized control study was conducted to evaluate Responsive Teaching (RT) with a sample of 15 Turkish preschool-aged children with Down syndrome (DS) and their mothers over a six-month period of time. RT is an early intervention curriculum that attempts to promote children's development by encouraging parents to engage in highly responsive interactions with them. Subjects were randomly assigned to treatment conditions: the control group consisted of standard preschool classroom services; the RT group received bi-weekly RT parent-child sessions in addition to standard services. RT mothers made significantly greater increases in their Responsiveness and Affect as wellas decreases in Directiveness than control group mothers. There were also significant group differences in children's interactive engagement and development. Children in the RT group improved their developmental quotient scores by an average of 47% compared to 7% for children in the control group. Results are described in terms of the effects of parental responsive interaction on the developmental functioning of children with DS.

**Key Words:** *early intervention; relationship-focused intervention; parental responsiveness; developmental learning; Down syndrome; responsive teaching*

Relationship focused (RF) intervention attempts to enhance the development and social emotional functioning of young children with delays and disabilities by encouraging parents or other primary caregivers to engage in highly responsive interactions with their children (Affleck, McGrade, McQueeney, & Allen, 1982; Greenspan & Wieder, 1998; Mahoney, Robinson, & Powell, 1992). This approach to developmental intervention is derived from parenting studies that indicate parental responsiveness is one of the major social environmental influences on the development of young children. This research has been reported for diverse groups of children ranging from typically developing children (Bornstein & Tamis-LeMonda, 1997; Tamis-LeMonda, Bornstein, & Baumwell, 2001), to children at risk due to prematurity (Beckwith & Rodning, 1996; Landry, Smith, Swank, Assel, & Vellet, 2001), social environmental disadvantage (Landry, Smith, Miller-Loncar, & Swank, 1997), or adoption (Stams, Juffer, & van Ijzendoorn, 2002; van Londen, Juffer, & van Ijzendoorn, 2007), as well as children with significant developmental disabilities (Yoder & Warren, 1999) including autism (Siller & Sigman, 2002, 2008) and Down syndrome (Mahoney, Finger, & Powell, 1985).

Several studies have reported that RF interventions can be effective at promoting children's cognitive, communicative, and social emotional functioning (see reviews by Mahoney & Nam, 2011; McCollum & Hemmeter, 1997; Trivette, 2003). To date these studies have been conducted with premature children, socioeconomically disadvantaged children, and children with developmental delays associated with a range of disabilities. However, for the most part these studies have yet to determine the effectiveness of RF intervention for specific disabilities, although evidence of effectiveness with young children with autism is increasing (e.g., Aldred, Green, & Adams, 2004; Carter et al., 2011). In general, the key to the effectiveness of RF intervention appears to be the degree to which they enhance primary caregivers' responsiveness with their children (Aldred, Green, Emsley, & McConachie, 2012; Mahoney & Nam, 2011).

The purpose of this study is to examine the effectiveness of an RF intervention called

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Responsive Teaching (RT) with children with Down syndrome (DS). Responsive Teaching is a manualized developmental intervention (Mahoney & MacDonald, 2007) that is designed to promote children's cognitive, communicative, and social emotional functioning. Similar to other RF interventions (e.g., Hanen [Sussman, 1999], the Ecological Language Program [ECO; MacDonald, 1989], and Floortime [Greenspan & Wieder, 1998]), RT encourages parents to use the Responsive Interaction (RI) strategies as a means for increasing their level of responsiveness with their children. RI strategies are suggestions for modifying the various interactive dimensions of responsive behavior (e.g. Contingency: "Respond immediately to little behaviors"; Reciprocity: "Take one turn and wait"; Affect: "Interact for fun"; Match: "Do what my child can do"; and Non-Directiveness: "Follow my child's lead" (Mahoney & Nam, 2011).

However, RT differs from other RF interventions insofar as it is based upon the assumption that the child engagement behaviors that RI strategies have been reported to promote, such as initiation, exploration, joint attention, are the learning processes that mediate the impact of parental responsiveness on children's development (Mahoney, & MacDonald, 2007). As a result, RT encourages parents to model behaviors and communications that are matched to children's current level of functioning and discourages parents from using directive instructional methods such as prompting, shaping, and reinforcing extrinsically to produce these behaviors. Rather, parents are encouraged to use RI strategies to increase their children's use of the engagement, or pivotal, behaviors that are purported to be the foundations for developmental learning.

Three studies have been published indicating that children who participate in RT make significant improvements in their development (Karaaslan, Diken, & Mahoney, 2013; Mahoney & Perales, 2005) and social emotional functioning (Mahoney & Perales, 2003). In each of these studies, the increases in parental responsiveness promoted by RT were associated with increases in children's use of pivotal behaviors. Consistent with its underlying assumptions, two of these evaluations reported that intervention changes in children's cognitive and communication were also associated with increases in children's pivotal behavior (Karaaslan, Diken, & Mahoney, 2013; Mahoney & Perales, 2005).

While children with DS have participated in previous evaluations of RT, the number of participants has been insufficient to draw conclusions regarding the effectiveness of RT with this population. In fact, there is considerable skepticism about the likelihood of RF interventions being effective for children with DS, especially among those who maintain that children with DS require developmental interventions that provide more structure and direction than they might receive in RF interventions (e.g., Buckley, 2008; Feeley, Jones, Blackburn, & Bauer, 2011; Spiker, Boyce, & Boyce, 2002). This skepticism is based upon two lines of evidence. One is the commonly reported finding that mothers tend to be more directive while interacting with children with DS than with typically developing children (e.g., Landry, Garner, Pirie, & Swank, 1994; Roach, Barratt, Miller, & Leavitt, 1998). Such findings have been interpreted as indicating that children with DS need to be directed or prompted to engage in developmental learning opportunities because of their tendency to be passive and nonpersistent (Landry, Garner, Pirie, & Swank, 1994; Marfo, 1992; Spiker et al., 2002). The second is the belief that directive intervention procedures are necessary to offset the learning problems associated with DS (Hodapp & Fidler, 1999), such as deficits in imitation (Rondal, Lambert, & Sohier, 1981) and requesting (Fidler, Philofsky, Hepburn, & Rogers, 2005; Mundy, Kasari, Sigman, & Ruskin, 1995). Despite these arguments, results from descriptive studies, which have reported that the mastery motivation or task persistence of children with DS (Gilmore, Cuskelly, Jobling, & Hayes, 2009) as well as their cognitive (Brooks-Gunn & Lewis, 1984; Mahoney, Finger, & Powell, 1985) and communication functioning (Mahoney, 1988) are associated with their parents' level of responsiveness, suggest that RF interventions can be a viable alternative for children with DS.

This study involved a six-month randomized control trial of RT with a sample of preschool children with DS and their mothers who lived in Turkey. The study generally replicated the intervention protocol reported in a previous evaluation of RT (Karaaslan et al., 2013) that was conducted with children having a range of disabilities. In this study, all subjects received standard classroom special education services that are routinely

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provided to children with disabilities in Turkey. In addition, subjects in the RT group received individualized parent-child intervention sessions once each week. During each session, parents were taught one to two RI strategies and encouraged to use these strategies during routine interactions to promote their children's pivotal behavior intervention objectives

This study addressed three research questions. First, could mothers of children with DS learn to become more responsive by participating in RT? Second, would children with DS who received RT display higher levels of pivotal behavior than children in the standard treatment group? Third, would children who received RT make greater improvements in their cognitive, communicative, and social functioning than children who received standard special education services?

## Methods

**Subjects.** Subjects included 15 mothers and children with DS who were between 2 to 6 years of age. Participants were recruited from two special education rehabilitation centers in Turkey. Three criteria were used for subject selection: children were under six years of age; children had a diagnosis of DS; and mothers had not been involved in a parenting intervention. Out of 20 dyads that met these criteria, 15 agreed to participate. After the entire sample had consented to participate, subjects were randomly assigned to either the RT or Standard Treatment control groups using a computer generated list of random numbers.

Table 1 presents the demographic characteristics of the participants. Mothers' average age was 42.3 years; they had an average of 9.3 years of education and all were married. The average age of the children at the start of the study was 49.3 months, and one half were males. Results from $t$ tests indicated no significant group differences in mothers' age, education, and marital status, as well as gender of the children. While children in the RT treatment group were older than children in the control group ($d = .76$), these group differences were not significant. In addition, there were no significant group differences in children's developmental ages (see Table 1) or developmental quotients as measured by both the Turkish Version of the Denver Developmental Screening Test-II and the Ankara Developmental Screening Inventory.

## Procedures

**Responsive teaching.** Subjects in the RT treatment group received intervention during weekly 1.5 to 2 hour individual parent-child sessions for a six-month period of time. Sessions were conducted at either a center-based facility or in families' homes. The intervention was based upon procedures described in the RT curriculum (Mahoney and MacDonald, 2007), which had been translated into Turkish (Note: copies of the Turkish Translation can be obtained from O. Kaaraslan. During each session the interventionist worked with mothers to help them use RI strategies to enhance their children's use of their individualized pivotal intervention objectives (for descriptions of the RT curriculum go to www.ResponsiveTeaching.org.).

The intervention protocol was based upon the procedures recommended in the RT manual. The interventionist: (a) explained how the pivotal behavior was associated with the child's developmental concerns; (b) described and demonstrated 1 to 2 RI strategies to promote this pivotal behavior; (c) coached mothers while they attempted to implement the RI strategies with their child; and (d) helped mothers develop a plan to integrate these strategies into their routine activities and interactions with their child.

**Standard intervention.** Children in both the RT and control groups received early intervention services at their local special education rehabilitation centers two days per week. The Ministry of National Education (MoNE, 2012) in Turkey is responsible for all educational services including early intervention. According to the Special Education Act and Regulations for Special Education Services, the MoNE provides early intervention services that consist of one hour of group special education and/or two hours of individual special education support per week (MoNE, 2012; Prime Ministry Administration for Disabled People, 2012). Group special education is conducted with approximately 10 children, including children with and without disabilities. During group instruction children are taught social and adaptive living skills typically through the use of Picture Exchange Communication System (PECS) and applied behavioral analysis. Individual special education consists of one-to-one instruction related to the outcomes listed on the child's IEP. Parents may observe but do not participate actively in their

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Table 1
*Demographic Characteristics of Mothers and Children at Start of Intervention*

| Variable | Responsive teaching ($n$ = 7) | | Control group ($n$ = 8) | | Total sample ($n$ = 15) | | |
|---|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *F* |
| Mother's characteristics | | | | | | | |
| Age (years) | 42.4 | 5.7 | 42.3 | 4.3 | 43.3 | 7.6 | 0.05 |
| Education (years) | 8.9 | 2.8 | 9.6 | 3.4 | 9.3 | 3.1 | 0.22 |
| Marital status (% married) | 100 | | 100 | | 100 | | |
| Children's characteristics | | | | | | | |
| Age (months) | 55.1 | 15.4 | 44.1 | 13.6 | 49.3 | 15.1 | 2.16 |
| % males | 29 | | 38 | | 33 | | 0.13[a] |
| Child development | | | | | | | |
| Personal-social[1] | 18.7 | 8.7 | 17.9 | 9.8 | 18.3 | 9.0 | 0.30 |
| Language[1] | 20.4 | 10.9 | 19.8 | 11.2 | 20.1 | 10.6 | 0.01 |
| Language-cognitive[2] | 18.6 | 6.2 | 17.1 | 7.7 | 17.8 | 6.8 | 0.16 |
| Social-emotional[2] | 18.0 | 5.7 | 17.9 | 9.4 | 17.9 | 7.6 | 0.01 |

[1]Denver Developmental Age; [2]ADSI Developmental Age; [a]chi-square.

children's intervention (Karaaslan, Diken, & Mahoney, 2013).

**Data collection.** Developmental assessments and mother-child observations were collected at the beginning of intervention and two months after the completion of intervention.

**Child development.** Because there are no standardized Turkish child development instruments, developmental screening tests that had been standardized with Turkish children were used to assess child development. These included the Turkish Version of the Denver Developmental Screening Test-II and the Ankara Developmental Screening Inventory. These instruments were administered by independent certified examiners who were blind to subjects' group assignment.

***Turkish version of the Denver Developmental Screening Test-II (Denver-II: Anlar and Yalaz, 1996).*** The Denver II is a developmental assessment for children from birth to six years of age. It is completed mostly by a certified examiner observing the child, although parents are asked to be informants for items that cannot be observed. The Denver Developmental Screening Test (DDST) was originally developed by Frankenburg and Dobbs in 1967 and revised in 1990 (Frankenburg & Dobbs, 1990). Correlations of DDST developmental ages with mental age scores obtained from the Stanford Binet, Yale Developmental Schedule, and Bayley Infant Development Scale range between .86 and .97 (Frankenburg, Camp, & Van Natta, 1971). The Denver was first adapted into Turkish by Anlar and Yalaz in 1980 and revised in 1996 (Anlar & Yalaz, 1996). It includes 116 items that assess four domains of developmental functioning: personal-social, language, fine motor, and gross motor development. The Turkish standardization sample included 990 children between 1 to 78 months of age. Interrater and test–retest reliabilities of the Turkish Version of the Denver Developmental Screening Test are 90% and 86%, respectively (Anlar & Yalaz, 1996).

***Ankara Developmental Screening Inventory (ADSI; Savaşır, Sezgin, & Erol, 2005).*** The Ankara Developmental Screening Inventory (ADSI) evaluates the development of children between 3 to 72 months of age based upon information obtained from mothers or other primary caregivers (Öztop & Uslu, 2007; Savaşır, Sezgin, & Erol, 2005). This inventory is designed to be culturally sensitive for Turkish children. It consists of 154 items answered by mothers as "yes," "no," or "I don't know" that assess children's cognitive-language (65 items), fine motor (26 items), gross motor (24 items), and social/emotional functioning (39 items). The standardization sample included

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860 Turkish children. The standardization study of the ADSI included item analyses for each subscale, as well as discriminant analyses and criterion-related validity data. Test–retest reliabilities for three age groups (0–12 months, 13–44 months, and 45–72 months) ranged from 0.88 to 0.99 Cronbach's alphas were 0.98 for children from 0 to12 months; 0.97 for children from 13 to 44 months; and 0.88 for children from 45 to 72 months. Overall these data indicated that the ADSI is a reliable and valid inventory for young Turkish children (Savaşır, Sezgin, & Erol, 1994, 2005).

**Mother-child interaction.** To assess mothers' style of interaction, children and their mothers were video recorded while playing together for 15 minutes with a set of developmentally appropriate toys (i.e., stacking rings, wooden puzzles, xylophone, nesting blocks, toy car, toy airplane, toy train, and picture books). Mothers were instructed to play with their children as they typically do. Video recordings of these observations were coded with Turkish translations of the Maternal Behavior Rating Scale and Child Behavior Rating Scale.

***Maternal Behavior Rating Scale.*** The Maternal Behavior Rating Scale [MBRS (Mahoney, 1999) is a 12 item global rating scale that assesses characteristics of parents' interactive style using five-point Likert ratings. This scale has been used extensively in research with mothers of young children with disabilities. Results from this research indicate that MBRS ratings of mothers' interactive style are associated with children's rate of developmental growth (e.g., Mahoney, Finger, & Powell, 1985; Kim & Mahoney, 2004) and are sensitive to the effects of parent-mediated interventions (e.g., Mahoney & Powell, 1988; Mahoney & Perales, 2003, 2005).

The MBRS was translated and validated with 56 Turkish mother-child dyads in which the children had disabilities by the first author. Factor analysis indicated that the Turkish Version of the MBRS had three subscales that were nearly identical to the factors reported for the English version (i.e., Responsiveness [responsivity, sensitivity, effectiveness, inventiveness], Affect [expressiveness, acceptance, enjoyment, warmth, praise], and Achievement/Directiveness [achievement, pace, and directiveness]). In general, the Turkish Version of the MBRS had high internal consistency. For the entire scale Cronbach's alpha was .73 and Kaiser-Meyer-Olin (KMO) was .80. Internal consistency for the three subscales was also high as indicated by Cronbach's alphas of .87 for Responsiveness, .86 for Affect, and .72 for Achievement/Directiveness.

***Child Behavior Rating Scale.*** Children's interactive behavior was assessed with a Turkish translation of the Child Behavior Rating Scale [CBRS (Mahoney & Wheeden, 1998)] from the video recorded observation of mother-child play described above The CBRS consists of seven global items that assess children's engagement in social interaction. This scale has been used to assess children's interactive behavior with their mothers and other adults (e.g., Kim & Mahoney, 2004; Mahoney, Kim, & Lin, 2007). It has been reported to be sensitive to the effects of RF interventions (e.g., Mahoney & Perales, 2003; 2005).

The CBRS was translated and validated with 56 Turkish mother-child dyads in which the children had disabilities. Factor analysis indicated that similar to the English version, the Turkish Version of the CBRS had two factors: Attention (attention, interest, persistence, and cooperation) and Initiation (initiation, joint attention, and affect). The Turkish Version of the CBRS had high internal consistency. Cronbach's alpha was .89 and Kaiser-Meyer-Olin (KMO) was .82. Cronbach's alphas for attention and initiation were .89 and .84, respectively.

**Coding and reliability of mother-child observation.** Video recordings of mother child interaction were coded separately for the MBRS and CBRS by two raters who were blinded to group assignment. These raters received approximately 40 hrs of training and had attained 80% exact agreement on each scale. For each scale, pre- and postintervention observations were coded at the same time to avoid rating drift, and observations were randomly sorted so that pre- and postobservations were counterbalanced and were not coded consecutively for any dyad.

Twenty percent of all observations were coded by a second rater to assess reliability. Reliability was computed based on interrater agreement for all observations using the formula ([agreements/(agreement + disagreement)] × 100). Exact agreement between raters for the MBRS ranged from 73.3% to 86.7% with an overall agreement of 83.4%, and for the CBRS ranged from 80% to 93.3% with an overall agreement of 85.7%.

DOI: 10.1352/1934-9556-51.6.458

**Treatment fidelity.** All RT intervention sessions were provided by a professional with a doctoral degree in special education who had received five months of training on RT in the United States and was a certified RT provider. Ten percent of all sessions were evaluated by an independent coder using the 24-item RT Intervention Session Guide ([Removed for review]) to assess the degree to which the interventionist adhered to both to the RT curriculum content and intervention procedures. The coder gave a plus (+) when any item on the RT Intervention Session Guide was followed as intended and a minus (−) for items that were not followed. Treatment integrity was judged to be 100% for all sessions.

## Results

**Treatment group comparisons.** Preliminary analyses were conducted to examine group differences and homogeneity of variance on each of the dependent variables used to assess mothers' interactive behavior, children's engagement and child development. Results from ANOVAs indicated no significant group differences on any of the dependent variables at time 1 ($ps > .05$), nor were there differences between population variances on each of these variables as measured by Levene's test ($ps > .05$).

Repeated measures MANOVAs were used to analyze pre- and postdifferences for each of the dependent variables for the RT treatment and control groups. Because of the large nonsignificant age differences between the two groups of children, children's age was used as a covariate in each of these analyses to potential influence of this variable on both interactive and developmental outcomes. However, in each analysis children's age was not significantly associated with treatment effects, although it did influence the overall effects of time. As a result, the following discussion and tables do not report findings associated with the effects of time by Age.

**Mothers' interactive behavior.** Pre- and postdata for the MBRS are presented in Table 2. At the beginning of intervention mothers had average ratings on Responsiveness and Affect that were approximately "2." By the end of intervention, mothers in the RT group made a 67% and 56% increase on these two measures compared to mothers in the control group who made 13% and 6% increases. Pre-intervention assessments also indicated that both groups had average ratings on Achievement/Directiveness that were in the moderately high range ($M = 4.3$). Post-intervention ratings were 27% lower for RT mothers and 3% lower for control group mothers.

Results from the MANOVA indicated that the effect for time was not significant, but that the time × treatment interaction was significant, $F(3, 11) = 16.46$, $p < .001$, $\eta^2 = .82$. Overall mothers in the RT group made greater interactive changes than mothers in the control group, which, as indicated by univariate analyses, were significant for all three MBRS subscales. Each of these effect sizes were in the large range as measured by Hedge's *g*: Responsiveness, $p < .001$; Affect, $p < .001$; and Achievement Orientation/Directiveness, $p < .01$. At postintervention mothers in the RT group had higher ratings on Responsiveness and Affect and lower ratings on Achievement/ Directiveness than control group mothers.

**Children's interactive engagement.** Pre- and postintervention results from the CBRS are presented in Table 3. Both groups of children demonstrated low levels of engagement at the beginning of the study, averaging ratings of "2.5" or lower on CBRS subscales. By the end of intervention, CBRS ratings for the RT group increased by 54% in attention and 57% in initiation, while ratings for control group children increased by 11% and 7% on these two subscales respectively.

Results from the MANOVA indicated that the effect for time was not significant, but that the time × treatment interaction was significant, $F(2, 12) = 15.87$, $p < .001$, $\eta^2 = .74$. Children in the RT group made significantly greater increases than children in the control group, which as indicated by univariate analyses were significant for both CBRS factors ($ps < .001$) and were in the large effect size range.

**Relationship of change in mothers' responsiveness to change in children's interactive engagement.** A correlation was computed to examine whether changes in children's interactive engagement were associated with changes in mothers' responsiveness. For this analysis, children's interactive engagement was assessed with a composite CBRS score, which was the average of the seven CBRS items both at pre- and postintervention. This yielded a significant correlation ($r = .87$, $p < .001$) indicating that intervention changes in children's CBRS scores were highly associated with changes in mothers' responsiveness.

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Table 2
*Before and After Data on Mother's Interactional Behaviors*

| | Responsive teaching | | | | Control group | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre- | | Post- | | Pre- | | Post- | | | | |
| Variable | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *F* (time) | *F* (time × treatment) | Effect size[c] (time × treatment) |
| MBRS[a] | | | | | | | | | 2.41 | 13.62** | |
| Responsiveness[b] | 2.39 | 0.20 | 4.00 | 0.54 | 2.19 | 0.44 | 2.47 | 0.41 | 6.37* | 35.94*** | 0.62 |
| Affect[b] | 2.11 | 0.41 | 3.29 | 0.70 | 1.78 | 0.36 | 1.88 | 0.35 | 6.88* | 36.15*** | 0.68 |
| Achievement-directiveness[b] | 4.29 | 0.41 | 3.14 | 0.38 | 4.33 | 0.68 | 4.21 | 0.43 | 2.17 | 14.46** | 0.42 |

*$P < .05$, **$P < .01$, ***$P < .001$; [a]MANOVA, [b]ANOVA, [c]Hedge's *g*.

**Child development.** Table 4 reports pre- and postintervention measures of children's developmental quotients as measured by the Denver II and ADSI. Prior to intervention both groups had average developmental quotients of 39 or lower, indicating moderate to severe developmental delays. At the completion of intervention, the average developmental quotients across the four measures increased by 47% for children in the RT group compared to 7% for children in the control group. Despite differences in the manner these two assessments were administered (assessor observation vs. parent report), developmental quotients for these two instruments were comparable to each other and highly correlated both at preintervention ($r_{\text{language quotients}} = .77$; $r_{\text{social quotients}} = .75$) and postintervention ($r_{\text{language quotients}} = .86$; $r_{\text{social quotients}} = .89$).

Results from the MANOVA indicated that the effect for time was nonsignificant, but that the time × treatment interaction was significant, $F(4, 9) = 6.31$, $p < .01$, $\eta^2 = 0.74$. This effect was attributable primarily to RT children making significantly greater improvements across all four child-development subscales than control group children ($ps < .01$). Group differences on the Denver were in the medium-effect size range, while ADSI differences were in the large-effect size range.

## Discussion

This study has reported data regarding the impact of RT on preschool-aged Turkish children with DS and their mothers. There were three main findings from this study.

First, RT was effective at encouraging mothers to increase their Responsiveness and decrease their Achievement/Directiveness. At the start of intervention, as indicated by Responsiveness ratings that were considerably below the mean and Achievement/Directiveness ratings that were extremely high, both groups of mothers focused more on guiding and directing their children's play and communication than on responding to and supporting the behaviors their children initiated. While mothers in the control group maintained their style of interaction at the end of intervention, RT strategies were effective at encouraging mothers to focus more on responding to and supporting their children's self-initiated behavior and discouraging mothers from teaching and controlling. In addition,

Table 3
*Before and After Data on Children's Behavior*

| | Responsive teaching | | | | Control group | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre- | | Post- | | Pre- | | Post- | | | | |
| Variable | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *F* (time) | *F* (time × treatment) | Effect size[c] (time × treatment) |
| CBRS[a] | | | | | | | | | 3.20 | 15.87*** | |
| Attention[b] | 2.57 | 0.51 | 3.96 | 0.51 | 2.50 | 0.63 | 2.78 | 0.54 | 5.93* | 22.05*** | 0.63 |
| Initiation[b] | 2.43 | 0.37 | 3.81 | 0.66 | 2.42 | 0.64 | 2.58 | 0.56 | 5.08* | 31.56*** | 0.68 |

*$P < .05$, **$P < .01$, ***$P < .001$; [a]MANOVA, [b]ANOVA, [c]Hedge's *g*.

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Table 4
*Before and After Data on Children's Development*

| Variable | Responsive teaching $n = 7$ | | | | Control group $n = 8$ | | | | $F$ (time) | $F$ (time × treatment) | Effect size[c] (time × treatment) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pre- | | Post- | | Pre- | | Post- | | | | |
| | $M$ | $SD$ | $M$ | $SD$ | $M$ | $SD$ | $M$ | $SD$ | | | |
| Child development[a] | | | | | | | | | 1.89 | 6.31** | |
| Personal-social[1, b] | 34 | 10 | 51 | 13 | 39 | 18 | 44 | 15 | 1.99 | 7.02* | 0.34 |
| Language[1, b] | 36 | 12 | 54 | 10 | 43 | 20 | 48 | 21 | 6.50* | 13.05** | 0.42 |
| Social-emotional[2, b] | 34 | 7 | 47 | 10 | 37 | 12 | 38 | 7 | 0.30 | 15.60** | 0.67 |
| Language-cognitive[2, b] | 35 | 14 | 52 | 12 | 39 | 14 | 40 | 10 | 3.99 | 10.08** | −1.14 |

[1]Denver Developmental Quotient; [2]ADSI Developmental Quotient; $*P < .05$, $**P < .01$, $***P < .001$; [a]MANOVA, [b]ANOVA, [c]Hedge's $g$.

RT mothers' affective relationship with their children improved markedly over the course of intervention which contrasted with control group mothers who continued to display low levels of affect.

The second finding was that the children in the RT group made significant increases in their interactive engagement compared to control group children. These increases in engagement were highly correlated with their mothers' level of responsiveness, suggesting that one of the immediate effects of RT is to encourage and support children to become more active participants in interactions with their parents. Insofar as engagement is the variable that mediates the relationship between children's environment (including the context and adult/parent behavior) and their achievement (e.g., Kishida & Kemp, 2006; McWilliam & Bailey, 1992), these findings suggest that parental responsiveness plays an important role in enhancing the quality of children's learning opportunities. Furthermore, to the extent that RT parents sustain enhanced responsiveness throughout the course of their routine interactions with their children, over time this is likely to have a cumulative impact on children by optimizing the conditions for their developmental learning.

Third, results from both the Denver and the ADSI indicated that children in the RT group made significantly greater developmental improvements both in language and social development than children in the control group. While average group differences observed for both developmental measures were comparable across the two assessments, effect sizes were more than two times greater for the ADSI (which was based upon maternal report) than for the Denver (which based primarily upon examiner observation). While these differences do not negate findings regarding the effects of RT on child development, they do raise question about the actual the magnitude of these effects.

There are two implications of results from this study. First, despite the small sample size, findings from this study replicate results reported in a previous randomized control trial examining the impact of RT on mothers and children who lived in a different region of Turkey (Karaslan, Diken, and Mahoney, 2013). In both studies mothers were highly directive and somewhat unresponsive with their children at baseline. Yet, as found in this study, not only did the previous study report that RT resulted in significant increases in mothers' Responsivenss and declines in Directiveness, but, using the same instruments as this study, the child development gains attained by RT children were similar to those observed in this study (Karaslan, Diken, and Mahoney, 2013).

The second implication is that findings from this study call to question assumptions that children with DS need structured and directive early intervention procedures to offset the effects of DS on their social and learning skills (Buckley, 2008; Feeley et al., 2011). Research reporting that parents of children with DS are more directive than parents of typically developing children have been interpreted as indicating that mothers of children with DS accommodate to deficiencies in their children's interactive behavior by becoming more controlling (e.g., Landry, Garner, et al., 1994; Marfo, 1992; Spiker, Boyce, & Boyce, 2002).

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Similarly, findings that parental responsiveness is associated with higher levels of developmental functioning among children with DS (Bornstein & Tamis-LeMonda, 1997; Drake, Humenick, Amankwaa, Younger, & Roux, 2007; Brooks-Gunn & Lewis, 1984) have also been explained in terms of parental accommodations. That is, children with DS who have higher mental ages tend to be more actively engaged (Brooks-Gunn & Lewis, 1984) and play and communicate in more age appropriate ways. Parents are purported to accommodate to these higher-functioning children by becoming more responsive and supportive of the play and communications their children initiate. In other words, the style of interaction parents display is thought to be strongly influenced by the nature of their children's behavior. High levels of directiveness are thought to be a necessary accommodation to compensate for the low level of play and interactive behavior that many children with DS display.

The pattern of parent-child interaction described above provides an apt description of the children and parents who participated in this study. At the beginning of this study, the children exhibited moderate to severe levels of developmental delay as well as extremely low levels of interactive engagement. Presumably the high levels of directiveness their parents displayed at the onset of intervention resulted at least partly from their reactions to their children's behavior. Yet despite the characteristics of their children, all of the mothers who participated in RT became more responsive and less directive. In addition, as mothers' became less controlling and more supportive, their children appeared to make commensurate improvements both in their interactive engagement and developmental functioning.

**Limitations of study.** There are at least two major limitations of this study. The first has to do with the size of the sample. Despite the fact that this study used a randomized control research design, the sample was not large enough to control all factors that might have affected intervention outcomes. While randomization procedures appeared to have equated the two groups in terms of some variables known to effect the outcomes investigated in this study, such as the age and education of the mothers as well as children's IQs and developmental ages, the sample was inadequate to eliminate the likelihood that unmeasured factors may have affected the intervention effects observed both for parents as well as children.

The second limitation is that because of the lack of individually administered standardized child development assessments in Turkish, both of the instruments used to assess children's development relied to varying degrees parent report. There is considerable evidence that parents can provide reliable and valid information on parent report assessments (e.g., Dale, 1991; Frankenburg, Camp, & van Natta, 1971; Saudino et al., 1998). Indeed, the high levels of correlations between children's scores on the Denver and ADSI suggest that mothers and test examiners made similar judgments about children's developmental capabilities. Yet, the larger intervention effect sizes reported from the ASDSI versus the Denver could have resulted from RT Treatment parents overestimating their children's developmental capabilities at postintervention. This may have occurred not only because of mothers' awareness of participating in an experimental treatment but also because they were personally involved in the intervention by implementing RT strategies with their children.

In summary, while results from this study provide preliminary support for the notion that RT is an effective intervention for young children with DS, future research is needed not only to address the internal validity threats identified above, but also to assess the generalizability of this intervention to more diverse populations of parents and children with DS. It needs to be determined whether RT is effective at promoting child development with populations of parents who are responsive and relatively nondirective with their children to begin with. There is a great need for evaluations of RT with larger and more diverse samples of parents and children with DS. Such studies need to use individually administered standardized test of child development to obtain more reliable estimates of the actual impact of this intervention on children's development, and to investigate how these improvements sustain over time.

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