

# Using Relationship-Focused Intervention to Enhance the Social-Emotional Functioning of Young Children with Autism Spectrum Disorders

Gerald Mahoney  
and  
Frida Perales  
Case Western Reserve  
University

This study investigates the effectiveness of relationship-focused intervention on the social and emotional well-being of children with autism spectrum disorders. Relationship-focused intervention is a general approach to developmental intervention that encourages and supports parents to enhance their use of responsive interactive strategies during routine interactions with their children. The sample for this study consisted of 20 young children diagnosed with autism or pervasive developmental disorder and their parents. Parents and children received weekly intervention sessions for 8 to 14 months. These sessions focused on encouraging parents to use a *Responsive Teaching* curriculum to promote children's socioemotional development. Comparisons of pre- and postassessments indicated that the intervention was successful at encouraging mothers to engage in more responsive interactions with their children. Increases in mothers' responsiveness were associated with significant improvements in children's social interaction, as well as in standardized measures of their social-emotional functioning. These results indicate that relationship-focused intervention holds much promise for enhancing the social-emotional functioning of children with autism spectrum disorders.

Relationship-focused (RF) intervention is a general approach to developmental intervention that encourages parents to use responsive interactive strategies (e.g., take one turn and wait; follow the child's lead) during routine interactions with their children. This approach to intervention is derived from child development research reported over the past 30 years that has consistently indicated a moderate relation between the degree in which mothers engage in responsive interactions with their children and children's level of cognitive functioning (Beckwith & Cohen, 1989), language (Bornstein, Tamis-LeMonda, & Haynes, 1999; Hoff-Ginsburg & Shatz, 1982), and socioemotional behavior (Kochanska, Forman, & Coy, 1999). These findings have been reported for diverse populations of parents, including middle-socioeconomic status (SES) parents and lower-SES parents (Beckwith & Cohen, 1989), teenage mothers (Fewell, Casal, Glick, Wheeden, & Spiker, 1996), and Caucasian (Tamis-LeMonda, Bornstein, Baumwell, & Melstein Damast, 1996) and Black (Bradley, 1989) mothers from North America and Europe (Vereijken, Ricksen-Walraven, & Kondo-Ikemura, 1997), and Japan (Bornstein, 1989). The children in these stud-

ies have included typically developing children, children at risk due to prematurity or poor environmental conditions, children with mild and moderate developmental delays (Mahoney, Finger, & Powell, 1985), and children with autism spectrum disorders (ASD; Siller & Sigman, 2002).

Consistent with these research findings, several interventions that use similar responsive interactive strategies have been developed to address most aspects of children's developmental functioning, including cognition (Mahoney & Powell, 1988), communication (MacDonald, 1989; Manolson, Ward, & Dodington, 1995), and socioemotional functioning (Greenspan & Weider, 1998). At least 13 studies have reported that RF intervention can enhance children's cognitive and language functioning (e.g., McCollum & Hemmeter, 1997). However, only one study has been published reporting the positive effects of RF intervention on children's socioemotional functioning (Greenspan & Weider, 1997). This study was a "chart review" of 200 children diagnosed with ASD who received RF intervention over a 2- to 8-year period. However, several methodological problems obscured the contribution

Address: Gerald Mahoney, Mandel School of Applied Social Sciences, Case Western Reserve University, Cleveland, OH 44106.

of RF intervention to these outcomes: (a) the intervention was implemented on an irregular basis, (b) there was no documentation of how RF intervention was carried out by parents, and (c) nonstandardized measures and clinical judgments were used to assess child outcomes.

Despite frequent recommendations for RF intervention for children with ASD (e.g., Dawson, 1991; Greenspan, 1992; Prizant & Wetherby, 1989; Rogers & Dilalla, 1991), the approach is generally considered to be a “promising intervention” rather than “best practice” (Dawson & Osterling, 1997). Hesitancy to fully endorse this approach not only stems from its limited empirical support but also is related to the lack of theoretical clarity regarding the mechanisms by which RF intervention promotes children’s development and social–emotional functioning.

Child development experts typically explain the developmental influence of responsive interaction in terms of its reported effect on children’s attachment relationship with their mothers (De Wolff & van Ijzendoorn, 1997). This focus has lead many to assume that the effects of RF intervention are mediated through its significance on the attachment relationship between children and their parents. However, this rationale could be interpreted as implying that RF intervention is primarily a method for addressing deficiencies in parents’ interactive relationships with their children. Yet, because empirical evidence of deficient attachment relationships between mothers and their children with ASD is lacking, there is no legitimate basis for postulating that the developmental or social–emotional disturbances that children with ASD manifest in early childhood are related to the quality of their parents’ relationship with them.

One alternative explanation for RF intervention is that enhanced maternal responsiveness encourages children to learn and use the behaviors they need to attain higher levels of social–emotional and developmental functioning. Regardless of the quality of their attachment relationship with their children, the more responsive parents become, the more opportunities children have to learn the developmental behaviors they need to achieve higher levels of functioning. This explanation is compat-

ible with findings from a recent study by Siller and Sigmond (2002). These investigators found no differences in the quality of interactions between mothers and children with autism compared with mothers and children with developmental disabilities and with mothers and typical children who were matched for developmental age. Nonetheless, the more mothers of children with autism engaged in responsive interaction with their children, the higher the levels of communication functioning their children attained at 1, 10, and 12 years of age (Siller & Sigmond, 2002).

In a similar manner, RF intervention may promote the foundational behaviors that underlie the developmental and social–emotional functioning of children who have ASD by enhancing parents’ responsiveness, regardless of whether there are inadequacies or deficiencies in the attachment relationship between them and their children. In this study, we examine the effect of RF intervention on the socioemotional behavior of children with ASD using a newly developed early intervention curriculum, *Responsive Teaching* (RT; Mahoney & MacDonald, in press). Similar to most RF intervention curricula, RT focuses on teaching parents to use responsive interaction strategies to address their children’s individualized developmental needs. Several features distinguish RT from other RF intervention models. First, RT is a comprehensive intervention that has 19 predefined intervention objectives designed to address four developmental domains: cognition, communication, motivation, and social–emotional functioning. As indicated in Table 1, these objectives, referred to as *pivotal intervention objectives*, are global developmental behaviors with two characteristics: They have been reported in the research literature to be influenced by maternal responsiveness (e.g., Ainsworth & Bell, 1974; Carpenter, Nagell, & Tomasello, 1998; Feldman & Greenbaum, 1997; Kochanska, 1997, 1998; Kochanska et al., 1999; Landry & Chapieski, 1989; Leadbeater, Bishop, & Raver, 1996; Mahoney, 1988a, 1988b; Mahoney et al., 1985; Mahoney, Fors, & Wood, 1990; Mahoney & Neville-Smith, 1996; Mangelsdorf, McHale, Diener, Heim Goldstein, & Lehn, 2000; Nelson, 1973;

TABLE 1. Responsive Teaching Pivotal Intervention Objectives

	Developmental domain			
	Cognition	Communication	Social–emotional functioning	Motivation
Social play	Joint activity	Trust/attachment	Interest	
Initiation	Joint attention	Empathy/intersubjectivity	Persistence (success)	
Exploration/manipulation	Vocalization	Cooperation	Enjoyment	
Problem solving	Intentional communication	Self-regulation	Feelings of competence	
Practice	Conversation		Feelings of control	

Thomas, Chess, & Birch, 1968; van den Boom, 1994, 1995), and they have been identified in contemporary child development theory and research as being critical processes for each of their respective domains of functioning (e.g., Ainsworth, Blehar, Waters, & Wall, 1978; Bates, 1979; Bowlby, 1969; Bruner, 1983; Piaget, 1963).

Second, RT includes a series of intervention topics that interventionists can use to explain the rationale of this intervention to parents. Intervention topics describe how each of the pivotal intervention objectives contributes to child development. They are designed to help parents understand how RT strategies are thought to promote the developmental or socioemotional outcomes they desire for their children.

Third, RT is a holistic intervention. Whereas the intervention topics discussed during each session are tailored to children's individualized developmental concerns, all areas of children's functioning are addressed at the same time, regardless of the focus of a particular session. Because the same qualities of parental responsiveness are reportedly associated with children's cognitive, communication, and socioemotional development, RT uses the same strategies to address each of these developmental domains. Thus, if intervention focuses on one domain of development, such as communication, the RT strategies that parents are asked to use with their children are the same strategies that are used to address the other three areas of functioning.

The children who participated in this evaluation each received comprehensive intervention services that were designed to address their full scope of developmental needs. In this article, we focus only on the effect this intervention had on children's social-emotional functioning. Other findings reported from this project indicated that children with ASD made significant increases in their rate of cognitive and language development; these improvements were related to the degree to which parents became more responsive with their children; and these intervention effects were similar for developmentally matched groups of children with ASD and children with developmental delays who did not have ASD (Mahoney & MacDonald, in press).

This study included children and parents who received *Responsive Teaching* but did not include a comparison group who did not receive this treatment. To offset the threats to validity associated with this type of research design (e.g., observed treatment effects could be attributed to factors such as maturation or history), following the recommendations by Shadish, Cook, and Campbell (2002), intervention outcomes are analyzed in relation to the logic model of *Responsive Teaching*, which is depicted in Figure 1. Thus, our analysis does not only focus on whether children made improvements on social-emotional behaviors from pre- to postintervention because these could be attributed to factors such as maturation or history.

Rather, the analysis focuses on whether improvements in social-emotional functioning that occurred during early intervention were associated with the kinds of changes in parental responsiveness that were promoted through the RT curriculum.

In summary, this study is designed to examine two questions regarding the effect of RF intervention on the social-emotional functioning of children with ASD during 12 months of intervention. First, do children who receive the RF intervention make significant improvements in their social-emotional functioning? Second, are children's intervention improvements in social-emotional functioning related to the apparent effect of the RF intervention on their parents' responsiveness?

## METHOD

### Participants

Participants were 20 children who had been diagnosed by their physicians as having autism or pervasive developmental disorder (PDD) and their mothers. The participants were recruited over a 15-month period from October 2000 through December 2001. The sample was referred to the center where this project was conducted from three sources: (a) county service coordinators for the Part C early intervention program, (b) family physicians who thought that the child's problems warranted early intervention, or (c) referrals by other parents who had attended the center. Eighty percent of the children were under 3 years of age when they enrolled, and the other 20% were 4 and 5 years of age. Services were provided at no cost to parents.

A total of 26 children and their families were initially enrolled in this study. Six of these children and families were not included in the final sample; two discontinued services prior to 8 months, and 4 had incomplete data required for analyses.

Table 2 presents the demographic characteristics of the parents and families. The average age of the mothers was 34.1 years, and the majority were Caucasian (95%) and married (100%). The mothers had an average of 15.5 years of education, and half worked part- or full-time. Families had an average of 2.0 children, and the majority (60%) had incomes that were in the middle to upper-middle range.

The characteristics of the children who participated are presented in Table 3. The children were an average of 32 months of age at the start of intervention, and 60% were boys. The *Transdisciplinary Play-Based Assessment* (TBPA; Linder, 1993) was used to estimate the children's cognitive and language development at the beginning of intervention. Each of the play and social behaviors children produced during a 30- to 40-minute unstructured and semistructured play observation were transcribed and

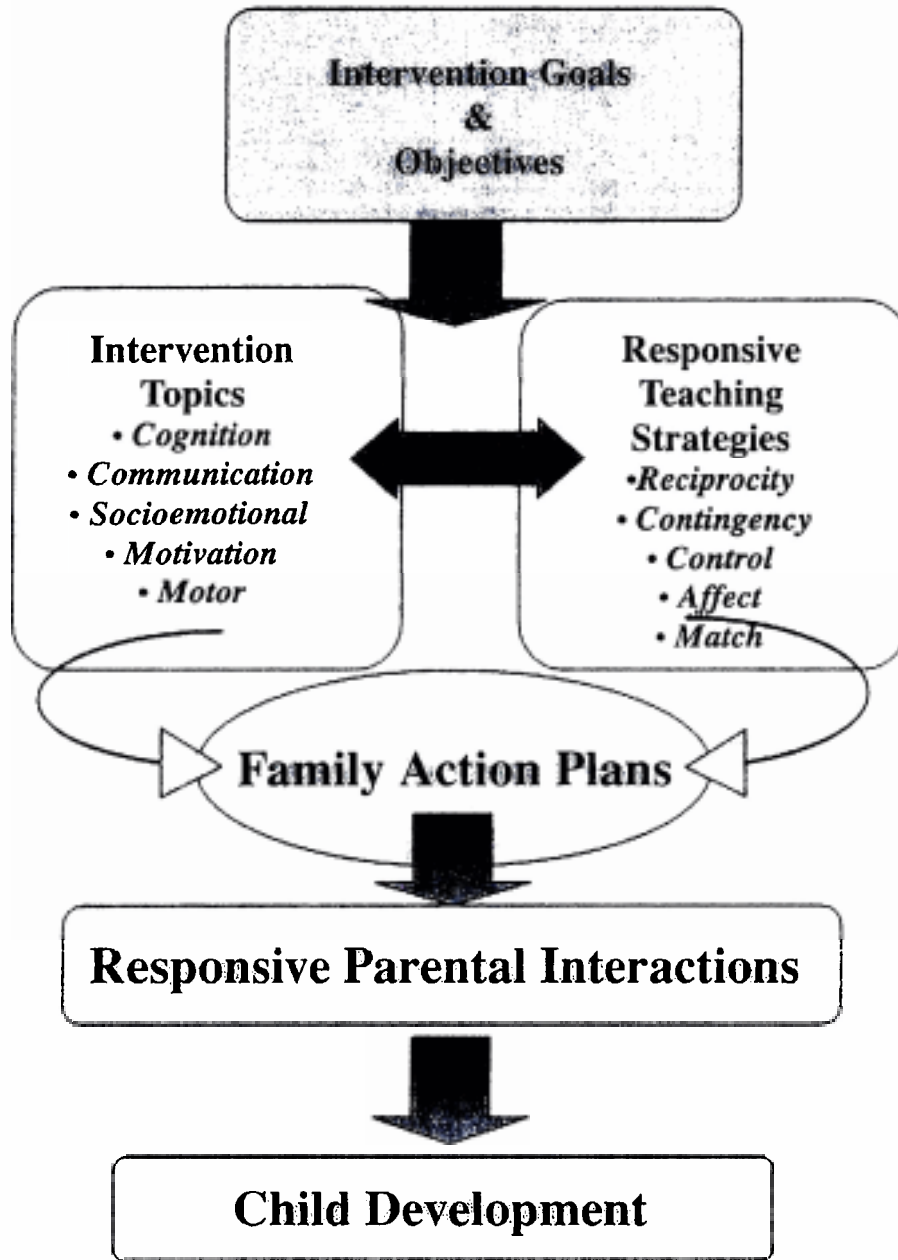


FIGURE 1. Responsive teaching logic model.

coded according to their developmental age level as reported in the *Developmental Rainbow* (Mahoney & Perales, 1996). Developmental ages for cognitive and language development were estimated by independent raters based on the highest age level of developmental behaviors the children consistently produced (i.e., more than 10 times) during the course of the observation for each of the four developmental domains. Interrater reliability for developmental age estimates was calculated for 20% of the observations, yielding a Pearson correla-

tion coefficient of 0.92. Results from the TBPA indicated the children had moderate delays in cognitive and language functioning at the onset of intervention.

Consistent with their diagnoses of autism or PDD, these children also exhibited severe social-emotional problems as indicated by their scores on the *Temperament and Atypical Behavior Scale* (TABS; Bagnato, Neisworth, Salvia, & Hunt, 1999). Their overall TABS scores were at the 1st percentile, and their scores on three of the four subscales were below the 10th percentile. Scores for all

four subscales were clinically significant, ranging from -1 standard deviation (*Hypersensitivity*) to -3 standard deviations (*Detached*).

### Procedures

Parents and children received intervention during weekly 1-hour individual sessions that were conducted either in a center-based setting or in parents' homes. Intervention sessions were directed by one of four early intervention specialists, each of whom had a master's degree in a discipline related to working with young children with disabilities (two speech pathologists, a school psychologist, and an educator). Information regarding the intervention is presented in Table 4, which shows the intervention occurred over a 1-year period ( $M = 11.4$  months). Although parents usually were scheduled to participate in one session each week, on average they received 30.9 sessions during the year. Intervention objectives addressed in these sessions were distributed across the four developmental domains addressed by the RT curriculum. However, consistent with children's developmental profiles, most of the sessions (76.7%) addressed cognitive and communication objectives.

Each intervention session focused on (a) helping parents learn one to two new RT strategies that they could incorporate into their interactions with their children during daily routines and (b) encouraging parents to continue using strategies that they had previously learned. Each RT strategy is designed to help parents accentuate one of five different components of responsive interactive behavior: reciprocity, contingency, shared control, affect, and match. Interventionists used the RT curriculum guide (see sample in the appendix) to individualize the content to the child's individualized intervention objectives. The curriculum guide recommends several topics and strategies for each pivotal intervention objective that can be used during a session. For each session, interventionists select the one to two topics and strategies that are most pertinent. When necessary, topics and strategies presented in previous sessions are repeated. This process continues until the child makes substantial improvement on the objective or else needs to move to a complementary intervention objective.

Most intervention sessions included a Family Action Plan that recommended intervention activities for parents to carry out with their children at home. Although parents reported that they were successful at following through with these plans for more than 50% of the sessions, they did not follow through with recommendations for almost 15% of the sessions (see Table 4).

At the end of intervention, parents were asked to estimate the amount of time they devoted to carrying out early intervention activities with their children. Parents indicated they used RT strategies approximately

TABLE 2. Demographic Characteristics of Parents and Families<sup>a</sup>

Variable	M	SD
Mothers		
Age (yrs.) <sup>a</sup>	34.4	4.4
Education (yrs.)	15.5	2.6
Marital status (% married)	100.0	
Race (% Caucasian)	95.0	
Employed (%)		
Part-time	50.0	
Full-time	25.0	
Fathers		
Age (yrs.) <sup>a</sup>	36.0	6.0
Education (yrs.)	15.9	2.6
Family income level (%)		
Low	20.0	
Middle	20.0	
Moderate to high	40.0	
# Children in family	2.0	.6
Participant child birth order (%)		
First	40.0	
Second	40.0	
Third or later	20.0	

<sup>a</sup>Age at time study began.

18.6 hours each week, which is an average of more than 2.5 hours per day. These data suggest that parents perceived themselves to be carrying out RT throughout many, if not most, of the daily interactions they had with their children.

### Data Collection

The data used for this study were collected at the beginning and end of the intervention. Preintervention data were collected over a 2-week time frame. In the first week, there was a 5- to 10-minute videotaped observation of mothers and children playing with each other using a standard set of developmentally appropriate toys. After this, mothers were asked to complete a questionnaire that included a scale to assess children's social-emotional functioning, the *Infant Toddler Social Emotional Assessment* (ITSEA; Carter & Briggs-Gowan, 2000). In the second week, the TABS was administered to mothers through a telephone interview.

Postintervention data collection began approximately 1 year after children's first assessment or after 8 months of intervention for children who transitioned early from

TABLE 3. Child Characteristics

Variable	Children with ASD <sup>a</sup>	
	M	SD
Age (mos.) <sup>b</sup>	32.1	7.1
Boys (%)	60.0	
Cognitive age (objective abilities) <sup>c, d</sup>	16.5	6.0
Cognitive age (symbolic skills) <sup>c, d</sup>	15.3	5.3
Expressive language age <sup>c, d</sup>	13.8	6.7
Receptive language age <sup>c, d</sup>	12.0	7.2
Social-emotional characteristics		
Detached <sup>e</sup>	20.0	21.1
Hypersensitivity/hyperactivity <sup>e</sup>	39.6	14.6
Underreactive <sup>e</sup>	35.7	12.8
Dysregulated <sup>e</sup>	33.6	15.9
Overall atypical behavior <sup>e</sup>	55.1	36.3

<sup>a</sup> $N = 20$ . <sup>b</sup>Age at time study began. <sup>c</sup>Developmental age in months. <sup>d</sup>*Transdisciplinary Play-Based Assessment* (Linder, 1993). <sup>e</sup>*Temperament and Atypical Behavior Scale* (Bagnato, Neisworth, Salvia, & Hunt, 1999). Subscale scores are  $t$  scores with a mean of 50 and a standard deviation of 10. The overall Atypical Behavior Index is a standard score with a mean of 100 and a standard deviation of 15.

TABLE 4. Intervention Data

Variable	M	SD
Length of intervention (mos.)	11.4	2.4
Mean # of sessions	30.9	10.6
Targeted pivotal intervention objectives (% of session)		
Cognition	26.8	
Language/communication	49.9	
Social-emotional	10.6	
Motivation	12.6	
Parent follow-through with family action plans (%)		
None to marginal	14.6	
Fair	34.5	
Excellent	50.9	
Hours parents devoted to intervention activities (per wk)	18.6	18.1

this program. The same procedures and measures that were used for the initial data collection were used at this time.

The instruments used to assess children's social-emotional functioning were both newly developed norm-

referenced, parent-respondent instruments. The TABS was developed for children between 1 and 6 years of age. It has 55 items that assess parents' perception of children's temperament, attention, attachment, social behavior, play, vocal and oral behavior, senses and movement, and stimulation and self-injury. These items are arranged into four subscales: detached, hypersensitive/active, underreactive, and dysregulated. This test was normed on a national sample of 833 children, including 212 children with disabilities. The four subscales, which were established through confirmatory factor analyses, correspond to the factor structure used for the *Zero to Three Diagnostic Classification* (Greenspan & Weider, 1994). Data from the normative sample indicate that the TABS has high levels of test-retest stability ( $r = .94$ ) and internal consistency ( $r_s = .79$  to  $.95$ ).

The ITSEA is a 169-item, close-ended scale that assesses parental perceptions of internalizing (e.g., depression, withdrawal), externalizing (e.g., aggression, activity), and regulatory problems (sleeping and eating difficulties), as well as the social competencies (e.g., empathy, compliance) of children who are between 12 and 48 months of age. It was standardized on an ethnically and socioeconomically representative sample of 1,279 parents of children between 12 and 48 months of age. It is reported to have high levels of test-retest reliability and internal consistency. The test manual reports that it has moderate to high correlations with the *Child Behavior Checklist* (Achenbach & Rescorla, 2000).

The videotaped observations of parent-child interaction were used to assess mothers' interactive style and children's social interactive behavior. Mothers' style of interaction was assessed with the *Maternal Behavior Rating Scale* (MBRS; Mahoney, Powell, & Finger, 1986; Mahoney, 1999). This 12-item scale assesses four dimensions of parenting—responsiveness, affect, achievement, and directiveness—using a 5-point Likert scale. Previous research has indicated that this scale assesses parenting characteristics that predict children's developmental growth and is sensitive to the effects of parent-mediated interventions (Mahoney & Powell, 1988; Mahoney, Boyce, Fewell, Spiker, & Wheeden, 1998). Children's social interactive behavior with their parents was assessed with the *Child Behavior Rating Scale* (CBRS; Mahoney & Wheeden, 1998), which consists of global rating items using a 5-point scale for seven behaviors: attention, persistence, interest, cooperation, initiation, joint attention, and affect. Previous research indicated that the behaviors measured by this scale differentiate children's interactions with adults (teachers) during instruction and free-play and are sensitive to differences in teachers' styles of interaction (Mahoney & Wheeden, 1998).

Each of the videotaped observations of mother-child play were coded independently by raters who had received at least 40 hours of training on each scale and

who had attained at least 80% agreement within 1 point on a 5-point Likert scale. Pre- and postintervention observations were coded at the same time for groups of four to six participants each to ensure that the same rating criteria were used for pre- and postintervention observations. Observations were randomly sorted so that pre- and postobservations for each participant would not be coded consecutively, and the order in which pre- and postobservations were coded was counterbalanced. This procedure minimized potential bias to rate postintervention measures higher than preintervention measures.

A second rater coded a random selection of 30% of all observations to ensure that adequate levels of reliability were maintained. For the MBRS, interrater reliability, as estimated using the Spearman correlation, was  $r = 0.73$ . Raters attained 60% exact agreement and 99% agreement within one scale point. For the CBRS, interrater reliability, as estimated using the Spearman correlation, was  $r = 0.73$ . Raters attained 56% exact agreement and 100% agreement within one scale point. The level of reliability attained for these two scales is consistent with the levels of reliability reported for previous studies in which these scales were used (e.g., Mahoney et al., 1998).

## RESULTS

Pre- and postintervention measures for each of the dependent variables are presented in Table 5. Repeated measures of multivariate analyses of variance (MANOVA) were used to analyze pre- and postchanges on each of the assessment instruments listed in this table. Univariate analyses of variance were used to identify scale items or subscales that contributed to significant multivariate effects.

### *Effects on Mothers' Style of Interacting with Their Children*

Multivariate analyses indicated that intervention changes in mothers' style of interaction were significant,  $F(4, 16) = 7.24, p < .0001, \eta^2 = .64$ . Consistent with the emphasis of the RT curriculum, univariate analyses indicated that mothers made significant improvements in Responsiveness,  $F(1, 19) = 22.94, p < .0001, \eta^2 = .55$ , and Affect,  $F(1, 19) = 21.84, p < .0001, \eta^2 = .54$ , but did not make significant changes in Achievement Orientation,  $F(1, 19) = 1.31, p > .05, \eta^2 = .06$ , and Directiveness,  $F(1, 19) = 0.86, p > .05, \eta^2 = .04$ .

Over the course of intervention, measures of Responsiveness and Affect increased by 35% and 27%, respectively, whereas measures of Achievement Orientation and Directiveness declined approximately 13% and 4%, respectively. Eighty percent of the mothers increased their level of responsiveness during intervention. At preintervention, 10 of the mothers had Responsiveness ratings

that were below the midpoint of the scale. At postintervention, only three mothers had ratings below the midpoint.

### *Effects on Children's Social Interactive Behavior*

Results from the MANOVA indicated significant improvements in children's CBRS scores from pre- to postintervention,  $F(7, 13) = 8.59, p < .001, \eta^2 = .82$ . Compared to preintervention, postintervention children had significantly higher ratings in Attention,  $F(1, 19) = 13.60, p < .01, \eta^2 = .42$ ; Persistence,  $F(1, 19) = 18.98, p < .001, \eta^2 = .50$ ; Interest,  $F(1, 19) = 33.88, p < .0001, \eta^2 = .64$ ; Cooperation,  $F(1, 19) = 26.09, p < .001, \eta^2 = .58$ ; Initiation,  $F(1, 19) = 17.08, p < .001, \eta^2 = .47$ ; Joint Attention,  $F(1, 19) = 57.91, p < .000, \eta^2 = .75$ ; and Affect,  $F(1, 19) = 11.03, p < .01, \eta^2 = .37$ . On average, children's ratings on these behaviors increased by 50% during intervention, ranging from 19% (Affect) to 84% (Joint Attention).

### *Effects on Children's Socioemotional Functioning*

Both of the instruments used to assess children's socioemotional functioning indicated significant improvements during intervention. Multivariate analyses indicated that postintervention TABS scores were significantly higher than preintervention scores,  $F(5, 14) = 8.61, p < .001, \eta^2 = .76$ . Univariate analyses indicated significant improvements on three of the four subscales. At postintervention, children with ASD were less detached,  $F(1, 18) = 10.20, p < .01, \eta^2 = .36$ , had fewer problems in self-regulation,  $F(1, 18) = 10.67, p < .01, \eta^2 = .37$ , and were more socially reactive,  $F(1, 18) = 10.66, p < .01, \eta^2 = .37$ , than at the beginning of intervention. Overall TABS scores improved by more than 1 standard deviation, which was also significant,  $F(1, 18) = 5.40, p < .05, \eta^2 = .23$ . On average, children's TABS Classification, which is based upon overall scores, improved from "Temperament and Regulatory Disordered" at preintervention to "At-Risk" at postintervention.

Multivariate analyses of the ITSEA also indicated significant improvement in social-emotional functioning,  $F(4, 16) = 6.59, p < .01, \eta^2 = .62$ . Univariate analyses indicated significant improvements on two of the ITSEA subscales. At the end of intervention, children had fewer problems in self-regulation,  $F(1, 19) = 10.45, p < .01, \eta^2 = .36$ , and higher social competence scores than at the beginning of intervention,  $F(1, 19) = 12.47, p < .01, \eta^2 = .40$ .

### *Predictors of Social-Emotional Functioning*

Although the sample size for this study was too small to allow us to use causal modeling statistical procedures,

TABLE 5. Means and Standard Deviations for Maternal and Child Measures Before and After Responsive Teaching Intervention

Instrument & measures	Preintervention		Postintervention	
	M	SD	M	SD
<i>Maternal Behavior Rating Scale<sup>a</sup></i>				
Response	2.72	.76	3.67***	.66
Affect	2.74	.58	3.48***	.46
Achievement	3.48	.65	3.05	.45
Direct	3.25	.57	3.13	.46
<i>Child Behavior Rating Scale–Social Interaction<sup>a</sup></i>				
Attention	2.95	1.15	4.05**	.83
Persistence	3.00	1.21	4.35***	.93
Interest	2.15	1.09	3.70***	.98
Cooperation	2.05	.95	3.40***	1.00
Initiation	2.75	1.41	4.10***	.85
Joint attention	1.90	.97	3.50***	1.05
Affect	3.35	.81	4.00**	.73
<i>Temperament and Atypical Behavior Scale<sup>b</sup></i>				
Detached	19.95	21.10	33.74**	22.23
Underreactive	35.68	12.80	46.79**	14.00
Dysregulated	33.58	15.90	42.84**	13.29
Hypersensitivity	39.60	14.60	42.63	11.65
Overall	55.11	36.30	73.84*	38.02
<i>Infant Toddler Social Emotional Assessment Scale<sup>c</sup></i>				
Internalizing	49.03	8.59	52.93	8.76
Externalizing	47.94	8.62	50.03	9.57
Self-regulation	41.65	8.88	46.93**	7.70
Social competence	20.82	10.52	29.86**	11.41

Note. *Maternal Behavior Rating Scale*—Mahoney (1999); *Child Behavior Rating Scale*—Mahoney and Wheeden (1998); *Temperament and Atypical Behavior Scale*—Bagnato et al. (1999); *Infant Toddler Social Emotional Assessment*—Carter and Briggs-Gowan (2000).

<sup>a</sup>Scores range from 1 to 5. <sup>b</sup>Subscale scores are *t* scores with a mean of 50 and a standard deviation of 10. The overall Atypical Behavior Index is a standard score with a mean of 100 and a standard deviation of 15. <sup>c</sup>Scores are *t* scores with a mean of 50 and a standard deviation of 10.

\*Premean versus postmean difference significant at  $p < .05$ . \*\*Premean versus postmean difference significant at  $p < .01$ . \*\*\*Premean versus postmean difference significant at  $p < .001$ .

we ran two exploratory analyses to examine the underlying assumptions of the Responsive Teaching Logic model, as illustrated in Figure 1. To examine the contribution of changes in maternal responsiveness to changes in children's social interactive behavior, we conducted a regression analysis, controlling for the effects of maternal responsiveness at the beginning of intervention. Changes in children's social interactive behavior were computed as the difference between the average of their seven CBRS ratings at preintervention to their average CBRS ratings at postinter-

vention. Results from this analysis (presented in Table 6) were significant,  $F(1, 18) = 7.31, p = .015$ . Changes in maternal responsiveness accounted for 25% of the variance in changes in children's social interactive behavior, whereas mothers' level of responsiveness at the beginning of intervention was not significantly associated with changes in children's social interactive behavior.

To illustrate how changes in maternal responsiveness contributed to improvements in children's TABS and ITSEA scores, we divided the sample into three equivalent

groups according to the amount that mothers changed their responsiveness during intervention: Minimal Change ( $n = 7$ ), Moderate Change ( $n = 7$ ), and High Change ( $n = 6$ ). We then examined the differences among these three groups of children across the five socioemotional subscales in which children made significant changes during intervention, covarying mothers' level of responsiveness at preintervention. Results were statistically significant,  $F(5, 13) = 3.26, p < .05, \eta^2 = .58$ . As illustrated in Figure 2, children made little or no change on these social-emotional measures when their mothers made minimal changes in responsiveness, they made moderate improvement when mothers made moderate changes in responsiveness, and they made the highest levels of improvement when mothers made substantial changes in responsiveness. However, univariate analyses indicated that only one of these five comparisons, the Self-Regulation subscale of TABS, was statistically significant,  $F(2, 16) = 7.15, p < .01, \eta^2 = .49$ .

## DISCUSSION

In this study, we have reported some positive findings from an evaluation of the effects of an RF intervention on the social-emotional functioning of a sample of 20 children with ASD over a 1-year period. The participants in this study were a convenience, rather than representative, sample of parents and children. Most of the parents came from intact families, were well educated, and had middle- to upper-middle-class incomes. Nonetheless, the social-emotional and developmental problems manifested by their children were quite severe—typifying the types of social-emotional problems manifested by young children identified with autism spectrum disorders.

The families who participated in this intervention attended a mean of 31 one-hour intervention sessions. Yet, although this intervention involved limited professional contact, 80% of the parents became more responsive with their children during intervention. In addition, parents reported that they followed through with RT intervention for an average of 2½ hours every day. Although this might be construed as a low-intensity intervention based on the amount of contact between professionals and parents, it appears to have actually been a relatively high-intensity intervention, involving about as much intervention time as has been described with other interventions reported to be effective with children with ASD (Dawson & Osterling, 1997).

The most important finding from this study is that the children who participated in the interventions made statistically, and we believe clinically, significant improvements in social-emotional functioning. These improvements were indicated by decreases in their problem behaviors, including detachment, underactivity, and self-

TABLE 6. Multiple Regression Analyses for Changes in Children's Social Interactive Behavior

Model	$\beta$	$t$ value	Significance	$R^2$
Change in responsiveness	.54	2.70	.014	.25
Responsiveness T1	.19	0.70	.496	

regulation, and increases in their social competence, as indicated by items measuring empathy and cooperation as well as by observations of social interactive behaviors. On average, these children, who had overall TABS scores at the onset of intervention that were consistent with diagnoses of autism or PDD, achieved postintervention scores that exceeded the TABS criteria for these conditions.

Despite the widespread advocacy for RF intervention for children with social-emotional problems (cf. Zeannah, 2000), few studies have evaluated children's social-emotional functioning directly. This study provides support for the notion that interventions that help parents become more responsive are associated with improvements in children's social-emotional well-being. However, the quasi-experimental design of this study prevents us from concluding that the social-emotional outcomes children attained during this study were causally linked to parents' use of RF intervention. Nonetheless, three elements included in this study help to offset some of the most serious threats to the validity of this research design, thereby increasing the likelihood that the outcomes children attained were causally related to the intervention.

First, we used standardized assessment instruments to evaluate children's social-emotional functioning to reduce the possibility that the intervention effects could be attributed to maturation. The norm-referenced scoring criteria used in these instruments reduce the likelihood that scores should change as children grow older. Because these tests are designed so that children's scores should remain stable over time and because the intervention effect sizes were in the moderate to strong range, from .62 on the ITSEA to .76 on the TABS, the changes observed in this study are far greater than is likely to occur through maturation. However, caution must still be exercised in interpreting these results, as the use of standardized tests does not eliminate the possibility that maturation or other factors contributed at least partly to these developmental changes (Shadish et al., 2002).

Second, three different measurement instruments—two parent-report measures (e.g., ITSEA and TABS) and one observational measure (e.g., CBRS)—were used to assess changes in children's social and emotional functioning to reduce the possibility that our assessments might be biased by measurement error. The parent-report instruments, which included different types of items, both indi-

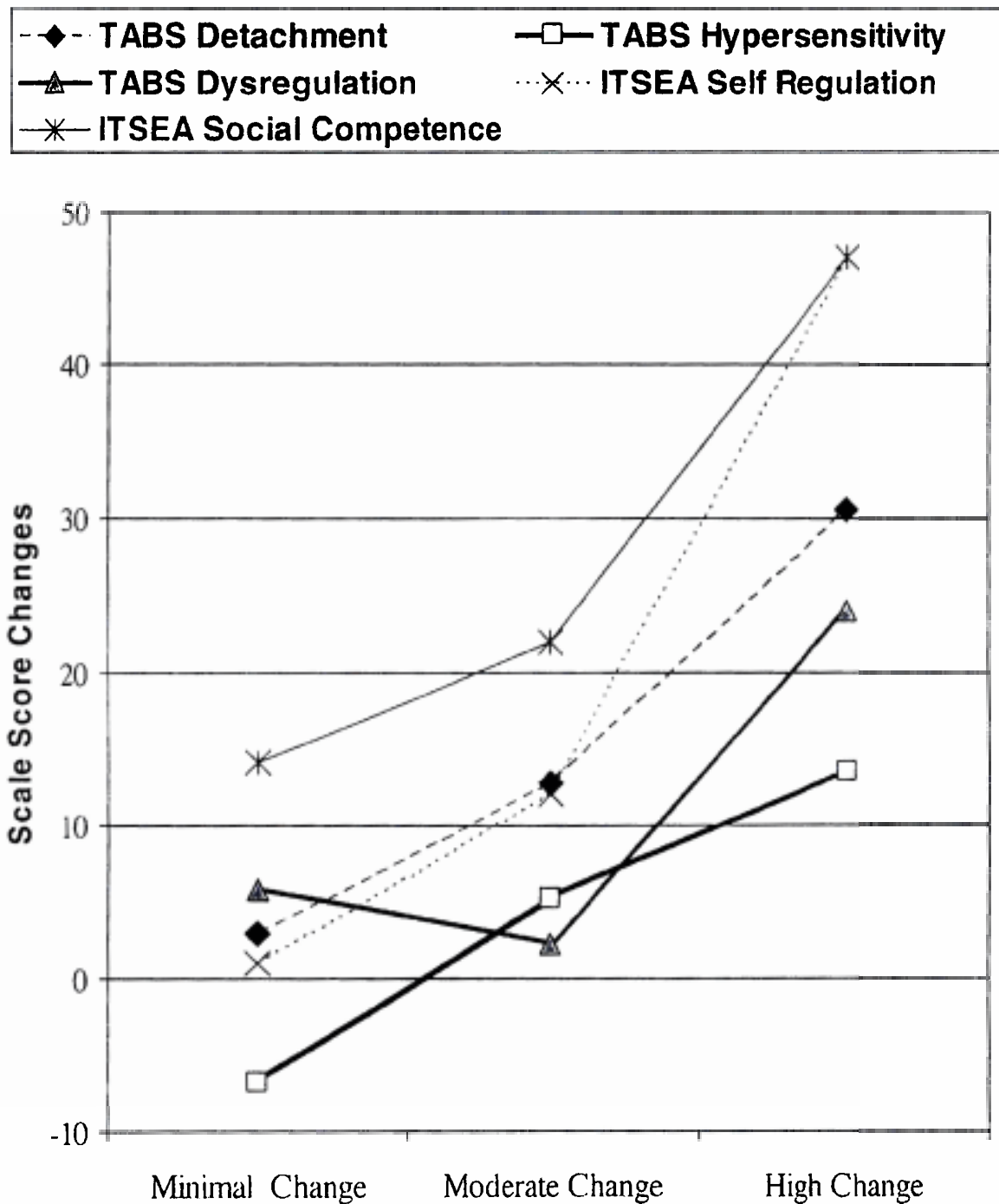


FIGURE 2. Relationship between changes in mothers' responsiveness and changes in children's social-emotional behavior.

cated significant changes in social-emotional functioning during intervention. Furthermore, the one subscale common to these two instruments, Self-Regulation, indicated similar intervention effects. The items on the CBRS that were most closely associated with children's social-

emotional functioning, cooperation, joint attention, and affect, all improved significantly. The consistent pattern of results observed across these assessments reduces the likelihood that findings from this study can be attributed to measurement error (Shadish et al., 2002).

Third, one of the major problems in interpreting results from the type of design used in this study is ruling out whether factors other than the intervention might be responsible for the observed changes in children's social-emotional functioning. To address this problem, we evaluated the effects of this intervention by analyzing our results in relation to the logic model of RT. As indicated earlier in this report, RT is predicated on the assumption that the effects of intervention are dependent on mothers becoming more responsive with their children. Regardless how much intervention children receive, children's improvements should be related to the degree to which mothers or primary caregivers change their responsiveness during intervention.

The analyses we conducted to examine the relationship between changes in mothers' responsiveness with children's improvements during intervention support this rationale. Although RT was effective at encouraging mothers on average to become more responsive to their children, there was considerable variability in the changes parents made, ranging from none to substantial. The fact that children changed little or none in their social-emotional behavior unless their mothers became more responsiveness reduces the likelihood that maturation or history were responsible for the observed changes.

Most of the empirically validated social-emotional interventions currently used with young children, especially children with autism spectrum disorders, are designed to either eliminate or help children learn discrete social-emotional or developmental behaviors (Dawson & Osterling, 1997). This approach is most clearly illustrated in the discrete trial training procedures that Lovas (1987) has demonstrated to be effective at addressing the needs of children with ASD. However, when we began developing RT, we became aware that responsive interaction strategies are ineffective at teaching discrete skill intervention targets. A study by Kaiser et al. (1996) that used responsive interaction strategies to teach language to young children illustrates this point. Although responsive interaction strategies were highly effective at promoting children's rate of language development as indicated by proportional improvements in children's language age scores, they were almost completely ineffective at helping children learn discrete language objectives targeted for intervention, as indicated by their learning an average of less than one language target per month.

Yet, despite the limitations of responsive interaction at teaching discrete skills, as reported in this study and reported with two other samples of children (Mahoney & MacDonald, *in press*), responsive interaction has a significant impact on children's social interactive behavior. Perhaps one of the more important questions related to this study is, How can we explain the social-emotional changes observed in this study? If maternal responsiveness

is truly enhancing children's social-emotional functioning, what is the mechanism by which these effects occur? In this study, we were unable to collect data to directly address this issue. But the RT curriculum was designed based on some assumptions about how this process might occur.

The social behaviors that responsive interaction seems to enhance may be the same pivotal response behaviors that Koegel and others have reported to mediate the effects of discrete trial training interventions (e.g., initiation, persistence; Koegel, Koegel, Shoshan, & McNerny, 1999). Pivotal behaviors are the behaviors children use to acquire the knowledge, skills, and competencies that are the hallmarks of higher levels of functioning (Koegel, Koegel, & Carter, 1999). They are the processes children employ to learn and practice new behaviors during spontaneous interactions. Following this line of reasoning, it seems possible that as parents engage in higher levels of responsive interaction with their children, they are actually encouraging children to learn and use pivotal developmental behaviors, which are the processes that enable them to acquire untrained socioemotional competencies.

As a result, we designed RT based on the assumption that responsive interaction strategies address children's developmental and social-emotional needs by promoting their use of pivotal developmental behaviors. In the social-emotional domain, we believe that, at a minimum, these pivotal behaviors include attachment, empathy, cooperation, and self-regulation. All of these behaviors have been reported to be associated with maternal responsiveness, and they are commonly acknowledged to be general developmental processes that play a critical role in early social-emotional development. The extent to which the 15 pivotal intervention objectives in RT identified in Table 1 mediate various developmental domains should be explored in future research.

In summary, in this study we have reported data indicating that RF intervention was associated with improved social-emotional functioning in a sample of 20 children with ASD. These results not only underscore the potential role that parental responsiveness plays in promoting children's social-emotional functioning but also suggest that pivotal developmental behaviors may play an important mediating role in children's social-emotional well-being. Results from this study are provocative and promising but far from conclusive, particularly in light of the limitations of the research design and the socioeconomic characteristics of the families who participated. Although these data add to the body of literature advocating the use of RF intervention as a socioemotional intervention for children with children with ASD, they must still be viewed as preliminary findings. There is a critical need to replicate this research with better controlled research designs involving more representative samples of parents and a broader range of children with autism and PDDs. ♦