Effectiveness of Emotion Recognition Training for Young Children with Developmental Delays

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Abstract

Emotion recognition is a basic skill that is thought to facilitate development of social and emotional competence. There is little research available examining whether therapeutic or instructional interventions can improve the emotion recognition skill of young children with various developmental disabilities. Sixteen preschool children with developmental delays were randomly assigned to experimental and control groups. The experimental group received instruction in emotion recognition throughout the academic year in a discrete trials format and showed significant growth in emotion recognition skill and higher scores on a more comprehensive measure of emotion understanding ability. The control group showed no such gains. Significant individual variability in response to the intervention was noted. Results suggested that emotion recognition training delivered within a behaviorally based intervention program can lead to significant gains in emotion recognition skill for children at a wide range of ability levels. Implications and suggestions for future research and interventions are discussed.
Keywords: emotion recognition, emotion understanding, developmental disabilities, intervention, training.

Recently, early childhood educators and policy makers have placed an increased emphasis on assessing emotional development in young children who are considered educationally at-risk. (Department of Health and Human Services Administration on Children, Youth, and Families/Head Start Bureau, 2000). The desire to assess emotional development is not surprising given that children's skill in understanding others' emotions appears closely tied to their ability to establish and maintain positive social relationships with others in the school years and throughout life. Specifically, researchers have found that young children who have better developed emotion recognition and emotional perspective-taking abilities demonstrate higher levels of prosocial behavior and are more popular with their peers (Denham, 1986; Denham, McKinley, Couchoud, & Holt, 1990; Leppanen & Hietanen, 2001). Other research has linked emotion recognition and understanding with high levels of pretend play and behavioral and emotional competence with peers (Carlo, Knight, Eisenberg, & Rotenberg, 1991; Lindsey & Colwell, 2003). In contrast, children who are poor at emotion recognition and emotional perspective-taking are at increased risk of being disliked by their peers (Denham et al.; Leppanen & Hietanen, 2001), are rated by teachers as being more socially withdrawn (Strand, Cerna, & Downs, in press), and are at risk for the numerous negative educational and psychosocial outcomes long known to be associated with peer rejection (Asher & Wheeler, 1985; Asher & Coie, 1990; Ladd, 1990).

Although results such as these have suggested that emotion understanding in general, and emotion recognition in particular, are important developmental variables, there is limited information available regarding the effectiveness of attempts to manipulate emotion recognition skill in individuals who have disabilities. Research with adults has generally indicated that interventions can successfully improve the emotion recognition ability of those who have learning disabilities, (McKenzie, Matheson,

McKaskie, Hamilton, & Murray, 2000), intellectual disabilities (McAlpine, Singh, Ellis, & Kendall, 1992; Rydin-Owen, Drake, & Bratt, 1999), high-functioning autism (Bolte, Hubl, Feineis-Matthews, Dierks, & Poutska, 2006), or acquired brain injury (Guercio, Podolska-Schroeder, & Rehfeldt, 2004). However, studies focused on children have been less consistent. For example, Dyck and Denver (2003) reported no improvements in emotion recognition skill for deaf children exposed to an 11-lesson psychoeducational program. In contrast, Stewart and Singh (1995) found that teaching via directed rehearsal led to significant gains in basic emotion recognition skill in a study of boys with mental retardation.

Emotion recognition has long been thought to be impaired in children with autism spectrum disorders (ASD; Hobson, Ouston, & Lee, 1989), so it is not surprising that some researchers have examined the effectiveness of emotion recognition training with this population. As has been the case in children with other disabilities, the results have been equivocal. Using a computer training program, LaCava, Golan, Baron-Cohen, and Myles (2007) found significant gains in emotion recognition skill in children with ASD. However, Silver and Oakes (2001) reported that computer training did not lead to significant emotion recognition gains in adolescents with ASD compared to controls. Other research has shown that children with autism exposed to behavioral interventions may develop advanced emotion understanding abilities (e.g., the understanding of desire-based emotions in others) but may still have difficulties with basic emotion recognition (Downs & Smith, 2004).

It is interesting to note that none of the studies cited above attempted to teach emotion recognition skills to preschoolers, even though the developmental literature suggests that the preschool years are typically a time of significant growth in this ability (Denham, 1998). Given the contradictory results of the limited research conducted to date, and the apparent importance of emotion recognition as a basic skill that supports positive social development, it is necessary to examine whether emotion recognition is a skill that can be taught to young children with developmental delays or disabilities. Further, it is important to evaluate whether improvements in emotion recognition skill facilitate gains in processing other types of emotional stimuli. This is especially true given that both behavioral and cognitive-developmental theories identify emotion recognition skill as an essential prerequisite to successful social and emotional functioning (Barnes-Holmes, McHugh, & Barnes-Holmes, 2004; Denham, 1998; Baron-Cohen, 1995).

The purpose of the present research was to investigate whether emotion recognition is a variable that can be manipulated via a behaviorally based assessment and intervention program. We hypothesized that young children with developmental delays and/or disabilities exposed to direct instruction in emotion recognition would show significant growth in their ability to recognize both basic and advanced emotions. In addition, we sought to examine whether any observed gains in emotion recognition were associated with improved understanding of other emotionally relevant stimuli.

Method

Participants and Setting

Participants were sixteen children (nine boys and seven girls) who were enrolled in a publicly funded developmental preschool located in Washington state and whose parents elected to have them participate in the research project. Children were referred to and enrolled in the preschool when they demonstrated a significant developmental delay (i.e., 2 or more standard deviations below the mean) in one or more areas of functioning (communication, motor skills, social/adaptive behavior, and/or cognition). Some of the children had a specific diagnosis such as autism. However, most had not yet received any clinical diagnosis. They were simply demonstrating a developmental delay in one or more domains and were at serious risk for poor educational, behavioral, and psychosocial outcomes. At the

beginning of the academic year participants' names were each printed on a separate piece of paper and placed into a box. A research assistant randomly selected one name from the box and placed it into the experimental group. The second name randomly selected from the box was placed into the control group. Participant names were randomly selected from the box and placed into the experimental and control groups following the same process until none remained.

Table 1 presents information for each child in the two groups regarding age, gender, verbal ability, and diagnostic/developmental status. The mean age at baseline of students in the experimental and control groups were 48.25 months and 49.75 months, respectively, and were not significantly different. Regarding verbal ability, three children in the experimental group and two children in the control group scored in the significantly delayed range on the Peabody Picture Vocabulary Test-Third Edition (PPVT-III; Dunn & Dunn, 1997), and two children in each group did not achieve basal scores. The remaining three children in the experimental group scored in the low-average or average range, and the remaining four children in the control group scored in the average or above-average range. Mean verbal ability scores at baseline were 64.25 for the experimental group and 70.88 for the control group and were not significantly different. Ethnically, twelve of the children were White, three were Latino and White, and one was of Asian and European descent. All of the children came from homes where English was the primary language.

Procedure

Emotion Recognition Assessment. All participants were assessed within 2 weeks of the beginning and the end of the academic year (i.e., prior to and after the intervention) to determine how many emotional expressions they were able to recognize from a set of twelve photographs. Children in the experimental group also were assessed approximately every four weeks over the course of the academic year with different twelve-photograph sets on days they did not receive emotion recognition instruction. Each photograph depicted a different emotional expression ranging from simple expressions such as 'happy' to more complex emotions such as 'excited.' Each target photograph was presented with three distracter photographs and participants were asked to point to the targeted emotional expression, so that vocal verbal responses were not required. Responses were scored as correct when the child pointed to the targeted facial expression. All other responses were scored as incorrect. If a child did not respond to the initial request or pointed to more than one facial expression a single prompt was provided (e.g., point to happy). No additional prompts were provided and no feedback was provided to the children regarding the accuracy of their responses.

Table 1. *Age, Gender, Receptive Vocabulary Score, and Diagnosis for Participants*

Participant	Age in months	Gender	PPVT-III	Diagnosis
1	46	Male	59	Cerebral Palsy
2	48	Male	No basal	Autism
3	45	Female	No basal	Autism
4	44	Female	59	Communication/Cognitive Delay
5	61	Male	84	Social/ Adaptive Delay
6	49	Male	88	Cognitive Delay
7	31	Female	54	Communication Delay
8	62	Female	90	Cognitive Delay

Control 1	63	Male	57	Communication/ Cognitive Delay
Control 2	40	Female	No basal	Autism
Control 3	43	Female	57	Communication/ Cognitive Delay
Control 4	32	Male	No basal	Communication/ Cognitive Delay
Control 5	60	Male	87	Social/ Adaptive Delay
Control 6	47	Female	117	Social/ Adaptive Delay
Control 7	53	Male	98	Social/Adaptive Delay
Control 8	60	Male	88	Cognitive Delay

PPVT-III = Peabody Picture Vocabulary Test- Third Edition

Emotion Understanding Assessment (EUA). At the beginning and end of the academic year (i.e., prior to and after the intervention) all participants were presented with 20 questions developed by Howlin, Baron-Cohen, and Hadwin (1999) to determine their level of emotion understanding. There were five possible levels of emotion understanding and each child was assessed beginning at level 1 and continuing through to level 5. All participants completed all levels of the EUA, and there were four questions asked on each level. The levels, the abilities they measured, and example questions are shown in Table 2.

Drawings (with facial expressions excluded) and, when necessary, verbal prompts were presented with each question in levels 3 through 5 to facilitate comprehension (e.g., "Look, this picture tells us what Eric wants."). Responses were coded as either correct or incorrect, and each child received a total score of 0-4 on each level for a total possible score of 0-20 on the entire measure. Responses were scored as correct when the child pointed to the requested facial expression on levels one and two. On levels three, four, and five responses were scored as correct when the child pointed to or stated the correct emotion(s) the character would be expected to feel in the scenarios provided.

Emotion Recognition Instruction. The children attended the preschool for two hours per day an average of three days per week (6 hours total per week). Children in the experimental group were "pulled out" of their regular preschool programming in 10- to 15-minute blocks of time in order to receive direct instruction using discrete trial training methodology (DTT; Smith, 2001) on a one-to-one basis in an adjacent classroom or outside on the playground. Each discrete trial unit of instruction lasted for approximately 3-10 seconds and consisted of five parts (see Lovaas, 2003 and Smith, 2001 for a more detailed description of DTT procedures):

1. Discriminative Stimulus (Cue): The instructor (undergraduate psychology students trained by the lead experimenter) presented a brief instruction or question to the child (e.g., "Show me happy").

2. Prompt: In conjunction with or immediately following the cue, the instructor helped the child to make the correct response (e.g., the teacher modeled the response or took the child's hand and guided him/her to perform the response). As instruction progressed the prompt was gradually faded and eventually eliminated so that the child responded to the cue alone.

3. Response: What the child did or said following the cue.

4. Consequence: Correct responses were immediately reinforced with verbal praise, access to toys, or other things the child enjoyed. If an incorrect response occurred the instructor withheld positive reinforcement and, following the inter-trial interval (see below), implemented a prompted learning trial.

5. Inter-trial interval: After the consequence, the instructor paused for 1-5 seconds before presenting the cue for the next trial.

Table 2. *Abilities Assessed and Example Questions on Each Level of the Emotion Understanding Assessment*

Level	Ability assessed	Example question
Level 1	Emotion recognition photographs	Show me the happy face.
Level 2	Emotion recognition drawings	Show me the happy face.
Level 3	Situation-based emotion understanding	Kim's daddy has to go away on a trip. How will Kim feel when her daddy goes away on a trip?
Level 4	Desire-based emotion understanding	This is Tina. This picture tells us what Tina wants. Tina wants a kitten picture. Look, Tina's sister buys her a flower picture. What does Tina want? How will Tina feel when her sister buys her a flower picture?
Level 5	Belief-based emotion understanding	This is Eric. This picture tells us what Eric wants. Eric wants to go on the train. This picture tells us what Eric thinks. Eric doesn't know about the train. He thinks they are going in the car. What does Eric want? What does Eric think? Eric wants to go on the train. Eric thinks they are going in the car. How does Eric feel? How will Eric feel when him and daddy go on the train?

Note. Example questions are from *Teaching children with autism to mind-read: A practical guide* (pp. 59, 127, 194, 195), by P. Howlin, S. Baron-Cohen, and J. Hadwin, 1999, West Sussex, UK: Wiley.

Following each 10- to 15-minture DTT session children returned to their regular preschool programming during which time the DTT instructors prepared materials for the next session and checked the just collected data for accuracy and completeness. The data collection consisted of documenting each learning trial, including information on the items or skills targeted, child responses, and the level and type of any prompt that was used. This ongoing data collection was used to continuously modify instruction and goals to ensure maximum benefits and efficacy.

Each child received between 30 and 42 hours of DTT over the course of the 27 weeks of the intervention at an average of 1.30 to 1.58 hours per week. Within those 1.30 to 1.58 hours per week each child in the experimental group received instruction in emotion recognition and several additional areas (e.g., colors, numbers, imitation, drawing, etc.). Thus, children in the experimental group spent approximately 5-10 minutes per week receiving direct instruction in emotion recognition using stimulus photographs and picture books that were different from the photographs used in the assessments. Emotion recognition instruction was initiated following the second baseline assessment (approximately 5 weeks after the beginning of the academic year) for four of the children, and following the fourth baseline assessment (approximately 13 weeks into the academic year) for the other four children in the experimental group.

For each child in the experimental group, emotion recognition instruction began with picture stimuli of basic emotions (e.g., happy, sad) and progressed to more complex emotions (e.g., surprised, nervous) when the child demonstrated mastery of each previously introduced emotion. Each emotion (e.g., happy) was introduced to the child via massed trials (i.e., receptive identification of one emotion

presented by itself) until the child responded correctly in four out of five consecutive trials. Next, another emotion (e.g., sad) was introduced to the child via the same massed trial procedure until correct responses were provided in four out of five consecutive trials. The next step involved discrimination training where the two emotions (e.g., happy and sad) were presented to the child at the same time and the child was required to correctly identify each emotion in four out of five consecutive trials. After the child learned to discriminate between the two emotions, a third emotion (e.g., mad) was introduced to the child by itself via massed trials. Once the child successfully identified the third emotion (e.g., mad) in four out of five consecutive trials that emotion was presented simultaneously with the two previously introduced emotions (e.g., happy and sad), and the child was required to correctly identify each of the three emotions (e.g., happy, sad, and mad) in four out of five trials over two different days and with two different instructors. When this criterion was reached each emotion was considered mastered and a new, more complex emotion was introduced. Previously mastered emotions were presented to the child in trials with two other emotions periodically over the course of the year to ensure retention.

Children in the control group received their regular preschool programming, which followed a child-centered philosophy stressing social and emotional growth. No specific emotion recognition training curriculum was employed with the control group. Rather, modeling and incidental teaching were used to teach children in the control group emotion recognition and understanding skills, when appropriate, within the context of regular classroom routines. In order to address the possibility that children in the experimental group could make gains in emotion recognition or emotion understanding simply due to receiving individual attention, a sufficient number of research volunteers were included in the project to raise the number of staff in the preschool so that children in the control group received the same amount of individual attention as children in the intervention group. Weekly observations of the preschool were conducted by graduate research assistants to ensure that children in the control condition received one-to-one attention at rates comparable to the children in the intervention group.

Procedural integrity. To ensure intervention fidelity, the lead experimenter and/or a graduate assistant with extensive training and experience implementing DTT supervised all instructional and assessment sessions, and daily feedback was given to each instructor orally and via a structured checklist. The checklist was developed using definitions provided by Koegel, Russo, and Rincover (1977) and was utilized daily until the instructor achieved at least 90% competence in all skill areas of instruction and assessment. After achieving at least 90% competence, instructors were rated on the checklist and provided feedback a minimum of once per week, while also continuing to receive daily oral feedback. Inter-rater reliability for the structured checklist was assessed periodically throughout the school year (i.e., every 3 weeks), with agreement ranging from 87 to 100%. In addition, 25% of the emotion recognition and emotion understanding assessments were scored by two different research assistants. Inter-observer agreement was 100% for emotion recognition assessment scores and ranged from 95-100% for emotion understanding assessment scores. All scoring inconsistencies on the emotion understanding assessment were resolved through discussion with the lead experimenter or a supervising graduate assistant.

Study Design and Sequence. A single-subject design was utilized in this study in order to measure changes in emotion recognition accuracy across the school year for each participant in the experimental group. This allowed us to examine whether the rate or overall amount of improvement in emotion recognition skill were associated with individual differences in child characteristics such as language ability or diagnosis. In addition, a multiple baseline was used to help ensure that any observed gains in emotion recognition accuracy were the result of the emotion recognition training rather than child maturation or assessment practice effects.

In order to further rule out the possibility that children might make gains in emotion recognition accuracy over the course of the school year simply due to maturation or attendance in a preschool program, the control group was included in the study to allow for between- and within-group statistical

comparisons. Inclusion of the control group also allowed us to statistically evaluate the possibility that improvements in emotion recognition accuracy may be associated with growth in more general emotion understanding. Table 3 shows the sequence of assessment and instructional procedures used in this study with the control and experimental groups.

Table 3. *Sequence of Assessment and Instructional Procedures Implemented with the Experimental and Control Groups Across the School Year*

Time	Experimental Group	Control Group
Week 1	Assess emotion recognition Assess emotion understanding	Assess emotion recognition Assess emotion understanding
Weeks 4-5	Assess emotion recognition Begin emotion recognition instruction for participants 2, 3, 5, 8	
Weeks 8-9	Assess emotion recognition	
Weeks 12-13	Assess emotion recognition Begin emotion recognition instruction for participants 1, 4, 6, 7	
Weeks 16-17	Assess emotion recognition	
Weeks 19-20	Assess emotion recognition	
Weeks 23-24	Assess emotion recognition	
Week 27	Assess emotion recognition Assess emotion understanding	Assess emotion recognition Assess emotion understanding

Results

Data analysis involved conducting between-group and within-group mean comparisons in order to evaluate the effects of the intervention on emotion recognition ability, as well as to identify any changes in emotion understanding ability in the experimental and control groups. Data analysis also involved exploring graphical displays of individual developmental trajectories of emotion recognition scores for each child assigned to the experimental group. The goal of this idiographic analysis was to explore the time-dependent nature of intervention effects, and also to examine the extent to which intervention effects relate to child characteristics including verbal abilities and diagnosis.

Emotion Recognition

Group Scores at Baseline and Year-End. Due to the relatively low number of participants, between-group analyses involved the use of Mann-Whitney U Tests to evaluate differences across the experimental and control groups with respect to baseline and year-end emotion recognition scores. Results revealed no differences in baseline emotion recognition scores between the experimental (mean 1.63, *sd* 1.99) and control (mean 1.88, *sd* 1.89) groups $z = -0.34$, *ns*. Year-end emotion recognition scores were significantly higher for the experimental (mean 7.75, *sd* 4.80) than for the control (mean 2.28, *sd* 2.39) group, $z = -2.24$, $p < .05$. Within-groups analyses involved the use of Wilcoxon signed ranks tests to compare baseline and year-end emotion recognition scores for both the experimental and control groups. Results revealed that the emotion recognition scores of children in the experimental group increased significantly over the course of the academic year $z = -2.53$, $p < .05$, whereas the scores of children in the control group did not increase significantly $z = -0.97$, *ns*.

Individual Scores at Baseline and Year-End. Table 4 shows the individual baseline and year-end emotion recognition scores that were the basis for the group analyses. Looking more closely at the

individual scores of participants, four of the eight children assigned to the experimental group obtained the maximum year-end score of 12, and all children assigned to this group showed improved scores from the baseline to the year-end assessment. Six of the eight children in the experimental group were able to recognize at least six more emotions at year-end compared to baseline. In contrast, no child assigned to the control group achieved the maximum score of 12, and four of eight showed no improvement from the baseline to the year-end assessment. Further, no child in the control group was able to recognize more than two additional emotions at year-end compared to baseline.

Table 4. *Receptive Vocabulary Score, Diagnosis, Baseline and Year-End Emotion Recognition Scores for Participants*

Participant	PPVT-III	Diagnosis	Baseline score	Year-end score
1	59	Cerebral Palsy	0	6
2	No basal	Autism	0	2
3	No basal	Autism	0	1
4	59	Communication/Cognitive Delay	1	12
5	84	Social/ Adaptive Delay	4	12
6	88	Cognitive Delay	4	12
7	54	Communication Delay	0	6
8	90	Cognitive Delay	4	12
Control 1	57	Communication/ Cognitive Delay	1	0
Control 2	No basal	Autism	0	0
Control 3	57	Communication/ Cognitive Delay	0	2
Control 4	No basal	Communication/ Cognitive Delay	0	0
Control 5	87	Social/ Adaptive Delay	4	5
Control 6	117	Social/ Adaptive Delay	4	6
Control 7	98	Social/Adaptive Delay	2	4
Control 8	88	Cognitive Delay	4	2

PPVT-III = Peabody Picture Vocabulary Test- Third Edition

Rate of Individual Score Changes Over Time. Figure 1 presents emotion recognition scores taken at eight evenly spaced time points over the course of the academic year for children in the experimental group, allowing for a visual analysis of change across time for these individuals. These data illustrate that the gains made by children in the early phases of the training (i.e., from intervention time 1 to time 2) were similar to the changes occurring at a later point in training (i.e., from intervention time 4 to time 5). That is, although there were differences across children with respect to slope, within-child changes that occurred over the course of training appeared relatively steady, showing no evidence of non-linearity. An exception to this occurred for participants 5 and 8 between time 5 and time 6 because of ceiling effects. In addition, as seen in Figure 1, no children in the experimental group showed improvements in emotion recognition skill under baseline testing conditions.

Child Characteristics and Score Changes Over Time. With respect to child characteristics, the children who made the largest gains and achieved a maximum emotion recognition score at year-end (participants 4, 5, 6, and 8) appeared to differ from children who achieved smaller gains in terms of their

having higher verbal ability scores, and also higher baseline emotion recognition scores. Participant 4 was an exception, as this child had severely delayed language and a low baseline emotion recognition score but made large gains in emotion recognition skill and reached the criterion measure. The four experimental group children who showed the least amount of growth in emotion recognition skill all had severely delayed language and low baseline emotion recognition scores. Two of these children (participants 1 and 7) reached 50% accuracy on the year-end assessment, but the two children (participants 2 and 3) with the lowest verbal ability scores at baseline showed little change over time and only accurately recognized one and two emotions, respectively, at year-end.

Regarding diagnostic status, our results revealed that the children who made the smallest gains in emotion recognition accuracy over the course of the year (participants 2 and 3) both had a diagnosis of autism. The children who achieved 50% accuracy on the year-end assessment were diagnosed with cerebral palsy (participant 1) and communication delay (participant 7), respectively. The children who made the largest gains and achieved maximum emotion recognition scores (participants 4, 5, 6, and 8) did not have specific psychiatric or medical diagnoses but were demonstrating delays in cognition (participants 6 and 8), cognition and communication (participant 4), and social and adaptive behavior (participant 5).

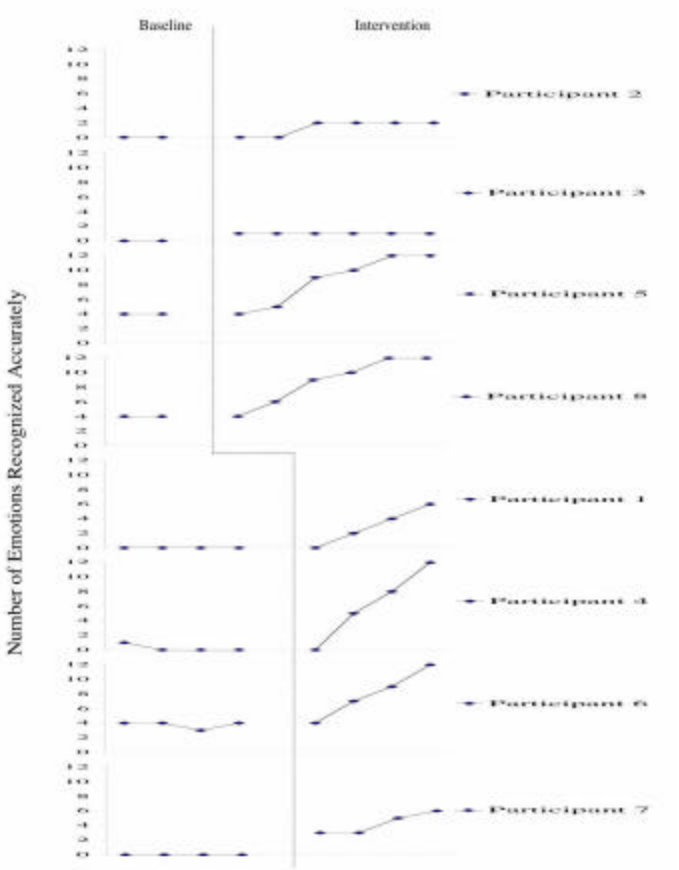

Figure 1. *The number of emotions out of twelve correctly identified by experimental group participants in each testing session at baseline and after implementation of emotion recognition training.*

Emotion Understanding

Analyses were also conducted to identify any significant differences or changes in emotion understanding ability over the course of the intervention for children in the experimental and control groups. Mann-

Whitney U tests revealed no significant differences in emotion understanding scores at baseline between the experimental (mean 5.50, *sd* 6.45*)* and control (mean 8.25, *sd* 7.83*)* groups, $z = -0.76$, *ns*. Similarly, year-end emotion understanding scores for the experimental group (mean = 8.75, *sd* 7.81) were not significantly different than control group scores (mean = 8.38, *sd* 8.50). Examining within-group differences, Wilcoxon signed rank tests indicated that emotion understanding scores increased from baseline to year-end for the children in the experimental group $z = -1.83$, $p = .06$, at a level approaching significance, whereas emotion understanding scores of children in the control group did not show any increase from baseline to year-end $z = -0.09$, *ns*.

Discussion

The purpose of this study was to investigate whether a behaviorally based assessment and intervention program could facilitate significant change in emotion recognition skill in young children with developmental delays or disabilities. Overall, the results indicated that for some children emotion recognition is an ability that can be manipulated through such an intervention program. Taken as a whole the children in the behaviorally based intervention group showed significant growth in emotion recognition ability over the course of the academic year, whereas children in the control group did not show such growth. Given the lack of significant change in emotion recognition ability observed in all participants in the control group, and the fact that children in the experimental group did not show improvements until emotion recognition training was initiated, it appears likely that the observed changes in the experimental group were the result of the assessment and intervention procedures that were implemented.

Although the intervention group as a whole showed significant growth in emotion recognition skill, individual variability was noted among participants. Specifically, two children in the intervention group who each had a diagnosis of autism showed very little change in emotion recognition skill. The lack of change seen in those children is consistent with previous research suggesting that emotion recognition is a skill that may be particularly resistant to change in children with autism (Downs & Smith, 2004). It also is important to note that the two children showing the least amount of change in emotion recognition also exhibited the most severe receptive language delays. A significant amount of research has shown that emotion understanding abilities often are related to verbal ability (Astington & Baird, 2005; Downs, Strand, & Cerna, 2007; Prior, Dahlstrom, & Squires, 1990). Additionally, considering that the emotion recognition assessment required the children to receptively understand emotional labels and link those labels to pictures, the lack of change in emotion recognition skill observed in those two children was not particularly surprising.

Given the demonstrated link between emotion understanding and language, it was encouraging to observe that the other three children in the intervention group who had severely delayed receptive language did show significant growth in emotion recognition ability over the course of the academic year, with one reaching the criterion measure. Taken together, our results suggest that a time-limited component (i.e., 5-10 minutes per week) of a behaviorally based assessment and intervention program may lead to significant gains in emotion recognition skill for children at a wide range of ability levels, not just for those who are typically developing or only very mildly delayed. However, such training may not lead to significant gains for all children, particularly those who demonstrate severely delayed language development and have a diagnosis of autism. Because the emotion recognition training in the current study was fairly time-limited, future studies should investigate whether children with autism and severe language delays can make significant gains in emotion recognition when exposed to a more time-intensive intervention.

In conducting this study we also assessed whether improvements in emotion recognition skills were accompanied by gains on a more comprehensive measure of emotion understanding. Our results suggest that children provided emotion recognition training may become more adept at processing a wider range of emotional stimuli such as situation-, desire-, and belief-based emotions. Desire-based emotions refer to understanding how others could be expected to feel when their desires are fulfilled or denied. Belief-based emotions refer to understanding how others may feel when they think some event is likely to occur, irrespective of actual events. The children in the intervention group showed growth in overall emotion understanding even though they were not exposed to any emotional stimuli other than facial expressions during the intervention. Although the results should be interpreted cautiously, especially in light of the fact that the emotion understanding measure utilized contained some items that assess recognition, it is possible that the ability to accurately recognize emotions may be a key developmental milestone that facilitates further understanding of a variety of emotionally relevant stimuli.

Developmental theories and studies of emotional growth (Denham, 1998; Hadwin, Baron-Cohen, Howlin, & Hill, 1996; Pons, Harris, & de Rosnay, 2004) are certainly consistent with the notion that emotion recognition is a necessary building block supporting more advanced emotion understanding. However, we are not aware of any other studies that have documented gains on more general measures of emotion understanding following training focused solely on emotion recognition. If this finding can be replicated it is possible that basic emotion recognition training programs such as the one described here may be used to successfully facilitate improvements in the overall emotional competence of young children.

In addition to investigating in more depth the link between emotion recognition skill and general emotional competence, researchers should also further examine how emotion recognition skill is related to social behavior. As noted in the introduction, proficiency in emotion recognition and understanding has been correlated with positive social behavior in a number of studies (Carlo et al., 1991; Denham, 1986; Denham et al., 1990; Lindsey & Colwell, 2003). However, that does not mean that improved social skills necessarily result from improvements in emotion recognition and understanding. Indeed, some research conducted with children with autism has indicated that gains in emotion understanding may not lead to improved social conversational ability (Hadwin et al., 1996; Hadwin, Baron-Cohen, Howlin, & Hill, 1997).

Other research has indicated that emotion recognition may be more intimately related to social behavior than is the more general construct of emotion understanding. Specifically, a study conducted with typically developing preschoolers by Strand et al. (in press) revealed that emotion recognition, but not emotional perspective taking, was related to shyness. This finding was not particularly surprising considering that neurobiological studies have found that facial emotion recognition and shyness are likely both associated with amygdala functioning (Kagan, Reznick, & Snidman, 1988; Schmidt, Polak, & Spooner, 2001; Thomas et al., 2001a, b). Given the apparent relationship between emotion recognition and shyness at the behavioral and neurobiological levels, it will be important for researchers to explore how training in emotion recognition affects not only emotional development, but also related constructs such as shyness in typically devebping children and those with developmental disabilities. If studies reveal that emotion recognition training reliably leads to improved social skills, practitioners may gain access to a relatively simple intervention strategy that can help children who have, or who are at-risk for, peer difficulties.

This study was limited by the small, highly diverse group of participants which reduced statistical power and necessarily limits the generalizability of the findings. Future studies may find more statistically significant results if more participants are used. Another limitation was the use of a “preschool as usual” control group, as opposed to an alternative emotion recognition training method control group. As a result, it is impossible to say with any confidence that behavioral interventions are the most effective way

to provide emotion recognition training to young children with developmental disabilities. Indeed, other methods that are less staff or time intensive (e.g., group instruction, computer training) may prove to lead to similar emotion recognition skills gains. However, considering the difficulties many preschoolers with developmental disabilities have with attention and learning, it is quite possible that one-to-one behavioral interventions such as discrete trial teaching may prove more effective than less intensive methods. Clearly, such questions need to be investigated empirically.

Although the results do not provide evidence that behavioral interventions are the optimal, or only way to teach emotion recognition, the primary purpose of this study was simply to determine whether emotion recognition is a skill that can be manipulated via a behaviorally based assessment and intervention program. Given the limited research conducted on this topic to date, the finding that recognition of basic and complex emotions can be taught via behavioral interventions to children with various developmental disabilities is an important one. Future research should seek to examine whether other teaching or intervention approaches can also be used to teach emotion recognition skills to young children with various developmental and diagnostic profiles. There is also a clear need to evaluate whether successful training in emotion recognition leads to better emotion understanding in other arenas, as well as to improved social skills in young children with a variety of developmental, diagnostic, and behavioral characteristics.

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