Recognition, Expression, and Understanding Facial Expressions of Emotion in Adolescents With Nonverbal and General Learning Disabilities

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Abstract
Children with nonverbal learning disabilities (NVLD) have been found to be worse at recognizing facial expressions than children with verbal learning disabilities (LD) and without LD. However, little research has been done with adolescents. In addition, expressing and understanding facial expressions is yet to be studied among adolescents with LD subtypes. This study examined abilities of adolescents with NVLD, with general learning disabilities (GLD), and without LD to recognize, express, and understand facial expressions of emotion. Adolescents were grouped into those with NVLD, with GLD, and without LD using the Wechsler Intelligence Scale for Children–Third Edition (short form) and Wide Range Achievement Test–Third Edition. The adolescents completed neuropsychological, recognition, expression, and understanding measures. It is intriguing that the GLD group was significantly less accurate at recognizing and understanding facial expressions compared with the NVLD and NLD groups, who did not differ. Implications are explored with regard to the need to consider possible deficits in recognition and understanding of emotion in adolescents with LD in schools.

Keywords
learning disabilities, adolescents, social functioning, emotional processing, nonverbal learning disabilities

The importance of examining social functioning of students with learning disabilities (LD) has gained increasing recognition in the field (e.g., Tur-Kaspa, 2002; Wong & Donahue, 2002). Studies have consistently demonstrated that students with LD have lower peer status compared with their non-learning disabled (NLD) peers (Bryan, 1976; Silver & Young, 1985; Wiener, 1987).

The ability to recognize, express, and understand facial expressions of emotions has been shown to be important for social functioning (Boyatzis & Satyaprasad, 1994; Custrini & Feldman, 1989; Edwards, Manstead, & MacDonald, 1984; Monfries & Kafer, 1987; Philippot & Feldman, 1990; Zuckerman & Przewuzman, 1979) and related to general adjustment to school (Zuckerman & Przewuzman, 1979), sociometric status, popularity, and general social competence among children and adolescents without LD (Boyatzis & Satyaprasad, 1994; Custrini & Feldman, 1989; Philippot & Feldman, 1990). However, few studies have directly examined these processes among LD populations. Despite the limited amount of research in this area, existing studies have consistently shown children and adolescents with LD to be less accurate overall at recognizing facial expressions of emotion from still photographs compared with their NLD peers (Holder & Kirkpatrick, 1991; Most & Greenbank, 2000; Nabuzoka & Smith, 1995). However, due to the heterogeneity of the LD samples used in these studies, it is unclear as to whether children and adolescents with LD in general experience such difficulties and how students with certain LD subtypes would perform on recognizing facial expressions of emotions. Although the ability to directly express or understand facial expressions of emotion has yet to be studied among adolescent LD populations, children and adolescents with other exceptionalities have been shown to be less accurate on tasks that assess general understanding of facial expressions of emotion (Ellis et al., 1997; McAlpine, Singh, Kendall, & Ellis, 1992; Singh et al., 1998).

Realizing the problems inherent in using heterogeneous samples, investigators began to examine LD subtypes to

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acquire a more specific understanding of their academic, neuropsychological, social, and emotional functioning (Rourke, 1999; Rourke & Finlayson, 1978; Siegel & Ryan, 1989). Specifically, the nonverbal learning disabilities (NVLD) subtype, which is hypothesized to be made up of a distinct pattern of neuropsychological, academic, and social/emotional deficits, has received significant attention (Rourke, 1993; Rourke & Tsatsanis, 1996; Strang & Rourke, 1983). Studies have attempted to classify children into separate groups based on patterns of academic achievement (Rourke & Strang, 1978; Shafrir & Siegel, 1994; Siegel & Linder, 1984; Siegel & Ryan, 1988, 1989), cognitive abilities, and neuropsychological aspects, indicating that subtypes can be reliably identified (Rourke & Finlayson, 1978; Rourke & Strang, 1978; Strang & Rourke, 1983). Specifically, Rourke and Finlayson (1978) found a distinction on 16 neuropsychological and cognitive measures among children with differing subtypes on various visual-perceptual, verbal, and auditory-perceptual abilities. In addition, the poor verbal and auditory-perceptual skills exhibited by children with verbal learning disabilities (VLD) and the poor visual-spatial skills found among children with NVLD have been demonstrated in younger children between the ages of 7 and 8 years using similar cognitive and neuropsychological measures (Ozols & Rourke, 1988, 1991). Harnadek and Rourke (1994) used discriminant function analysis on 15 neuropsychological variables to determine the most salient dimensions of the NVLD syndrome. Deficits in visual-perceptual-organizational psychomotor coordination and tactile-perceptual skills accurately discriminated the NVLD group from the VLD and the NLD control. Furthermore, two recent studies (Drummond, Ahmad, & Rourke, 2005; Pelletier, Ahmad, & Rourke, 2001) have highlighted the differentiating features of classification among older and younger children, providing further credence to the evidence for the NVLD syndrome.

Taken together, these children and adolescents have been found to exhibit difficulties in visual-spatial-organizational skills, tactile-perceptual skills, and nonverbal problem-solving skills (Rourke & Finlayson, 1978; Rourke & Strang, 1978; Strang & Rourke, 1983). They have been found to exhibit academic difficulties within the area of mechanical arithmetic and mathematics, while demonstrating well-developed levels of word recognition (Rourke, 1993; Strang & Rourke, 1983). In addition, it has been suggested that their neuropsychological and social deficits may be related to difficulties in processing facial expressions of emotion (Rourke, 1999).

Recently, investigators studying almost exclusively children have found children with NVLD to be less accurate at recognizing facial expressions of emotion compared with children with verbal learning disabilities (VLD) and without LD (Dimitrovsky, Spector, & Levy-Shiff, 2000; Dimitrovsky, Spector, Levy-Shiff, & Vakil, 1998), as well as compared with children with psychiatric difficulties without LD controls (Petti, Voelker, Shore, & Hayman-Abello, 2003).

Based on the literature reviewed, there is evidence to suggest that children with NVLD have difficulty recognizing facial expressions of emotion (Dimitrovsky et al., 2000; Dimitrovsky et al., 1998; Petti et al., 2003); however, little has been done in this area with adolescents with NVLD. The studies have solely focused on the recognition of facial expressions in children or in a combined age group, making conclusions about adolescent functioning impossible. In addition, no studies have directly examined the abilities to recognize, express, or understand facial expressions of emotions simultaneously in a sample of adolescents with NVLD, with general LD, and without LD. Given the exclusive focus of previous studies on the recognition of emotions, they fail to encompass the complexity of the social interaction. Thus, this study sought to address this gap through the simultaneous examination of all three aspects of emotion processing.

The objective of this study was to examine adolescents’ abilities with NVLD, general learning disabilities (GLD) without LD to recognize, express, and understand facial expressions of emotion. Based on the literature, it was hypothesized that a heterogeneous LD group would perform significantly worse in recognition, expression, and understanding of facial expressions as compared with those without LD. In addition, a subtype comparison was predicted to reveal that adolescents with NVLD would be less accurate at recognizing, expressing, and understanding facial expressions of emotion compared with those with a general LD subtype and those without LD.

**Method**

**Participants**

The sample consisted of 69 adolescents (39 boys, 30 girls) ranging between 12.0 and 15.9 years old ($M = 170.3$ months, $SD = 12.3$ months) from schools in the Greater Montreal area and Cornwall/South Glengarry region in Ontario, Canada. In total, 1,723 consent forms were distributed and 308 forms were returned (return rate = 17.9%). Fifty-seven participants were excluded from the final sample as they either did not meet the IQ criteria (IQ estimate ≥ 85) and/or did not meet the academic achievement criteria of one of the three groups. The sample was divided into three groups: 23 adolescents with NVLD (13 boys, 10 girls), 23 matched adolescents without learning disabilities (13 boys, 10 girls), and a comparable group of 23 adolescents with GLD (13 boys, 10 girls). The adolescents from
the NVLD group were matched to those from the NLD group on gender, age within 10 months, and IQ within 6 points based on the short form of the *Wechsler Intelligence Scale for Children* (WISC-III; Wechsler, 1991). A less stringent criterion was used to create a comparable GLD group whereby the group was matched to the NVLD and NLD groups on gender, age within 18 months, and IQ within 20 points. This was done because of the difficulty in obtaining a three-way match between the NVLD, GLD, and NLD groups.

The sample was made up predominately of Caucasian adolescents (85.5%) with a small proportion of African Canadians (8.7%), East Indian (2.9%), and other (2.9%). In terms of school location, separate independent *t* tests were conducted on the variables of IQ and the reading, spelling, and arithmetic academic achievement standard scores between the adolescents from the different regions to ensure that no differences emerged as a function of location. No significant differences were observed among the adolescents from the two regions on the measures of IQ, reading, spelling, or arithmetic, so regions were collapsed.

**Classification of adolescents with learning disabilities.** Adolescents were classified as exhibiting an LD based on their IQ estimate scores on the WISC-III short form (Wechsler, 1991) and their academic achievement scores based on the *Wide Range Achievement Test–Third Edition* (WRAT3; Wilkinson, 1993). Specifically, adolescents were classified as having an LD if they obtained (a) a full scale IQ estimate score of 85 or above on the WISC-III and (b) a standard score of 80 or below (i.e., at least one standard deviation below the mean) on at least one area of academic achievement (i.e., reading, spelling, and/or arithmetic) on the WRAT3. Adolescents who obtained a full scale IQ estimate on the WISC-III of 85 or above and a standard score above 85 in all three areas of academic achievement were classified as NLD. The criteria used to classify the adolescents into LD and NLD groups generally reflect LD researchers’ and practitioners’ thinking within the field (Fletcher, Morris, & Lyon, 2003; Learning Disabilities Association of Canada, 2002). The use of a discrepancy between IQ and achievement scores was not used as this method has not been deemed meaningful by some researchers (Bender, 2004; National Center for Learning Disabilities, 2003).

**Classification of adolescents into learning disability subtypes.** Researchers (Rourke & Finlayson, 1978; Rourke & Strang, 1978; Shafrir & Siegel, 1994; Siegel & Linder, 1984; Siegel & Ryan, 1988, 1989; Strang & Rourke, 1983) have classified children and adolescents with NVLD using various types of standardized and nonstandardized measures of academic and central processing. However, there is general agreement that children and adolescents with NVLD exhibit difficulties in the academic area of arithmetic compared with that of reading (Rourke, 1999; Shafrir & Siegel, 1994; Siegel & Heaven, 1986). Subsequently, in this study, adolescents were classified as exhibiting an NVLD by meeting the following criteria: (a) a standard score of 80 or below on the arithmetic subtest, with a standard score above 85 on the reading subtest; and (b) at least a 15-point difference between the standard score on the arithmetic subtest and the standard score on the reading subtest (i.e., standard score on the arithmetic subtest is at least 15 points below standard score on the reading subtest).

Adolescents who did not meet the criteria of NVLD but met the LD criteria were classified as GLD. Specifically, adolescents were classified as exhibiting a GLD if they had a standard score of 80 or below in at least one area of academic achievement. The GLD group is notably different from the NVLD group as the majority of the adolescents with GLD experienced difficulties in the areas of reading and/or spelling. In addition, adolescents within the NVLD group experienced a relative weakness in the area of arithmetic as compared with that of reading (i.e., standard score on the arithmetic subtest is at least 15 points below standard score on the reading subtest), which was not exhibited by the adolescents within the GLD group. See Table 1 for IQ group scores and academic achievement area breakdowns.

### Table 1. Mean and Standard Deviation IQ and Achievement Standard Scores for Groups With and Without Learning Disabilities

<table>
<thead>
<tr>
<th>Group</th>
<th>WISC-III Reading</th>
<th>WRAT3 Spelling</th>
<th>WRAT3 Arithmetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>NLD</td>
<td>96.3 ± 7.0</td>
<td>100.0 ± 10.2</td>
<td>101.3 ± 9.1</td>
</tr>
<tr>
<td>NVLD</td>
<td>93.5 ± 6.9</td>
<td>98.2 ± 6.7</td>
<td>88.1 ± 11.6</td>
</tr>
<tr>
<td>GLD</td>
<td>94.9 ± 9.5</td>
<td>78.8 ± 11.0</td>
<td>77.6 ± 9.6</td>
</tr>
<tr>
<td>Total</td>
<td>94.9 ± 7.9</td>
<td>92.4 ± 13.4</td>
<td>89.0 ± 14.0</td>
</tr>
</tbody>
</table>

Note: *WISC-III* = *Wechsler Intelligence Scale for Children–Third Edition*, short form (Block Design and Vocabulary subtests); *WRAT3* = *Wide Range Achievement Test–Third Edition*; NLD = non-learning disabled; NVLD = nonverbal learning disabilities; GLD = general learning disabilities.

**Measures.**

*Wechsler Intelligence Scale for Children–Third Edition.* The WISC-III (Wechsler, 1991) is an individually administered test of intelligence for children and adolescents from 6 to 16 years old (*M* = 100, *SD* = 15). In this study, the short form version of the WISC-III, which consists of the Vocabulary and Block Design subtests, was administered to obtain a full scale IQ estimate. This particular short form...
combination was chosen as it has good reliability (0.91) and validity (0.86) with the full scale IQ and is considered a good measure of general intelligence (Sattler, 1992).

Wide Range Achievement Test—Third Edition. The WRAT3 (Wilkinson, 1993) is an individually administered test of academic achievement \( (M = 100, \ SD = 15) \), which measures the basic skills of reading, spelling, and arithmetic among individuals from ages 5 through 74. The WRAT3 has been found to demonstrate good internal consistency with coefficient alphas ranging from 0.85 to 0.95 over the nine WRAT3 tests. This measure has been found to demonstrate strong content validity, and discriminant analysis revealed that the WRAT3 was able to discriminate among children with and without LD (Wilkinson, 1993). Standard scores based on age norms for each of the individual subtests were calculated for each participant.

Conners-Wells Adolescent Self-Report Scale: Short Form (CASS:S). The CASS:S (Conners, 2000) is an individually administered 27-item self-report inventory designed to assess the presence and severity of Attention-Deficit/Hyperactivity Disorder (ADHD) symptoms in adolescents aged 12 to 17 years old. In this study, it was used as a measure of self-reported symptoms of Inattention and ADHD. The short self-report contains the following four subscales: (a) Conduct Problems (6 items), (b) Cognitive Problems/Inattention (6 items), (c) Hyperactive-Impulsive (6 items), and (d) ADHD Index (12 items). Items are scored on a 0 to 3 scale \((0 = \text{not true at all}, \ 1 = \text{just a little true}, \ 2 = \text{pretty much true}, \ 3 = \text{very much true})\). Raw scores are converted to \( T \)-scores, with higher \( T \)-scores indicating more clinically significant problems on each individual subscale. The internal reliability coefficients for the four subscales range from 0.753 to 0.849.

Reynolds Adolescent Depression Scale (RADS). The RADS (Reynolds, 1987) is an individually administered 30-item self-report questionnaire designed to assess the presence and severity of depressive symptoms in adolescents from 12 to 18 years of age. The adolescent was asked to respond to questions on a 4-point Likert-type rating scale ranging from 1 (almost never) to 4 (most of the time) to describe how they felt. The items were summed to give the total RADS raw score, which can range from 30 to 120, with higher scores indicating more reported depressive symptoms.

In general, the RADS has been shown to have high internal consistency, with Cronbach’s coefficient alphas ranging from 0.90 to 0.96, with high item-total scale correlations supporting homogeneity. The RADS has also been shown to have strong test–retest reliabilities with correlations ranging from 0.80 (6 weeks) to 0.79 (3 months) to 0.63 (1 year) (Reynolds, 1987). The RADS has also been shown to have moderate to high convergent construct validity with other self-report and clinical rating scales of depression (e.g., Reynolds, 1987).

As one’s mood and ability to sustain attention has been shown to be related to how one processes facial expressions of emotions (Kring, 2001; Singh et al., 1998; Stone & LaGreca, 1984), for the purpose of this study, any differences that emerged between the groups (i.e., LD or NLD or NVLD, GLD, NLD) on the RADS raw scores or on any of the CASS:S subscales were used as covariates in subsequent analyses.

Neuropsychological measures. All the adolescents were administered four neuropsychological measures to validate the appropriateness of the LD subtype groupings. The selection of the four measures was based on a study by Harnadek and Rourke (1994), who examined the relative discriminant validity of 15 neuropsychological measures to determine which measures were most effective in categorizing participants as NVLD from those whose LD lies more in the language area. Based on their findings, they concluded that the Trail Making Test (Reitan & Davidson, 1974) and the Target Test (Reitan, 1966) combined correlated 0.60 and the Grooved Pegboard Test (Klove, 1963) correlated 0.47 with the function that accounted for 69% of the total variance in the discrimination of the NVLD from those whose LD lies more in the language area. The authors also reported that the Speech Sounds Perception Test (Halstead, 1947; Reitan & Davidson, 1974) correlated 0.44 with the function that accounted for 31% of the total variance in the discrimination of those whose LD lies more in the language area from the NVLD group. The authors concluded that these four neuropsychological measures are able to discriminate children and adolescents with NVLD from those whose LD lies more in the language area.

Trail Making Test Part B. The Trail Making Test Part B (Reitan & Davidson, 1974) has been found to measure visual scanning, speed of eye-hand coordination (psychomotor), and information processing (Mitrushina, Boone, & D’Elia, 1999; Spreen & Straus, 1998). This test has been demonstrated to have good reliability and construct validity for rapid visual search and visual-spatial sequencing (desRosiers & Kavanagh, 1987) and not to correlate with verbal tests (Ehrenstein, Heister, & Cohen, 1982). In the children’s version, this measure consists of an 8 \( \times \) 11 inch page with 15 circles spread out over the page consisting of numbers 1 through 8 and letters A through G. The participant was asked to draw lines linking the numbers and letters in order, such that he or she alternated between numbers and letters (e.g., 1-A-2-B, etc.). One score was obtained, which was the total time in seconds to complete the task, with higher scores indicating worse performance.

Target Test. The Target Test (Reitan, 1966) is a measure of visual-spatial memory and is part of the Reitan-Indiana Neuropsychological Test Battery (Reitan & Davidson, 1974; Reitan & Wolfson, 1985). The Target Test consists of an 18 \( \times \) 18 inch stimulus figure board containing nine large black dots arranged in the form of a square. Using a pointer,
the researcher tapped out a design on the figure board for each item on this task. Following a 3-second delay, the participant was asked to reproduce the same visually presented figure pattern on his or her answer sheet. The participant’s score is the total number of items correctly reproduced, with higher scores indicating better performance.

**Grooved Pegboard Test (GPT).** The GPT (Klove, 1963) has been shown to measure psychomotor speed, fine motor control, and rapid visual-motor coordination (Lezak, 1995; Mitrushina et al., 1999). The GPT consists of a small metal board containing a 5 × 5 inch matrix of slotted holes angled in different directions. Each peg has a ridge along one side requiring it to be rotated into position for correct insertion into the hole. The task was to insert the 25 metal pegs with ridges along the sides one at a time into each hole in sequence. The participants were required to put the pegs into the holes as quickly as possible, first with the dominant hand and then with the nondominant hand. Scores represent time in seconds to complete the matrix with each hand, with higher scores reflecting a lower level of performance.

**Speech Sounds Perception Test (SSPT).** The SSPT (Halstead, 1947) necessitates immediate auditory memory and phoneme discrimination, but also good reading and spelling abilities (Reitan & Davidson, 1974; Reitan & Wolfson, 1993). The participants were played an audiocassette of 60 spoken single-syllable nonsense words divided into six series, which all contained the long e vowel sound. They were given a score sheet with four multiple-choice options for each of the 60 words, which differed in their beginning and/or ending consonant sounds. Participants were asked to underline the choice that matched the word heard on the audiocassette. Participants’ scores represent the total number of correct items and wrong items (i.e., errors) out of 60.

**Recognition measure: Pictures of Facial Affect (PFA).** The PFA (Ekman & Friesen, 1976) contains 110 35mm black-and-white slides of adult men and women expressing the facial expressions of happiness, sadness, anger, fear, surprise, and disgust in addition to a set of neutral faces. Ekman and Friesen (1976) report interjudge agreement to range from 70% to 100% for the emotions expressed on these photographs. In addition, race and culture of participants has generally not been found to play a significant role in the recognition of facial expressions of emotions (Boucher, 1979; Ekman, 1973). In this study, the subset of 48 slides (four male and four female faces for each of the six emotions, no neutral faces) was used. The individual emotion choices (i.e., happy, sad, anger, fear, surprise, and disgust) were placed on a sheet next to the participant and the choices were read aloud in order to not confound the results with low reading ability. For each picture of the individual facial expressions that appeared on the computer screen, the participant was asked to choose which face he or she thought was being expressed. The participant’s choice was circled on his or her answer sheet and scores represent the total number of correctly recognized facial expressions, with higher scores indicating better performance.

**Expression measure.** To assess the adolescent’s ability to display facial expressions of emotion, he or she was asked to make the six different facial expressions of emotions (happiness, fear, anger, surprise, sadness, and disgust) four times and to maintain each one for a period of 6 seconds in front of a video camera while being recorded. Five adult judges, who were all undergraduate students in psychology and blind to the study, to the hypotheses, and to the group placement of the participants, were used to code the data. The judges were first asked to individually study the facial expressions of emotions and their corresponding appropriate verbal labels from Ekman and Friesen’s (1976) PFA. They were then trained to sample videotapes of adolescents who were not directly used in the study expressing facial expressions of emotions. Following this, the judges individually viewed the participant’s facial expressions of emotions and were asked to provide the verbal label of the emotion for each of the individual faces expressed by each participant. The mean Kappa rating between randomized pairs among the five raters on 43.4% of the NLD group was 0.70, on 43.4% of the NVLD group was 0.70, and on 43.4% of the GLD sample was 0.65. The participant’s ability to express emotions was scored as the total number of correct facial expressions made as categorized by the judges. Previous research has shown this task to be effective in studying the ability of children and adults to display facial expressions of emotions (Brown, 1994; Field & Walden, 1982; Lewis, Sullivan, & Vasen, 1987; Walden & Field, 1990).

**Understanding measure.** To assess the adolescents’ understanding of facial expressions of emotions, they were asked to complete a short two-sentence story task, which was accompanied by a visual component. Specifically, the researcher read a short two-sentence story aloud while the participant followed along and simultaneously looked at a drawn picture directly below the verbal content that matched the story. The participant could rely solely on the visual pictorial of the story to complete the task, use the auditory information, or use the written text. All three provided sufficient information to complete the task. After hearing the story and seeing the picture of the story simultaneously, the participant was asked to point to the likely facial expression of emotion from an array of six slides from Ekman and Friesen’s PFA (one for each of the six emotions) that would best illustrate the facial expression of emotion that the main character would be displaying based on the story. The participants’ score represents the total number of correctly matched facial expressions, with higher performance indicating a better understanding of...
facial expressions. The understanding task is distinctly different from both the recognition and expression measures as it specifically includes contextual cues through the use of a short story and accompanying picture depicting a situation. The verbal stories of this measure were adapted from Ellis et al. (1997), McAlpine et al. (1992), Singh et al. (1998), and Stewart and Singh (1995) such that the same content and topic were employed in this study; however, the stories were adapted to fit the developmental level of the participants.

Procedure

Data collection began with the participants being individually administered the WISC-III short form and WRAT3 in a counterbalanced order within a session in a quiet well-lit room. Following the classification of participants into LD and NLD groups, the CASS:S and the RADS were also individually administered in a counterbalanced order within a session to all adolescents who were asked to continue in the study. All of the adolescents were then individually administered the four neuropsychological measures in a counterbalanced order within each session over two sessions of approximately 30 minutes each.

The participants were tested on the PFA for approximately 30 minutes. The PFA testing task was prefaced by a practice task in recognizing facial expressions. Six slides from the PFA that were not included in the testing session (one for each emotion) were used for practice. During the practice task, correct responses were confirmed and given for incorrect answers. Once it was clear that the participant understood the task, the 48 slides of the testing subset were individually presented in random order on a computer screen, and each slide was exposed for 10 seconds or until the participant provided a response.

In the expression task, each participant was individually seen in a quiet well-lit room where he or she was seated approximately 3 feet in front of a video camera. The researcher explained to the participant that she was going to film him or her making individual facial expressions of emotion. Following the explanation, the participants were provided with the opportunity to practice making facial expressions of emotions that were not directly asked in the testing session (e.g., making a silly face, making a confused face) to ensure that the participant understood the task.

In the understanding task, a three-ring binder was placed in front of the participant that contained a verbal and pictorial representation of a story on the left side and the six slides of facial expressions (one depicting each emotion) on the right side. For each story, the six individual pictures of the facial expressions were randomly assigned in terms of placement on the sheet; however, each participant viewed a fixed presentation. After hearing the story and looking at the visual depiction simultaneously, the participant was asked to choose among the six slides of facial expressions the likely resultant one of the main character. In total, each adolescent was shown 12 verbal/visual stories, with half of them being male pictures and half being female pictures.

Results

Group Classification

To determine whether adolescents with NVLD differed in their performance on the Trail Making Test Part B, the Target Test, the Grooved Pegboard Test, and the Speech Sounds Perception Test compared with adolescents with GLD and without LD, a one-way multivariate analysis of variance (MANOVA) was conducted. Results revealed a significant overall multivariate effect for group, Wilks’s Lambda, Λ = 0.68, multF(12, 122) = 2.18, p = 0.02, with the effect size estimated using the partial eta being η² = .176 (large effect). Univariate F tests revealed a significant effect of group on the Trail Making Test Part B, F(2, 66) = 3.49, p = 0.04, and on the Speech Sounds Perception Test, F(2, 66) = 6.79, p = 0.002, with the effect sizes estimated using the partial eta being η² = .096 (large effect size) and η² = .171 (large effect size), respectively. Following Tukey HSD post hoc multiple comparisons, it was observed that the NVLD group (M = 37.78, SD = 14.14) performed significantly worse on the Trail Making Test Part B compared with the NLD group (M = 29.20, SD = 8.35). No significant differences emerged between the NVLD and GLD or between the GLD and NLD groups. For the Speech Sounds Perception Test, Tukey HSD post hoc multiple comparisons revealed that the GLD group (M = 8.04, SD = 4.37) made significantly more errors than the NLD group (M = 4.35, SD = 2.33), whereas no significant differences emerged between the GLD and NVLD or between the NVLD and NLD groups.

Depression. To determine whether the adolescents with and without LD differed on their level of reported depressive symptoms, an independent samples t test was conducted with group (NLD/LD) serving as the independent variable and raw scores on the RADS serving as the dependent variable. Results revealed a significant effect for group, t(58.4) = 2.60, p = 0.01; the effect size was estimated using Cohen’s d = 0.76 (medium effect) with adolescents with LD reporting significantly more depressive symptoms (M = 59.33, SD = 13.79) than those without LD (M = 51.78, SD = 9.92). In all future analyses involving the LD/NLD comparison, use the RADS variable as a covariate.

To determine whether adolescents in the three groups (NVLD, GLD, and NLD) differed on the level of reported depressive symptoms, a one-way analysis of
variance (ANOVA) was conducted, with group (NVLD/ GLD/NLD) serving as the independent variable and raw scores on the RADS serving as the dependent variable. No significant results were observed, $F(2, 66) = 2.74$, $ns$, between the adolescents with NVLD ($M = 58.74$, $SD = 13.31$), GLD ($M = 59.91$, $SD = 14.53$), or NLD ($M = 51.78$, $SD = 9.92$) on their levels of reported depressive symptoms, with the effect size estimated using the partial eta as being $\eta^2_p = .077$ (medium effect). Therefore, in all further three-group analyses, the RADS was not covaried.

**Attention.** To determine whether the adolescents with and without LD differed on any of the subscales of the CASS:S, a one-way MANOVA was conducted, with group (NLD/ LD) serving as the independent variable and the individual subscales of the CASS:S serving as the dependent variables. Consistent with Stevens (1996), both multivariate and univariate results were examined even in the absence of a multivariate effect given the exploratory nature of the study. No significant multivariate results were revealed, Wilks’s Lambda, $\Lambda = 0.92$, $multif(4, 64) = 1.38$, $ns$, with the effect size estimated using the partial eta being $\eta^2_p = .079$ (medium effect size). However, univariate $F$ tests revealed a significant result on the Cognitive Problems/Inattention subscale, $F(1, 67) = 4.85$, $p = 0.03$, with the effect size estimated using the partial eta being $\eta^2_p = .067$ (medium effect size). Specifically, the LD group ($M = 57.30$, $SD = 9.40$) reported significantly more problems on the Cognitive Problems/Inattention subscale than the NLD group ($M = 52.39$, $SD = 7.20$). Thus, in further LD/NLD comparisons, the Cognitive Problems/Inattention subscale was covaried.

To assess whether the three groups (NVLD, GLD, and NLD) differed on any of the subscales of the CASS:S, a one-way MANOVA was conducted, with group (NVLD/ GLD/NLD) serving as the independent variable and the individual subscales of the CASS:S serving as the dependent variables. No significant multivariate results were revealed, Wilks’s Lambda, $\Lambda = 0.81$, $multif(8, 126) = 1.78$, $ns$, with the effect size estimated using the partial eta being $\eta^2_p = .101$ (large effect size). However, univariate $F$ tests revealed significant results on the Cognitive Problems/ Inattention subscale, $F(2, 66) = 5.04$, $p = 0.007$, and on the ADHD Index, $F(2, 66) = 3.23$, $p = 0.046$, with the effect sizes estimated using the partial eta being $\eta^2_p = .141$ (large effect size) and $\eta^2_p = .089$ (large effect size), respectively. Tukey HSD post hoc tests revealed adolescents with GLD reporting more problems on the Cognitive Problems/ Inattention subscale ($M = 60.26$, $SD = 8.85$) compared with the NVLD ($M = 54.35$, $SD = 9.17$) and NLD ($M = 52.39$, $SD = 7.20$) groups, who did not significantly differ from each other. Furthermore, three-group analyses covaried for both the Cognitive Problems/Inattention subscale and the ADHD Index subscale.

**Gender.** An independent samples $t$ test was conducted with gender (male/female) serving as the independent variable and the mean total recognition, expression, and understanding scores serving as the dependent variables. No significant differences were observed between males and females in their ability to recognize (males, $M = 36.77$, $SD = 4.33$; females, $M = 38.70$, $SD = 3.79$), $t(67) = 1.94$, $ns$, with the effect size estimated using the partial eta as being $\eta^2_p = .053$ (medium effect), or correctly express (males, $M = 18.92$, $SD = 3.83$; females, $M = 18.43$, $SD = 3.46$), $t(67) = 0.55$, $ns$, expressions of emotions with the effect size estimated using the partial eta as being $\eta^2_p = .044$ (small effect). However, on understanding facial expressions, results revealed a significant effect for gender, $t(67) = 2.74$, $p = 0.008$, with the effect size estimated using the partial eta as being $\eta^2_p = .101$ (large effect). Females ($M = 10.10$, $SD = 1.42$) were more accurate at understanding facial expressions of emotions than males ($M = 9.13$, $SD = 1.49$). Gender was not used as a covariate because the groups were matched on gender.

**Research questions.** To determine whether adolescents with LD as a group were less accurate overall at recognizing facial expressions of emotion than adolescents without LD, a one-way analysis of covariance (ANCOVA) was conducted with the RADS raw scores and CASS:S Cognitive Problems/ Inattention subscale scores serving as covariates. A significant group effect was found, $F(1, 65) = 5.57$, $p = 0.02$, with adolescents with LD ($M = 36.78$, $SD = 4.38$) being less accurate overall at recognizing facial expressions of emotions than adolescents without LD ($M = 39.26$, $SD = 3.28$), with the effect size estimated using the partial eta being $\eta^2_p = .079$ (medium effect).

To assess whether adolescents with NVLD as a group were less accurate overall at recognizing facial expressions of emotion than adolescents with GLD and without LD, a one-way ANCOVA was conducted, with scores on the CASS:S Cognitive Problems/Inattention and ADHD Index subscales serving as covariates. A significant effect of group was uncovered, $F(2, 64) = 8.26$, $p = 0.001$, with the effect size estimated using the partial eta as being $\eta^2_p = .205$ (large effect). Least significant difference pairwise comparisons with Bonferroni correction revealed the GLD ($M = 34.70$, $SD = 3.76$) to be significantly less accurate overall at recognizing facial expressions of emotions than adolescents with NVLD ($M = 38.87$, $SD = 3.99$) and without LD ($M = 39.26$, $SD = 3.26$). No significant difference was found between adolescents with NVLD and without LD (see Figure 1).

To determine whether adolescents with LD as a group were less accurate overall at expressing facial expressions of emotion than adolescents without LD, a one-way ANCOVA was conducted with the RADS raw scores and
CASS:S Cognitive Problems/Inattention subscale scores serving as covariates. Contrary to what was predicted, no significant difference was found between the LD and NLD groups, $F(1, 65) = 0.50, \text{ ns}$, with effect size estimated by partial eta $\eta^2 = .008$ (small effect). To assess whether adolescents with NVLD were less accurate overall at expressing facial expressions of emotion than adolescents without LD and with GLD, a one-way ANCOVA was conducted with scores on the CASS:S Cognitive Problems/Inattention and ADHD subscales serving as covariates. No significant effect for group was uncovered, $F(2, 64) = 0.73, \text{ ns}$, with effect size estimated by partial eta $\eta^2 = .022$ (small effect).

To assess whether adolescents with LD as a group were less accurate overall at understanding facial expressions of emotion than adolescents without LD and with GLD, a one-way ANCOVA was conducted with the RADS raw scores and CASS:S Cognitive Problems/Inattention subscale scores serving as covariates. Contrary to what was predicted, no significant difference was found between the LD and NLD groups, $F(1, 65) = 2.72, \text{ ns}$, with effect size estimated by partial eta $\eta^2 = .040$ (small effect). To assess whether adolescents with NVLD as a group were less accurate overall at understanding facial expressions of emotion than adolescents without LD and with GLD, a one-way ANCOVA was conducted with the CASS:S Cognitive Problems/Inattention and ADHD Index subscale scores serving as covariates. A significant group effect was uncovered, $F(2, 64) = 5.26, p = 0.008$, with effect size estimated by partial eta $\eta^2 = .141$ (large effect). Least significant difference pairwise comparisons with Bonferroni correction revealed adolescents with GLD ($M = 8.83, SD = 1.45$) to be less accurate overall at understanding facial expressions of emotions than adolescents with NVLD ($M = 9.91, SD = 1.53$) and without LD ($M = 9.91, SD = 1.41$). No significant difference was found between adolescents with NVLD and without LD (see Figure 2).

**Discussion**

The purpose of this study was to investigate the abilities of adolescents with different subtypes of LD and without LD on different emotion processing tasks. Specifically, the ability to recognize, express, and understand six basic facial expressions of emotion was examined among adolescents with NVLD, with GLD, and without LD.

In this study, adolescents with NVLD performed significantly worse than adolescents without LD on the *Trail Making Test Part B*, which is generally consistent with previous findings (Harnadek & Rourke, 1994) and provides evidence for group validation. The fact that no significant difference emerged between the GLD and NLD groups on the *Trail Making Test Part B* provides additional support for group membership. In addition, the significant difference that emerged between the GLD and NLD groups on the *Speech Sounds Perception Test* further corroborates the accuracy of the groups. The nonsignificant finding between adolescents with NVLD and without LD on this measure provides further support for the appropriateness of the groups.
The hypothesis that adolescents with LD would be less accurate overall at recognizing facial expressions of emotions than adolescents without LD was supported. This finding is in line with previous studies examining facial expression recognition, which have consistently found children and adolescents with LD to be less accurate at recognizing facial expressions of emotion compared with those without LD (Holder & Kirkpatrick, 1991; Most & Greenbank, 2000; Nabuzoka & Smith, 1995). Yet, this result expands current research by providing more evidence and support that adolescents with LD when studied heterogeneously are less accurate at recognizing facial expressions of emotions than adolescents without LD.

The hypothesis that adolescents with NVLD would be less accurate overall at recognizing facial expressions of emotions compared with those with GLD or without LD was not supported. Contrary to the prediction, it was discovered that adolescents with GLD were significantly worse at recognizing facial expressions of emotions than adolescents with NVLD and without LD, with no difference between the NVLD and NLD groups. The lack of difference between the NVLD and NLD groups is inconsistent with previous studies (Dimitrovsky et al., 2000; Dimitrovsky et al., 1998; Petti et al., 2003). One possible explanation for these conflicting results is the different age groups used in this and previous studies. Specifically, this study examined differences in recognizing facial expressions of emotions between adolescents aged 12 to 15 years with NVLD and without LD, whereas other studies have focused almost exclusively on children (Dimitrovsky et al., 2000; Dimitrovsky et al., 1998; Petti et al., 2003). Although children with NVLD at a younger age (i.e., younger than 12 years) have been found to experience difficulties in recognizing facial expressions of emotion, perhaps during the period of adolescence their difficulties in recognizing the six primary facial expressions are more subtle. Thus, adolescents with NVLD tend to perform similarly to adolescents without LD in recognizing facial expressions of emotions.

One possible explanation for the significantly poorer performance of the GLD group as compared with the NVLD group in this study is the differences that emerged between the GLD and NVLD groups in terms of their severity of LD. In an attempt to provide an explanation for the differences in facial expression recognition between the GLD and NVLD groups, the breadth of severity across areas (i.e., number of academic areas classified as LD) was examined. Specifically, it was observed that the breadth of severity of LD across areas was greater for the GLD group and may explain their poorer performance at recognizing facial expressions of emotions as compared with the NVLD and NLD groups. Perhaps during the period of adolescence, the extent of the severity of an LD may be a more salient contributor to facial recognition difficulties than the specific LD subtype. In addition, the fact that Dimitrovsky et al. (1998) and Dimitrovsky et al. (2000) and Petti et al. (2003) did not provide evidence of severity for the sample of LD subtypes used in their studies highlights the possibility that during adolescence, it is the students with the most severe LD who continue to have difficulties recognizing facial expressions of emotions regardless of subtype.

One possible explanation for the breadth of severity of LD across academic areas leading to more difficulty in recognizing facial expressions is that perhaps there is a common cognitive mechanism that underlies the breadth of severity of academic difficulties that leads to their difficulties in recognizing facial expressions. This is not to say that it is the academic difficulties that lead to the increased difficulty in recognizing facial expressions of emotion among adolescents with GLD as compared with adolescents with NVLD and without LD, but perhaps a common cognitive element such as meta-cognition underlies such deficits. However, this remains purely a matter of conjecture.

The hypothesis that adolescents with LD would be poorer at expressing facial expressions as compared with adolescents without LD was not supported. In addition, no significant difference was found between the NVLD, GLD, and NLD groups in their abilities to express facial expressions of emotion. One possible explanation for the lack of significant difference between any of the groups may be the ease of this expression task for adolescents. Although previous studies have used this method of measuring facial expression abilities in the general population examining preschool-age children (Boyatzis & Satyaprasad, 1994; Field & Walden, 1982; Walden & Field, 1990), this task may have been too easy for adolescents given their age. In fact, all of the adolescents regardless of group were rated by independent judges as being accurate at expressing the facial expressions of emotion between 74% and 81% of the time. In addition, qualitative informal comments from the judges indicated that they generally thought the adolescents’ facial expressions were to some extent exaggerated. Given the nature of the task (i.e., posed facial expressions), making exaggerated facial expressions may be more likely to occur during the developmental period of adolescence than in preschool, as young children may not realize the possibility of exaggeration.

The nonsignificant finding between the LD and NLD groups on understanding of facial expressions of emotion does not lend support to the hypothesis that adolescents with LD would be less accurate than adolescents without LD on this task. In addition, the hypothesis that adolescents with NVLD would be less accurate overall at understanding facial expressions of emotions compared with those with GLD and without LD was not supported. Contrary to what was predicted, adolescents with GLD
were significantly worse at understanding facial expressions of emotions as compared with adolescents with NVLD and without LD, whereas no differences emerged between the NVLD and NLD groups. One possible explanation for the nonsignificant finding between the LD and NLD groups is that the NVLD group performed similarly to the NLD group in their level of accuracy at understanding facial expressions of emotions. As a consequence, when a two-group (LD/NLD) comparison was conducted, no differences emerged, as it is solely the GLD group that experienced significant difficulties on this task.

In contrast to the nonsignificant finding between the LD and NLD groups, a significant difference did emerge when the subtypes were examined. Specifically, adolescents with GLD were poorer at understanding facial expressions of emotion as compared with those with NVLD and NLD, with no difference between the NVLD and NLD groups. Although no studies have directly assessed the abilities of adolescents with NVLD, with GLD, and without LD to understand facial expressions of emotion, one possible explanation for these findings is the same as that given for the poor performance of GLD group on emotion recognition—specifically, that it is the severity of the LD, not necessarily the particular subtype of LD, that dictates such difficulties. Adolescents with GLD also exhibited the most severe LD in terms of the breadth of LD (i.e., number of academic areas classified as LD). These findings suggest that the severity of an LD may play a role in both recognition and understanding of facial expressions of emotion among adolescents with LD.

In summary, based on the literature reviewed combined with the results from this study, it appears that emotion processing may be subject to age differences in those with NVLD. Specifically, prepubertal children with NVLD have been shown to exhibit significant difficulties in recognizing facial expressions of emotion (Dimitrovsky et al., 2000; Dimitrovsky et al., 1998; Petti et al., 2003). However, findings from this study would suggest that during adolescence, students with NVLD may no longer lag behind their NLD peers on various indices of facial expression of emotion processing. Although adolescents with NVLD performed similarly to those without LD on the emotion processing tasks in this study, adolescents with NVLD still likely experience subtle difficulties in these areas. This study in no way claims that adolescents with NVLD do not exhibit social difficulties. Based on the literature reviewed, there is a considerable amount of consistent evidence suggesting that adolescents with NVLD experience social difficulties and have trouble comprehending general nonverbal cues. Further research is needed using a longitudinal design to document if there is a developmental pattern or age-related changes in emotion processing among students with NVLD.

In contrast, the GLD group performed significantly worse than the NVLD and NLD groups on recognition and understanding facial expressions of emotion. This may in part be due to the severity of the GLD group in terms of their breadth of academic difficulties across areas. Perhaps, when children with GLD develop into adolescents, the difficulties in these emotion processing tasks that they likely had as children still remain. These findings suggest that although examining a subtype of LD with assets and deficits is important, by adolescence, severity of LD may be more critical than the subtype of LD in emotion processing skills. Thus, as Nabuzoka and Smith (1995) suggested, there may well be a “social developmental lag” for children with NVLD. To further elucidate the hypothesis set forth concerning the developmental lag in facial expression recognition and understanding among individuals with NVLD, future studies could address this issue by assessing these skills among NVLD groups with a large age span, perhaps that straddles both childhood and adolescence (i.e., 8 to 15 years of age). In addition, future studies need to examine the severity of LD in conjunction with these emotion processing skills at a younger age. Furthermore, examining recognition, expression, and understanding of facial expressions of emotion using longitudinal studies may shed some light on these important issues.

There are limitations that must be mentioned. Every attempt was made to obtain an adolescent verbal learning disability (VLD) comparison group; however, given the difficult nature of finding these particular adolescents, a GLD comparison group was used instead. Although one may view not having a VLD group as a potential weakness, considering the findings of this study, it may also be considered a possible advantage. Specifically, the adolescent GLD group in this study highlights the importance of examining the severity of an LD as related to aspects of emotion processing. In addition, it could be argued that the NVLD group is generally an arithmetic disability group; however, students who were classified as having an NVLD were significantly worse on the Trail Making Test Part B, which provides confirmatory support for the classification of students with NVLD. Nonetheless, the fact that the neuropsychological measures were not used as part of the original classification criteria for the NVLD group could be considered as a limitation. Recently, Drummond and colleagues (Drummond et al., 2005) have proposed a classification system for children with NVLD that is said to be applicable to adolescents. Their proposed system of classification is highly rigorous and in clinical practice promises to be very reliable. However, in nonclinical-based research, it would be difficult to fully implement because of time and ethical constraints concerning time demands on participants. Nevertheless, replication of this study, simultaneously examining recognition,
expression, and understanding of emotion using the highly rigorous methodology proposed by Drummond et al., would be beneficial.

The lack of significant difference between any of the groups on the facial expression task may be related to the ease of this task for adolescents. Although previous studies have used this method of measuring facial expression abilities in the general population examining preschool-age children (Boyatzis & Satyaprasad, 1994; Field & Walden, 1982; Walden & Field, 1990; Zuckerman & Przewuzman, 1979), this task may have been too easy for adolescents given their age. As a consequence, the difference in age between the sample used in this study (i.e., adolescents) and those used in previous studies (i.e., preschool) may explain the adolescents’ performance and subsequently the lack of difference between the groups. Previous studies outlining the growing complexity of social perception as children age (Feldman, White, & Lobato, 1982; Magill-Evans, Koning, Cameron-Sadava, & Manyk, 1995; McAlpine, Singh, & Kendall, 1991; Morency & Krauss, 1982; Nowicki & Duke, 1994; Philippot & Feldman, 1990; Wiggers & Van Lieshout, 1985) have supported the improvement in the ability to accurately identify the emotional state of others with age. Third, given the low return rate (17.9%) of the consent forms by the adolescents, a note of caution is necessary. Although the return rate was not typical of general research studies, given the adolescent population, the low return rate was not surprising. In fact, after speaking with high school principals, they stated that a return rate of 10% to 20% was what they generally obtained for permission slips. Nonetheless, the low return rate is still considered a limitation. Subsequently, a note of caution is necessary in terms of generalizing the results.

**Educational Implications**

Despite a great deal of media coverage and general information to the public on adolescents with NVLD being at risk for social problems, it may be that the more severe the breadth of the LD, the greater the risk. Furthermore, these results indicate the need for professionals in the schools to be aware that a “basic” skill such as recognizing facial expressions of emotion may not be fully developed in all adolescents with learning disabilities and that for some students, the ability to understand the appropriate emotion for a situation may be impaired. Currently, much of the social instruction or support to students with LD in the high schools begins at a much higher level on the hierarchy of social skills (e.g., social problem solving) without a consideration of possible difficulties at a more basic level. These results highlight the need for practitioners to begin by evaluating students’ ability to engage in these more basic skills before asking the student to engage in more complex behaviors. Finally, these results demonstrate that educators cannot assume that a deficit associated with an LD as defined or described in young children will remain static through the developmental stages. At this time, it is still unclear what areas of deficit documented in children with LD are static and which may be subject to change over time. Assumptions concerning the fixed nature of all aspects of LD need to be challenged.

**Declaration of Conflicting Interests**

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**References**


