Lateralization of the Perception of Emotional Intonation in Children with Nonverbal Learning Disabilities

Heather Leanne McDonald©
Lakehead University

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Abstract

The purpose of the present study was to examine whether lateralization patterns for verbal and nonverbal material and behavioral presentations differ between children categorized as having a verbal (VLD) or nonverbal based learning disability (NLD). Based on their poor visual spatial skills and reported difficulties in social perception it was predicted that NLD children would be less lateralized with regards to nonverbal stimuli (emotional and musical) and more at risk for social problems and internalizing disorders than the VLD group. In the present study the expected left ear advantage (LEA) for nonverbal material was not found in any groups while a significant right ear advantage (REA) for verbal material was found in all but the VLD group. Contrary to predictions, NLD children demonstrated the highest lateralization scores for musical stimuli. No other significant differences in lateralization scores were found. With regards to behavior, a trend toward lower social skills was reported in NLD as compared to the control children. Reasons for the lack of expected ear advantages for nonverbal material and future directions for the study of social behavior in NLD children are discussed.

Introduction

Learning Disabilities is the umbrella term for a number of heterogeneous disorders all of which evidence significant difficulties in the mastery of one or more of the following: listening, speaking, reading, writing, reasoning and mathematical skills (Rourke & Fuerst, 1996). Compromised social and adaptive skills are often reported as secondary manifestations of these difficulties (Rourke & Fuerst, 1996). The wide range of parameters implied by this definition has invited subtyping with two groups commonly identified.

The first group is composed of children who exhibit psycholinguistic deficits in conjunction with strengths in visual spatial organization, tactile-perception, psychomotor speed and nonverbal problem solving (Rourke & Fuerst, 1996). Though math skills are sometimes impaired, reading and spelling skills are often significantly more compromised. The term for this subtype is language based or verbal learning disabilities and those affected appear to be more efficient at tasks thought to be subserved by the right cerebral hemisphere. By contrast, the second group demonstrates well developed psycholinguistic skills with significant problems in nonverbal areas mentioned above. Children within this subtype excel at word recognition and spelling but experience major academic difficulties with mechanical arithmetic, suggesting greater efficiency of left hemisphere functions as compared to those subserved by the right hemisphere (Rourke & Fuerst, 1996). These children, exhibiting what is referred to as nonverbal learning disabilities will be the focus of this study.

Nonverbal Learning Disabilities

The phenomenon of nonverbal learning disabilities (NLD) was first reported by Johnson and Myklebust in 1968 (Semrud-Clikeman & Hynd, 1990). Children described by this term are unable to comprehend the nuances of non-verbal interaction and the conceptual problems encountered in daily living despite having average or above average verbal capacities. Rourke and Harnadek (1994) further refined these symptoms into a syndrome comprised of neuropsychological deficits and assets (Rourke, 1989). These authors emphasize that the neuropsychological assets and deficits of NLD syndrome are causative and sequential moving from primary to secondary to tertiary with the levels of academic and psychosocial functioning dependent on the pattern of strengths and weaknesses at each stage throughout this sequence (Rourke, 1989).

In terms of neuropsychological strengths, among NLD individuals, simple motor skills and auditory perceptual capacities specifically for repetitive motoric acts are primary. These skills are reflected in secondary and tertiary assets for sustained auditory attention and memory for simple and rote verbal material. These children, after an initial lag in language development, usually become quite verbose but at the same time constrained in that their verbal output is often limited to rote functions and associations. Receptive language skills such as phonemic discrimination, segmentation and blending are also strong.

Neuropsychological deficits, most central to the NLD syndrome involve tactile and visual perception, psychomotor skills and adaptation to novel stimuli (Rourke, 1989). Delays in these functions create secondary impairments in tactile and visual attention and exploratory behavior which eventually manifest in poor visual and tactile memory and deficiencies in concept formation, problem solving, strategy generation, hypothesis testing and utilization of informational feedback. As well, speech tends to be excessive and delivered in a rote or repetitive manner with little prosody, suggesting a reliance on language as the sole means of gathering information, socially relating and relieving anxiety (Rourke, 1989).

These assets and deficits culminate in an unique academic and socioemotional profile (Rourke, 1989). Academically, these children have weak graphmotor skills and are unable to write without substantial practice. Reading comprehension is poor relative to single word reading, mechanical arithmetic rarely exceeds a grade five level and science based subjects that require concept formation and problem solving are persistently difficult. Similarly, novel information is intimidating for affected individuals and they have extreme difficulties in adapting to new and complex situations. Socially, these children have deficits in perception, judgment and interaction skills. Such a pattern puts them at increased risk for the development of socioemotional disturbances and psychopathology of the internalized variety (Harnadek & Rourke, 1994).

White Matter Model

The White Matter Model by Rourke is one attempt to explain the evolution and manifestation of the neuropsychological assets and deficits seen in children with NLD. This model is an extension of Goldberg and Costa's hypothesis regarding differences in neuroanatomical organization and subsequently the distinct processes subserved by each cerebral hemisphere (Goldberg & Costa, 1981). Goldberg and Costa assert that the right hemisphere is more adept at intermodal integration while the left hemisphere is better suited for unimodal processing or intramodal integration. This assertion is based on the distributions of white and gray matter in the two hemispheres. Gur, Packer, Hungerbuhler, Reivich, Obrist et al. (1980) found that the ratio of white matter compared to gray matter was greater in the right hemisphere than the left hemisphere. Since white matter is made up of long myelinated fibers ideal for transmitting information over a large region and gray matter is composed of short myelinated fibers and neuronal masses designed for communication within a contained area, it follows that an area endowed with a greater percentage of white matter would be better suited for intermodal integration while an area with a greater proportion of grey matter would lend itself to intramodal integration (Semrud-Clikeman, 1990) . Therefore the hemispheric distribution of gray and white supports the assertion that the right hemisphere is designed for intermodal communication while the left hemisphere is better suited for intramodal integration.

Goldberg and Costa (1981) state that with the greater composition of white matter the right hemisphere is equipped for communication between various modes of the brain which is essential when processing novel stimuli and acquiring a new descriptive system. Descriptive systems are pivotal in concept formation, problem solving and adapting to new circumstances, all of which are impaired in children with NLD. Likewise, precocious language development and verbosity are assets of NLD that are orchestrated by modality specific grey matter areas of the left hemisphere. Therefore, deficits of NLD can be explained by white matter destruction while their assets can be maintained by gray matter integrity.

It is fitting at this point to mention that, although the White Matter Model accounts for the NLD profile of assets and deficits, no consistent empirical evidence has been gathered to support white matter damage in these children nor how it arises. For instance, Rourke asserts that in the case of NLD white matter damage occurs after rudimentary linguistic skills have developed while prelinguistic white matter damage would result in NLD plus the global linguistic deficiencies seen in autism. However, it is quite difficult to ascertain if, or when, such damage occurs and it is for this reason that the White Matter Model is often criticized.

Right Hemisphere and Nonverbal Learning Disabilities

Though the right hemisphere White Matter Model can adequately explain the neuropsychological profile of the NLD child it is, as yet, to be corroborated by significant right hemisphere damage (Semrud-Clickeman, 1990). Case studies have documented mild abnormalities in brain scans of individuals with NLD and developmental histories reveal inherited deficiencies as well as postnatal insults that affect the right cerebral hemisphere but this association has not been substantiated empirically in large scale studies (Rourke & Tsatansis, 1996; Semrud-Clickeman, 1990). However, a plausible link between NLD and right hemisphere damage can be forged by examining the following areas: the functions of the right hemisphere, studies using right brain damaged adults, specific deficits in NLD children and brain pathology in similar syndromes.

To begin with, the constellation of NLD symptoms mentioned above are all rooted in the following functions thought to be mediated by the right hemisphere: spatial orientation, facial recognition, nonverbal memory and prosody (Ardilla & Ostrosky-Solis, 1984). This relationship between NLD symptomology and functions subserved by the right hemisphere can be further elucidated by examining the relationship between these children's verbal and performance IQ's on the WISC. In a study by Rourke, Young & Flewelling (1971) cited in Rourke and Fisk (1988), children subtyped as having NLD demonstrated significant differences in Verbal IQ and Performance IQ in favor of the former. Since verbal subscales are assumed to test left hemisphere functions and performance subscales are assumed to test right hemisphere functions it can be inferred that these children's scores reflect compromised right hemisphere functions. Independent measures of verbal, auditory-perceptual and visual-spatial abilities in the same group of children revealed a similar pattern of performance suggesting an impairment of skills tapping right hemisphere functioning (Rourke, Young & Flewelling, 1971).

By looking at the symptomatic similarities between children with NLD and right brain damaged adults a stronger case for right hemisphere involvement in NLD can be made. As mentioned previously children with NLD demonstrate significant problems in visual-spatial organization, tactile perception and psychomotor activity. Deficits in these areas greatly hinder the infant's exploration during the sensorimotor stage which is assumed to restrict conceptual development and later social behaviors (Rourke, 1982). Support for this assumption was gathered by Ozols and Rourke (1985) who found that NLD children evidenced difficulties when asked to attend, label and interpret gestures and facial expressions. In addition Rourke (1982) found that children with NLD failed to generalize previous learning to new situations, related to others in a stereotyped and routinized way and spoke in a monotonous, flat manner. When these behaviors accumulate, a social skills deficit in children with NLD becomes apparent. Similar problems with spatial orientation, interpretation of gestures and facial expressions and social skills have been documented in right brain damaged adults which lends further support to the role of the right hemisphere in NLD (Benowitz et al., 1983; Weintraub & Mesulam, 1983; Dagge & Hartje, 1985; Ross, 1981; Foldi, 1987; Moya, Benowitz, Levine & Finkelstein, 1987).

Academically, NLD children demonstrate strengths in reading and spelling but evidence significant difficulties in arithmetic (Rourke, 1989). Although arithmetic skills were originally considered to be a left hemisphere function, acquisition of more basic arithmetic processes have been found to be related to spatial imagery and concepts and is now assumed to be the domain of the right hemisphere, specifically the medial posterior area (Semrud-Clikeman & Hynd, 1990). Weinstrub and Mesulam (1983) found support for this assumption by demonstrating that subjects with right hemisphere dysfunction tended to have greater difficulty with basic arithmetic operations. Likewise John, Karmel and Corning (1977) found that arithmetic underachievers had differing evoked potentials in the right hemisphere as compared to normals and Querishi and Dimond (1979) found that calculation ability deteriorated in right brain damaged patients as opposed to left brain damaged patients or controls.

Additional evidence has been gathered for a link between weak arithmetic skills and right hemisphere integrity by examining electrostimulation studies of the right and left thalamus. Stimulation implicated the right thalamus in more basic processing such as number reading and arithmetic calculations and the left thalamus in higher order calculations (Ojemann, 1974). From this review of studies it can be hypothesized that the right hemisphere is involved in executing basic mathematical processes and further that compromised arithmetic skills in the NLD child may have their origins in right hemisphere pathology.

Not only is there a link between the right hemisphere and basic arithmetic but also between social deficits and poor arithmetic, a dyad seen in children with NLD. Badian and Ghublikian (1983) found that low achievement in arithmetic was related to social emotional problems whereas children categorized as high achievers were found to be more sociable and better adjusted. On a similar note, children who exhibited difficulties in math had problems learning social generalizations (Kirby & Asman, 1984). Children with Turners Syndrome also illustrate the connection between social and arithmetic deficits and right hemisphere dysfunction. These individuals present with both social incompetencies and mathematical deficits and, moreover, postmortem examinations have revealed right hemisphere pathology (Reske-Nielson, Christensen & Nielson, 1982). The shared symptoms of children with Turners syndrome and NLD therefore suggest damage to similar areas of the brain, in this case the right hemisphere.

Learning Disabilities and the Assessment of Lateralization

In the field of learning disabilities much research has been dedicated to assessing the role of abnormal lateralization in language based difficulties. Investigations of this type, however, are plagued by inconsistent findings and diverse theoretical interpretations (Kershner & Stringer, 1991). Representative results from this research will now be reviewed.

Bryden (1988a) reviewed 51 studies that assessed cerebral lateralization in reading disabled children by using non invasive techniques such as dichotic listening, visual half field recognition, verbal-manual time sharing or tactile dichhaptic (division of the sense of touch by using both hands) processing tasks. Thirty of these studies suggested that these children were on the whole less lateralized than children categorized as good readers, 14 studies showed no differences between the aforesaid groups and 7 studies reported poor readers as more lateralized (Obrzut, 1991).

These mixed findings become clearer when looking at the results of studies that employed directed attention in dichotic listening tasks. The dichotic listening procedure requires subjects to listen to and report two competing verbal messages arriving simultaneously at the right and left ear (Bryden , 1988b). A right ear advantage (REA) (i.e., reporting more right ear material than left) in this procedure is assumed to indicate left hemisphere specialization while a left ear advantage (LEA) denotes the preferential processing of the right hemisphere for language. When dichotic listening tasks are completed under free recall conditions with no designated ear order, strategy and memory effects are said to exert an influence over performance. According to Orbzut (1991), directed attention dichotic listening tasks are preferable when measuring lateralization of auditory-verbal material in children with learning disabilities. Therefore, the most refined method of assessing lateralization is to direct the subject's attention in a predetermined sequence to each ear (Orbzut, 1991). Such a procedure permits counterbalancing of ear order allowing one-half of subjects to attend first to the right ear and one half of the subjects to attend first to the left ear. This controls for fluctuations in attention.

In early studies by Obrzut, Hynd and Obrzut (1983) and Obrzut, Hynd, Obrzut and Pirozzolo (1981) using both free recall and directed attention dichotic listening tasks, normal children demonstrated a REA for auditory-verbal information throughout all three procedures namely: directed right, directed left and free recall but children with learning disabilities showed a deviant pattern of performance. Only the learning disabled group was able to reverse their ear effect and produce a LEA during the directed left condition as opposed to normal children who were unable to willingly attend to verbal stimuli received in the non dominant ear (Obrzut, Hynd & Obrzut, 1983; Obrzut, Hynd, Obrzut & Pirozzolo, 1991). Researchers drew two conclusions from these studies. The first is that when asked to focus their attention to a specific stimulus, learning disabled children shift their attention and do not demonstrate the expected REA and the second is that this attentional shift could be due to lack of left hemisphere dominance when processing verbal material (Orbzut & Boliek, 1988).

Hence, there appears to be two factors affecting the lateralization of verbal material in children with learning disabilities, a weak structural system and atypical shifts in attention (Orbzut & Boliek, 1988). Normal children possess a strong underlying structural system where contralateral auditory pathways are stronger and inhibit ispsilateral auditory pathways. This pre-wiring allows the left hemisphere to process verbal stimuli while suppressing the non dominant right hemisphere and produce a REA for verbal material (Orbzut & Boliek, 1988). When attentional components are studied in the normal population REA is enhanced in directed right conditions suggesting that anatomical structure co-exists with attentional strategies to produce the lateralization of verbal phenomena (Orbzut & Boliek, 1988). In learning disabled children both left and right hemispheres become involved in performing verbal tasks. This shared processing is assumed to be a result of a weak structural system that fails to suppress the non dominant hemisphere and thereby allow attentional factors to assume a greater influence over lateralized functioning (Orbzut & Boliek, 1988).

Evidence regarding abnormal lateralization in learning disabled children can also be found when measurement techniques and subtypes are varied. Stelmack and Miles (1990) used laterally placed parietal electrodes during a word recognition task to measure visual event related potentials (ERPs) in reading disabled and normal children. Trials included the presentation of words that were primed (an associated picture was presented before the word) or unprimed (an unassociated picture was presented before the word). During the unprimed recognition task normal reader's ERPs were significantly greater in the left than for the right parietal region. This ERP asymmetry between left and right parietal sites was not found for the reading disabled group. This pattern suggests less left hemisphere specialization and instead more bilateral representation of verbal processing in the reading disabled group as would be expected with a language based or verbal learning disability (Stelmack & Miles, 1990).

In a study by Mattson, Sheer and Fletcher (1992) lateralized disturbances were evaluated in children with learning disabilities who were divided into two groups according to Rourke's academic profile, namely a specific impairment in reading or arithmetic. The former impairment was assumed to indicate verbal learning disabilities and the latter nonverbal learning disabilities. Lateralized processing deficits in this study were not assessed by dichotic listening tests and were instead measured by an electrophysiological technique referred to as the 40 Hz EEG. This technique is based on studies that have found a 36-44 Hz lateralized increase in EEG activity during right and left hemisphere dominant tasks that required learning, attention and problem solving (Mattson, Sheer & Fletcher, 1992). As expected, controls in the present study demonstrated a task dependent shift of 40Hz EEG to the left and right hemisphere when processing verbal and nonverbal tests, respectively. Though effects did not reach significance, proportionally less left hemisphere EEG activity was found during the verbal tasks in children with reading disabilities while proportionately less right hemisphere activity was noted in children with arithmetic learning disorders.

Thus, whether by attentional dysfunction or fixed structural deficit, abnormal lateralization has been noted in children with language based learning disabilities. The clinical manifestations of NLD syndrome, specifically their inability to process prosodic material may also arise from similar models of abnormal lateralization

Lateralization and Emotional Intonation

If anomalies in lateralization occur in children with NLD they could be expected to involve a variety of areas that are significantly compromised in the syndrome. Although these children are quite verbose, the pragmatics of their communication (understood as the functional and contextual use of language) are significantly impaired (Rourke & Tsatsanis, 1996). As mentioned previously, a primary deficit in NLD is the inability to adapt to novel situations, hence these children are unable to pick up on the contextual cues in the environment that would foster adaptation. In social situations Ozols and Rourke (1985) found that these children failed to attend to and correctly interpret nonverbal cues such as facial expressions, gestures and emotional prosody. That is, when asked to recall aspects of a story acted out by puppets, children with a NLD profile failed to recognize the nonverbal nuances of the narrative as compared to children with language based learning disabilities and controls (Loveland, 1990). In children with nonverbal learning disabilities, anomalies in lateralization may contribute to difficulties in the pragmatic aspects of language and more specifically the perception of emotional cues.

Two hypotheses have dominated the research in the lateralization of emotional perception. The first is the right hemisphere hypothesis which asserts that the right hemisphere is superior in the perception of emotion. The second is the valence hypothesis which postulates that the right hemisphere specializes in the perception of negation emotion and the left hemisphere specializes in positive emotion (Borod, 1992). Studies that involve the auditory presentation of prosodic material as opposed to the visual presentation of facial expressions or emotional words have not found the division of processing based on valence and instead support the right hemisphere hypothesis (Mandal, Asthana & Pandey, 1996).

Studies with subjects without brain damage have often found a left ear advantage (LEA) when identifying and discriminating emotional intonation in dichotic listening tasks indicating that the right hemisphere is more adept for this type of processing. These studies have employed non speech sounds like shrieking, laughing and crying (Mahoney & Sainsbury, 1987), emotionally laden musical passages (Borod, 1992), neutral sentences stated with emotional intonation (Herrero & Hillix, 1990), emotional words (Bryden & MacRae, 1989) and emotionally intoned consonants (Erhan, Borod, Tenke & Bruder 1998).

Results from unilateral brain damaged populations do not present as clear a picture. Early studies found, as the right hemisphere hypothesis would predict, that right brain damaged subjects (RBDs) were more impaired in identifying and discriminating emotional prosody than left brain damaged subjects (LBDs) (Tucker, Watson & Heilman, 1977). Recent emotional discrimination tasks with these same populations demonstrate a similar pattern but identification tasks have not yielded significant interhemispheric differences (Tompkins & Flowers, 1985). One explanation that these authors put forth to explain this anomalous finding with respect to the right hemisphere hypothesis is that identification of emotion is cognitively a higher order task that is more effectively carried out by left hemisphere functions (Borod, 1992).

Despite the lack of uniformity in the findings from brain damaged patients, prosody appears in the general population to be processed by the right hemisphere. Even though children with NLD are suspected to have right hemisphere pathology and have difficulties with the comprehension of prosody no studies to date have examined laterality effects for emotionally laden material in this population.

The Present Study

When summarizing the research outlined above an unexamined area emerges. Although theoretical interpretations have been mixed, anomalies in lateralization have been found in children with learning disabilities. These studies, however, have never separated out children with nonverbal learning disabilities who have distinct neuropsychological and academic profiles as well as impairments in social perception. Since lateralization patterns have been found for the perception of basic emotion (necessary for successful social interactions), it follows that an issue to be explored is whether anomalies in lateralization, particularly the perception of emotional intonation are associated with social deficits in children with nonverbal learning disabilities.

Therefore, one purpose of the present research was to determine if anomalies in lateralization exist for children with nonverbal learning disabilities, when identifying emotional intonation, as compared to children with verbal learning disabilities and age matched controls. Dichotic emotion recognition, musical passage and word tests were administered to 8-14 year old children with nonverbal learning disabilities, verbal learning disabilities as well as a control group. An additional goal was to examine whether the NLD behavioral profile (i.e., low social skills and high internalizing symptomology) described in the research was present and related to lateralization scores.

It was expected that NLD children would not exhibit right hemisphere dominance (LEA) when processing emotional and musical material. These findings would support one or two camps of thought, the structural or attentional bias hypotheses. The structural hypothesis states that anomalies in lateralization come about as the result of structural deficits when damage is localized to a specific hemisphere and functions must be carried out by the remaining hemisphere. If, as purported by Rourke, white matter is affected in NLD children, the higher right hemisphere concentration of white matter would result in right hemisphere functions by default being carried out by the grey matter and subsequently the left hemisphere. Therefore, NLD children would demonstrate lateralization of function that is opposite to what is expected in the general population for emotionally laden material. Evidence for such a switch in dominance is found in a lateralization study testing children with congenital brain damage. Children with left hemisphere damage had an pathological LEA for auditory material whereas children with right hemisphere damage had a pathological right visual field advantage for chimeric faces (Korkman & Lennart, 1995). Based on this premise children with NLD would demonstrate an anomalous right ear advantage for emotional laden and musical stimuli in contrast to children with language based learning disabilities and controls who would demonstrate a left ear advantage.

The second hypothesis takes into account the attentional shifts seen in children with language based learning disabilities (Orbzut & Boliek, 1988). Structural weakness together with the failure to adequately suppress the non dominant hemisphere in processing would result in bilateral lateralization of hemisphere specific stimuli. Based on this premise the following results would be expected. When reporting dichotic words children with verbal learning disabilities will demonstrate a reduced REA for verbal material as compared to NLD or control children because of the failure to inhibit the right hemisphere and the subsequent involvement of both hemispheres in verbal processing. Conversely, children with nonverbal learning disabilities will be unable to inhibit the left hemisphere and experience a reduced left ear effect for nonverbal material as compared to controls and language based LD children because of the subsequent involvement of both hemispheres in nonverbal processing.

Taking into consideration the two hypotheses outlined above the following predictions are put forth for the present study.

1) Children with nonverbal learning disabilities would demonstrate a reduced left ear effect for emotionally laden phrases and musical passages while demonstrating a REA for verbal content.

2) Children with verbal learning disabilities would demonstrate a reduced right ear effect for verbal content while demonstrating a LEA for emotionally laden phrases and musical passages.

3) Children with nonverbal learning disabilities would have a higher rate of social problems and overall internalizing scores as compared to children with verbal learning disabilities and controls.

Method

Participants

This research study was conducted over a six month period and involved children with verbal learning disabilities (n=14; M=11.2 years, SD=17.78), with nonverbal based learning disabilities (n=10, M=10.8 years, SD=21.89) and control children with neither verbal or nonverbal based learning disabilities (n=9, M=10.8, SD=23.24). All children recruited were between the ages of 8 - 14. This age range was selected because Rourke & Fisk (1989) found that learning disability subtypes, evidenced by discrepancies in VIQ & PIQ, were significantly differentiated by these ages.

Learning disabled children were gathered from the Thunder Bay public school and separate school system as well as a private clinic by examining percentiles and IQ ranges stated in their learning assessment located in their Ontario School Record or private clinic files. LD children had a full scale IQ on the Wechsler Intelligence Scale for Children (WISC-III) or the Stanford Binet that was no less than 10^{th} percentile and fell in or above the Low Average Range and were free of a primary mental disturbance, recorded organic deficits in visual or auditory acuity or unusual childhood illnesses. They also had to have attended school regularly since the age of five and a half or six and speak English as their native language. This is fairly standard for defining children with learning disabilities (Rourke & Fisk, 1988).

Children were designated as having a nonverbal learning disability if they were reported in the learning assessment to have a significant discrepancy between verbal (VIQ) and performance IQ (PIQ) measured by the Wechsler Intelligence Tests or Verbal Reasoning (VRF) and Nonverbal Reasoning/Visualization Factor Scores (NVF) measured by the Stanford Binet in favor of the Verbal Scale or Verbal Reasoning Factor. For the purposes of sample description the percentiles provided for the verbal and performance scales in the learning assessment were converted into IQ scores and compared. For children with nonverbal learning disabilities the split between verbal and performance standard IQ scores ranged from 10 to 32 points (m=21.30, SD=11.24) so that across NLD children the difference between IQ scores was 10 points or greater. Paired sample t-tests were also completed and significant differences were found between the NLD groups verbal and performance IQ scores in the favor of the verbal scale (Verbal m=103.10 Verbal sd=11.58, Performance m=82.30 sd=4.76, $p<.05$)

In addition to the discrepancy noted above children included in the NLD group had lower percentile scores in one of the following areas: mechanical arithmetic, mathematical applications or reading comprehension, relative to the other scores in their academic profile. Academic scores were measured by one of the following achievement tests: Wide Range Achievement Test (WRAT-3), Weschler Individual Test (WIAT), Peabody Individual Achievement Test- Revised (PIAT-R) or the Kaufmann Test of Education Achievement (K-TEA). In two cases inclusion into the NLD group was based on an elevated Information score measured by the PIAT-R together with a low score in reading comprehension. These aforementioned academic criteria were liberal compared to those described by Rourke & Tsatansis (1996).

Similarly, children were designated as having a verbal learning disability (VLD) if they were reported to have a PIQ or NVF score that was significantly higher than their VIQ or VRF. For children with verbal learning disabilities the split between performance and verbal scores ranged from 11 to 37 points (*m*=19.69, SD=8.44) so that across VLD children the difference between IQ scores was greater than 10 points. Paired sample t-tests were also completed and significant differences were found between the VLD groups performance and verbal IQ scores in the favor of the performance scale (Performance m=103.92 sd=10.18, Verbal *m*=84.46 Verbal sd=5.53, p<.05). This discrepancy existed in combination with a lower percentile score in single word reading or spelling relative to other academic areas measured by one of the achievement tests mentioned above. In total 30 LD children were recruited and 6 were eliminated because they did not meet the criteria specified above.

Control children were recruited from the community by means of newspaper advertisements, posters and requests at local organizations. These children were screened for inclusion in the study using a short form of the Wechsler Intelligence Scale for Children (WISC-III) (Wechsler, 1991) . Deviation IQs, as described in Sattler (1992) were calculated, and each child had a VIQ and PIQ split of 10 points or less with the exception of one participant that had a split of fourteen points and was included because of the limited size of the control group. In total 13 control children were recruited, however, four were eliminated because their performance and verbal deviation IQs were more than fifteen points apart. All children in the control group had a full scale IQ that was at or above the Low Average Range and no less than the 10^{th} percentile. When IQ scores were compared across groups a significant difference was found for full scale IQ F(2, 29)=32.960, p<.01. Post hoc comparison of means using Tukey HSD revealed that control children had full scale IQs (m=111.33, sd=4.74, p<.01) that were significantly higher than children with verbal (m=94.08, sd=7.49, p<.01) and nonverbal learning disabilities (m=90.40, sd=4.74, p<.01). No significant differences in full scale IQ were found between NLD and VLD children.

When performance and verbal IQ scores were compared across groups a significant difference was found for performance scores $F(2, 29)=43.059$, $p<.01$ and verbal scores $F(2, 29)=27.115$, $p<.01$. Post hoc comparison of means using Tukey HSD revealed that children with nonverbal learning disabilities (Verbal *m*=103.10 Verbal sd=11.58, $p<.05$) and controls (Verbal *m*=112.33 Verbal sd=4.09, $p<.05$) had significantly higher verbal IQ scores than children with verbal learning disabilities (Verbal *m*=84.46 Verbal sd=5.53, $p<.05$). Children with verbal learning disabilities (Performance m=103.92 sd=10.18, $p<.05$) and controls (Performance m=108.00 sd=6.12, $p<.05$) had significantly higher performance scores than children with nonverbal learning disabilities (Performance m=82.30 sd=4.76, $p<.05$). Out of all children tested only one VLD child was found to be left handed all other children were reported to be right handed. Table 1 lists the age, gender, intelligence and test scores by group.

Apparatus

Intelligence: A short form of the Wechsler Intelligence Scale for Children (WISC-III) (Wechsler, 1991) consisting of two verbal subtests (Vocabulary and Similarities) and two performance subtests (Block Design and Object Assembly) was used to screen controls in order to ensure their VIQ and PIQ fell within fifteen points of each other.

The WISC-III is a clinical instrument that assesses intellectual functioning in children six to sixteen years of age. For the purposes of the present study and in the interest of time only four out of the thirteen subtests were administered to controls. Subtests chosen had the highest intercorrelation with performance and verbal IQ scores for children age 8-14. The Vocabulary subtest had intercorrelations with VIQ scores between .86 and .88 while the Similarities subtests demonstrated correlations between .82 and .87 (Wechsler, 1991). For the performance subtests, Block Design and Object Assembly had the highest intercorrelation with PIQ. Block Design demonstrated a correlation of between .76 and .83 while Object Assembly had a correlation between .74 and .81 (Wechsler, 1991).

Table 1

Age, Gender, Intelligence and Achievement Test Scores by Group

	Control		Nonverbal Learning Disabilities		Verbal Learning Disabilities	
	m	*sd*	*m*	*sd*	*m*	*sd*
n	9		10		14	
Gender						
Male	5		8		12	
Female	4		2		2	
Age (in months)	137.00	23.56	129.89	21.89	134.29	17.78
Full Scale (IQS)	111.33	4.74	90.40	4.79	94.08	7.41
Verbal Scale(IQS)	108.3	6.12	103.10	10.18	84.46	5.53
Performance (IQS)	112.33	4.09	82.30	4.76	103.92	10.18
Reading(%ile)			19.80	15.06	10.85	11.60
Reading Comp.(%ile)			12.14	11.44	15.20	18.58
Spelling(%ile)			19.60	16.47	8.00	7.84
Arithmetic (%ile)			20.00	14.00	22.62	19.90
Math Appl. (%ile)			11.50	3.70	38.17	21.89
Information (%ile)			73.75	34.42	19.25	5.68

*Only Achievement Scores Used to Categorize Participants are Listed
(IQS) Intelligent Quotients
(%ile) Percentiles

The WISC-III has been found to have correlations between .65 and .96 on concurrent measures such as WPPSI, WAIS and the Stanford Binet (Wechsler, 1991). Predictive validity have also been attained with similar tests with correlations ranging from .84 and .85 (Wechsler, 1991).

In terms of reliability, both the split half and the test-retest reliabilities of the WISC-III subtests have been calculated. The split half reliability of the subtests being that were used are as follows: Similarities .81, Vocabulary .87, Block Design .87 and Object Assembly .69 (Wechsler, 1991). Test-retest reliability were also calculated at a mean interval of 23 days. The stability coefficients for all ages by subtest are: Similarities .81, Vocabulary .89, Block Design .77 and Object Assembly .66 (Wechsler, 1991).

Internalizing and Externalizing Scores: The parent version of the Child Behavior Checklist (CBCL) (Achenbach & Edelbrock, 1991) was used to obtain ratings of the child's behavior specifically overall internalizing and externalizing scores. These scores were then used to determine whether or not an unique emotional/behavior profile was found across learning disabilities subtypes and controls.

The CBCL parent report form is a checklist designed to obtain parent's perception of both their childrens' problematic behavior and competences in a standardized manner (Achenbach & Edelbrock, 1991). The report form consists of two parts (Appendix A). The first part involves seven items which ask parent to: list their children's activities and then rank them according to time spent and ability using a four point scale (don't know, less than average, average, more than average), indicate how many friends their child has (none, 1, 2 or 3, 4 or more), how often they play with them (less than 1, 1 or 2, 3 or more), describe how well they get along with others (worse, about average, better), and finally list their child's academic subjects and rank them using a four point scale (failing, below average, average, above average). These items are summed and provide a score in the following areas: activity, social, academic and a total competence score. The summed items are than translated into a T-score so that the child may be compared to a normative group for his/her sex and age.

The second part consists of 113 problems items in which the parent is asked to rate the child from zero to two in terms of the frequency that he or she demonstrates specific behaviors. The rating scale is as follows: 0 if the item is not true, 1 if the item is somewhat true and 2 if the item is very true or often true. These scores summate into eight behavior scales namely withdrawn, somatic compliants, anxious/depressed, social problems, thought problems, attention problems, delinquent behavior and aggressive behavior, in addition to an internalizing (withdrawn, somatic compliants and anxious/depressed behavior), externalizing (delinquent and aggressive behavior) and total score. These scale and total scores are than translated into a T-score. A T-score over 70 places the child's score above the 98th percentile and in the clinical range.

Test-Retest Reliability has been shown to be high but is affected as the time intervals between the testing increases. Test-retest correlations of .87 for the competence scales and .89 for the problem scales at one week have been found and .62 and .75 for a year. Interparent agreement was found to be high ranging from .74 to .76 for competence scales and from .65 to .75 for problem scales (Achenbach & Edelbrock, 1991).

In terms of validity, the items on the CBCL have been significantly associated with relevant DSM diagnostic categories, have a correlation of between .59 and .88 on corresponding scales of the Connors' Parent Questionnaire and The Quay Peterson Revised Behavior Checklist as well as being able to distinguish between referred and non referred children at the $p<0.01$ level (Achenbach & Edelbrock, 1991).

<u>Social Problems</u>: Social problems were assessed by the Social Skills Rating System elementary (kindergarten to grade three) and secondary school form (grade three to six) (Appendix B) (Gresham & Elliott, 1990). This rating system was completed by the teacher and measured

prosocial skills, problem behaviors and academic competence. The social skills scale consists of three subscales measuring cooperation, assertion and self-control which are rated by the teacher according to frequency and importance. Items measuring problem behaviors fall into one of three subdomains: externalizing problems, internalizing problems and hyperactivity, while academic competence is assessed using a single scale that includes items measuring reading, mathematics performance, motivation, parental support and general cognitive functioning. Subscale and scale scores from each of these three domains are tabulated and then converted to functional categories of behavior referred to as behavior levels, standard scores and percentile ranks.

Internal consistency has been found to be high with coefficient alphas ranging from .86 to .92 for social skills scales, .78 to .88 for problem behavior scales and .95 for the academic competence scale (Gresham & Elliott, 1990). Teacher ratings also indicated stability over time with test-retest correlations of .85 for social skills, .84 for problem behaviors and .93 for academic competence (Gresham & Elliott, 1990).

When looking at validity, moderate total scale correlations have been found with social skills, -.68, problem behavior, .55, and academic competence, -.67, when compared to the Social Behavior Assessment measure (Gresham & Elliott, 1990). In addition, moderate to high correlations were found with the Child Behavior Checklist for externalizing, .75, internalizing .55, and total problem behavior scores, .81, and the Harter Teacher Rating Scale for social skills ,.70, problem behaviors, -.50, and academic competence, . 63, (Gresham & Elliott, 1990). Evidence was also found for divergent and convergent validity when scores were compared across the three forms: teacher, student and parent. Intercorrelations for different subscales measured by different informants were found to be relatively low with student-teacher correlations ranging from -.06 to .34 and teacher-parent correlations ranging from .04 to .28 (Gresham & Elliott, 1990). When collapsed across age levels (preschool, elementary and secondary) convergent validity coefficients were found to be significantly associated ($p<0.001$).

Dichotic Emotion Recognition Test: A dichotic listening test containing 48 emotionally laden (happy, sad, angry or fearful) nonsense phrases such as "dan hit ruffa gorp" spoken by a female voice were presented through stereo headphones. Inclusion of each emotionally laden stimulus phrase was decided by four independent raters who monaurally listened and assessed whether the phrases conveyed the intended emotional tone. The inter-rater reliability achieved was .86 (Mountain, 1993). All variations of emotionally laden stimulus phrases were dichotically paired with cocktail party noise and presented an equal number of times to each ear. Participants were asked to identify emotional intonation, while ignoring the nonsense content of each phrase, by pointing to one four pictures: two female faces and two male faces each with a distinct emotional expression (happy, sad, angry and fearful) (Ekman & Friesen, 1975)(Appendix C). When half of the phrases were completed the participant was asked to reverse the headphones. Each response was recorded and total number of correct left and right ear responses were tallied on a score sheet (Appendix D). The maximum number of correct responses, by ear, was 24 and chance performance was 0.25.

Dichotic Word Listening Test: A dichotic listening test containing six one-syllable words was divided into two strings of three words and presented simultaneously to each ear. Each set of three words had been synchronized for stimulus onset and both right and left ear stimuli begin with the same consonant to control voice onset. In addition, volume was equated across ears. Test- retest reliability is reported to be between .75 and .92 (Spreen & Strauss, 1991). In terms of validity, moderate levels of agreement have been found with speech localization determined by sodium amytal testing, as Strauss (1988) found that participants with speech localized in the left hemisphere demonstrated lateralization scores of 20.93 for the right ear and 12.95 for the left ear while individuals with right hemisphere speech obtained lateralization scores of 15.20 for the right ear and 21.48 for the left ear.

The test was divided into two sections the first of which is a practice trial that was repeated if the participant did not initially understand the instructions. During both sections the participant was asked to listen and repeat all the words that they heard and between the two trials the participant was asked to reverse the headphones. The researcher recorded all the reported words on the record sheet and then total correct left and right ear responses to determine ear advantage for verbal stimuli (Spreen & Strauss, 1991) (Appendix E). The maximum number of correct responses, by ear, was 60.

Dichotic Music Listening Test: A dichotic listening test containing musical excerpts that are two seconds in length and have synchronized onset and offset were presented to each ear simultaneously. Following the musical pair a repetition foil was presented and the participant was asked to identify whether this melody was the same as or different from those heard previously. Half way through the test the participant was asked to reverse the headphones. The examiner recorded same or different as a response to each trial summating the score correct for the right and left ear in order to determine ear advantage for musical stimuli (Spreen & Strauss, 1991) (Appendix F). The maximum number of correct responses, by ear, was 12 and chance performance was 0.50.

Handedness: Handedness was used as a indirect measure of speech lateralization (Bryden, 1988) as research has found a relationship between cerebral speech lateralization and handedness. That is, some studies employing the verbal dichotic listening task reveal a difference between left and right handers and although the strength of the effect sizes may vary, left handers tend to show a reduced laterality effect (Bryden, 1988). Handedness was assessed using a supplemental subtest of the NEPSY questionnaire (Appendix G). This subtest involved five activities that require the identification of the preferred hand (Korkman, Kirk & Kemp, 1998). Total left and right hand usages were recorded and the hand that was used most often was assumed to be the preferred hand.

Procedure

Learning Disabled children were recruited through the schools by having the special needs facilitator distribute a recruitment letter to the parent of every child on their caseload between the ages of 8-14 diagnosed with a learning disability (Appendix H). If the parents were interested they contacted the researcher by phone. At this time the researcher set up a testing appointment at the school and a package was mailed out containing a consent to participate in the study, an authorization to obtain learning assessment information from the OSR, an authorization to collect a social skills questionnaire from the child's teacher and a CBCL checklist for the to parent fill out (Appendix I). Parents were asked to send the completed packages to the school with the child on the day of testing. Learning disabled children from a private clinic were contacted by the clinic psychologist, testing took place at his office and all forms were completed by a parent at that time. Parents of control children responded by phone to postings in the community and a date was booked to complete the forms and test the children on the Lakehead University campus.

Included in the consent for participation is a space where parents were given the option after testing was completed to receive a brief report on their child's performance (Appendix J) and, if desired, a general summary of results once the study was finished.

Testing was done individually in a quiet room and consisted of the children responding to three dichotic listening tapes played on a Technics RS-TR232 stereo and run through a Panasonic RP-HT70 Stereo Earphones. They also completed a drawing and handedness test. Lateralization tests were rotated for each participant to ensure that order of presentation did not favor a specific test and influence the children's responses. Control children were also administered an intelligence screener which consisted of four WISC subtests. Testing lasted 45 minutes for learning disabled children and an hour to an hour and a half for controls.

For all dichotic listening tests right and left ear responses were tallied and a lateralization quotient was calculated. A laterality quotient was used to index the degree of ear advantage via the following formula

$$LQ = 100 \times \frac{(\text{Right Ear} - \text{Left Ear})}{(\text{Right Ear} + \text{Left Ear})}$$

This same equation was used for both verbal (i.e. words) and nonverbal (i.e. music and emotion) stimuli conditions. Therefore, the LQ for expected REA advantage for verbal material summated to a positive number while the expected LEA advantage for non verbal material (musical and emotional) summated to a negative number. For the purposes of intepretation the LQ's for non verbal material were reported as positive if a LEA was found.

Results

The questions and analyses posed in the study were organized into two sections. The first focussed on differences among the measures of lateralization across the three groups and examined lateralization quotients for verbal, emotional and musical material. A one way ANOVA was used to determine whether there were significant differences in lateralization quotients among children with verbal learning disabilities, nonverbal learning disabilities and the control group. T-tests were also used to compare groups. T-tests of male and female lateralization scores across and by groups were completed to determine if lateralization quotients differed based on gender. T-tests of left and right handed lateralization scores across and by groups were also completed to determine if lateralization quotients differed based on handedness.

Differences in lateralization measures were also examined by looking at whether each group demonstrated an ear advantage, namely a significant difference between their mean left ear and right ear response on verbal, emotional and musical material. T-tests for paired samples were run for the verbal learning disabilities, nonverbal learning disabilities and control groups to determine the direction of their ear advantage and whether it was significant for each category of material tested.

The second set of analyses were completed to determine whether differences existed in internalizing, externalizing and social skills measures as a result of group membership. In addition, behavioral measures, specifically social skills, were related to attributes of each group (i.e., academic competence and age) as well as lateralization quotients. Differences in behavioral measures across groups were assessed by a one way ANOVA. T-tests were also used to examine differences on behavioral measures between NLD and control groups. Frequencies were then calculated by group in order to estimate the occurrence of the three behaviors that made up the total social skills score: assertiveness, self control and cooperation. Bivariate Pearson correlations were also run to assess the relationships between age, academic competence and behavioral measures. An alpha level of .05 was used for all statistical tests.

Analysis 1: Differences in Lateralization Measures Across Groups

A one way analysis of variance (ANOVA) was conducted to examine differences in lateralization quotients across groups The means and standard deviations of laterality quotients for diagnostic groups and dichotic listening tests as well as the results of the one way ANOVA are reported in Table 2. A significant difference, $F(2, 30)=5.024$, $p<.05$ in the lateralization quotients for musical material was found across groups. Post hoc comparison of means using Tukey HSD revealed that children with nonverbal learning disabilities had higher lateralization scores than children with verbal learning disabilities (NLD m=0.26 sd= 0.32; VLD m=-0.07 sd= .18) $P<.05$. No significant group differences were found for the emotional or verbal lateralization quotients.

Since significant differences were not found across groups on the Emotional Dichotic

Table 2

Means and Standard Deviations of Lateralization Quotients for Nonverbal Learning Disabilities (NLD), Verbal Learning Disabilities (VLD) and Control Children on Dichotic Listening Tests

	NLD		VLD		Control	
	M	SD	M	SD	M	SD
Verbal Dichotic Listening Test	.43	.32	.16	.43	.42	.26
Musical Dichotic Listening Test	.26*	.32	-.07	.18	.04	.27
Emotional Dichotic Listening Test	.04	.09	.04	.11	-.05	.16

*Significant, p<.05 from VLD group

Listening Test, the mean number of errors was calculated for each emotional category (Happy *m*=.10 sd=.09; Sad *m*=.23 sd=.10; Fear *m*=.36 sd=.11; Angry *m*=.29 sd=.09). Fearful and Angry items were removed because of the higher error rate and the modified lateralization quotients for emotional material were compared across diagnostic groups. No significant means differences were found.

An independent samples t-test was run to examine differences between boys and girls on lateralization measures (musical, verbal, emotional) both across and by group (NLD, VLD, Control). No significant effect was found for gender across or between groups. A independent t-test was also completed to examine differences between left and right handed participants on lateralization measures both across and by group. Due to the fact that only one child in the sample was left handed no analyses could be completed because of the size of the left handed group and therefore no significant differences were found.

To further examine the nonsignificant difference on musical material and determine whether it was related to the ability to discern a melody, the total number of correct responses (both left ear and right ear responses) were calculated and compared using a one way ANOVA across groups with no significant differences found. When a Bivariate Pearson correlation was run, however, there was a significant positive correlation between the musical lateralization quotient and correct responses ($r=.354$, $P<.043$). This relationship was not seen when Bivariate Pearson correlations were run by group. Table 3 presents these correlations overall and by group.

To determine, by group, if right and left ear differences were present for verbal, emotional and musical material, paired sample t-tests were completed for verbal right ear scores and verbal left ear scores, emotional right ear scores and emotional left ear scores and musical right ear

Table 3
Correlation of Correct Responses on the Musical Differentiation Task and Music Lateralization Scores

Correct Responses	Music Lateralization Scores
Total Correct Responses	.354*
Nonverbal Learning Disabilities Correct Responses	.100
Verbal Learning Disabilities Correct Responses	.331
Control Correct Responses	.604

*Significant, $p<.05$

Table 4
Paired Sample T-Tests by Group for Correct Right Ear and Left Ear Verbal, Emotional and Musical Dichotic Listening Responses

Correct Responses	M	SD	t	df	p
Verbal Learning Disabilities					
1. Verbal Right	26.00	9.41			
Verbal Left	19.43	11.11	1.24	13	.236
2. Musical Right	6.21	2.01			
Musical Left	5.21	1.37	1.87	13	.084
3. Emotion Right	13.28	4.46			
Emotion Left	13.85	4.54	-.711	13	.489
4. Modified Emotion Right	7.70	2.64			
Modified Emotion Left	9.57	1.34	-3.55	13	.004*
Nonverbal Learning Disabilities					
1. Verbal Right	33.30	11.09			
Verbal Left	12.60	6.17	4.15	9	.003*
2. Musical Right	3.80	3.08			
Musical Left	4.70	2.79	-1.014	9	.337
3. Emotion Right	14.10	3.96			
Emotion Left	15.70	5.06	-1.672	9	.129
4. Modified Emotion Right	7.7	3.23			
Modified Emotion Left	8.8	3.39	-2.283	9	.048*
Control					
1. Verbal Right	39.88	8.34			
Verbal Left	16.33	8.74	5.193	8	.001*
2. Musical Right	5.22	2.39			
Musical Left	5.00	1.58	.187	8	.856
3. Emotion Right	13.88	5.04			
Emotion Left	13.11	6.53	.507	8	.626
4. Modified Emotion Right	9.00	1.22			
Modified Emotion Left	8.77	2.27	.373	8	.719

*Demonstrated a statistically significant Right Ear Advantage for Verbal Material and Left Ear Advantage for Modified Emotional Material
Maximum number of correct responses, by ear, for Verbal material was 60
Maximum number of correct responses, by ear, for Musical material was 7 and chance performance was 0.50
Maximum number of correct responses, by ear, for Emotional material was 24 and chance performance was 0.25

scores and musical left ear scores. A significant difference was found between verbal right ear scores and verbal left ear scores for children with nonverbal learning disabilities (Right *m*=33.3 Right sd=11.1, Left *m*=12.6, Left sd= 6.2, p<.05) and control children (Right *m*=39.9 Right sd=8.3, Left *m*=16.3 Left sd= 8.7 p<.05), indicating that both groups have right ear advantages. The verbal right ear scores and verbal left ear scores of VLD children were not found to differ significantly (Right *m*=26.00 Right sd=9.41, Left *m*=19.43 sd=11.11). No significant differences were found for left ear and right ear presentation of emotional or musical material in any group.

However, when a paired sample t-test was completed for the modified emotion right ear scores and modified emotion left ear scores a significant difference was found for children with verbal learning disabilities (Right *m*=7.7 Right sd=2.6, Left *m*=9.6, Left sd= 1.3, p<.05) and those with nonverbal learning disabilities ((Right *m*=7.7 Right sd=3.2, Left *m*=8.8, Left sd=3.4, p<.05) but not the control group (Right *m*=9.0 Right sd=1.22, Left *m*=8.77 sd=2.27), indicating that VLD and NLD children had a significant left ear advantage for the modified emotional material consisting of the presentation of happy and sad material. Table 4 presents a summary of these data respectively.

<u>Analysis 2: Differences and Relationships of Behavioral Measures Across Groups</u>

A one way analysis of variance (ANOVA) was also conducted to examine differences in behavior between groups. The means scores and standard deviation of social, externalizing and internalizing behavior as well as the results of the one way ANOVA are reported in Table 5. A difference approaching statistical significance, F (2,22)=3.19, p=.06, for social behavior was found across groups. Post hoc comparison of means using LSD revealed that children with nonverbal learning disabilities had a lower level of social skills than control children (NLD *m*=87.00 sd= 21.28; Control *m*=109.33 sd= 9.20) P<.05. No significant group differences were found for internalizing and externalizing behavior problems.

Table 5

Means and Standard Deviations for Nonverbal Learning Disabilities (NLD), Verbal Learning Disabilities (VLD) and Control Children on Behavioral Measures

	NLD		VLD		Control	
	M	**SD**	**M**	**SD**	**M**	**SD**
Internalizing Problems [a]	53.89	8.34	49.62	12.60	47.78	8.81
Externalizing Problems [a]	46.44	3.54	48.08	8.35	42.11	3.89
Social Skills [b]	87.00*	21.28	101.17	15.76	109.33	9.20

[a] Internalizing and Externalizing Scales from the Child Behavior Checklist Parent Version
[b] Social Skills Rating System Overall socialization score
* Approaching Statistical Significance, p=.06 from the control group

Since a difference approaching clinical significance was found between NLD and control groups on the social skills measure using a ANOVA, a t-test was also run. A significant difference was found between NLD and control children with regards to social functioning as NLD children (m=87.00, sd=21.28) demonstrated significantly lower social skills scores than the control group (m=109.20, sd=9.20). See Table 6 for the summary of the data.

To further examine the nature of the social skills differences across groups frequencies of the behaviors making up the social skills scale namely assertiveness, prosocial and cooperative, were run by group. For all behaviors measured, control children were found to most frequently fall in the "exhibits as many social skills as the average" or "exhibits more social skills than average". Children with nonverbal learning disabilities were found to most frequently fall in the "exhibits as many social skills as the average" or " exhibits fewer social skills than the average" with cooperative behavior most often falling in the latter category relative to the rest of the behaviors evaluated. Children with verbal learning disabilities were found to most frequently fall in the "exhibits as many social skills as the average" with assertiveness being the behavior to least frequently fall into the "exhibits more than average". The frequencies for all three behavior by group are presented in Table 7.

To address whether behavioral measures were related to participant attributes such as age and academic competence (measured by Teacher Ratings on the Social Skills Rating System) Pearson Bivariate correlations were run. Age was found to be negatively correlated with internalizing behavior ($r=-.396$, $P< .021$). When this relationship was examined, by group, a significant negative correlation was only found for children with verbal learning disabilities ($r=-.656$, $P<.015$). The correlations between age and internalizing behavior are presented in Table 8. A relationship was also found between teacher ratings of academic competence and social

Table 6

Independent Sample T-Test Comparing the Social Functioning of NonVerbal Learning Disabilities (NLD) and Control Children

Social Functioning	M	SD	t	df	p
NLD Children	87.00	21.28			
Control	109.20	9.20	-2.376	11	.037

Table 7

Frequencies of Social Behavior

	Social Behavior					
	Assertiveness		Self Control		Cooperative	
	n	%	n	%	n	%
1. Verbal Learning Disabilities						
More Than Average	0	0	1	8.3	2	16.7
Average	10	83.3	10	83.3	8	66.7
Fewer Than Average	2	16.7	1	8.3	2	16.7
2. Nonverbal Learning Disabilities						
More Than Average	0	0	0	0	0	0
Average	4	57.1	5	71.4	3	42.9
Fewer Than Average	3	42.9	2	28.6	4	57.1
3. Control						
More Than Average	2	33.3	2	33.3	2	33.3
Average	4	66.7	4	66.7	4	66.7
Fewer Than Average	0	0	0	0	0	0

Table 8

Correlation of Internalizing Behaviors and Age in Months

Internalizing Behaviors	**Age In Months**
Total Internalizing Behavior	-.395*
Nonverbal Learning Disabilities Internalizing Behavior	-.504
Verbal Learning Disabilities Internalizing Behavior	-.656*
Control Internalizing Behavior	.147

*Significant, $p<.05$

functioning. Social Skills were found to be positively correlated with teacher ratings of academic competence ($r=.730$, $P< .001$). When the relationship between academic competence and social skills was further examined, by group, positive correlations were evident in all groups with the strongest relationship found in the control group ($r=.964$, $P<.002$) The correlations between academic competence and social behavior are presented in Table 9.

Table 9

Correlation of Social Skills and Academic Competence

Social Skills	**Academic Competence**
Total Social Skills	.671**
Nonverbal Learning Disabilities Social Skills	.836*
Verbal Learning Disabilities Social Skills	.594
Control Social Skills	.964**

*Significantly different, p<.05
**Significantly different, p<.001

Discussion

The first objective of this study was to ascertain whether children with learning disabilities when separated into verbal and nonverbal subtypes demonstrate differences in lateralization for emotional, musical and verbal material. These two LD groups and a control group were also examined to see if differences were found in social skills as well as in externalizing and internalizing behavior. The findings and possible explanations in relation to these two objectives are now reviewed and put into the context of previous literature. The limitations of the present study are also discussed.

Previous research has found a left ear advantage for emotionally laden non speech sounds (ie. crying, laughing, shrieking), emotionally laden neutral phrases and emotional words presented dichotically (Mahaney & Sanisbury, 1987;Borod, 1992;Herrero & Hillix, 1990). Further, damage to the right hemisphere tends to affect both the processing and identification of emotions (Tucker, Watson & Heilman, 1977). It was predicted that NLD children, who are suspected to have right hemisphere pathology as described by the White Matter Model and difficulties with the comprehension of prosody, would also demonstrate a reduced left ear effect for emotional material and would differ significantly in terms of lateralization scores from children with VLD children and controls. The results indicated no such relationship. In terms of the lateralization for emotional laden material no significant differences were found between NLD, VLD and control children, nor did any of the groups demonstrate the expected left ear advantage for emotional material. However, when errors were analysed all children were most likely to mistake Angry or Fearful for another emotion. When these emotions were removed and only happy and sad were analysed no difference was found between groups but the expected left ear advantage was found in children with verbal and nonverbal learning disabilities. Controls, however, did not demonstrate this ear advantage.

Similar to emotions, music stimuli (specifically melody) has been found to be processed in the right hemisphere demonstrated by a significant left ear effect for music. Again because of the loss of right hemisphere integrity described in the White Matter Model it was assumed that NLD children would differ from VLD and control children and demonstrate a reduced ear advantage for music. Contrary to predictions NLD children had significantly higher lateralization quotients which suggest greater right hemisphere involvement in the processing of music as compared to VLD children.

Cerebral lateralization of verbal material to the left hemisphere is a well researched phenomenon. Findings across the general population suggest a robust right ear advantage for dichotically presented verbal material. When looking at lateralization in the learning disabled population, particularly reading disabilities, a major thrust in research has been to investigate whether anomalies exist in the processing of verbal material. Past studies with learning disabled children have been mixed, depending on the lateralization measure used, some have found less laterality effects while others found no pronounced differences (Kershner & Stringer, 1991) (Stelmack & Miles, 1990). To date, only one study has separated out subtypes and studied lateralization of verbal material. Mattson, Sheer and Fletcher (1992) using a electrophysiological technique found a nonsignificant trend toward less left hemisphere activity on a verbal task in the reading disabled versus arithmetically disabled group. In the present study, though no significant differences in lateralization quotients existed across groups for verbal material, a significant right ear advantage was found in the NLD and control groups but not in the VLD group.

Lack of expected effects on lateralization of nonverbal material may be related in part to the age of the participants in the current study. The majority of studies to date that have explored emotional recognition and found a left ear advantage have used university students or adults. Pollack and Wismer Fries (2001), however, examined laterality and emotional recognition in children and adults and found maturational differences. They compared the performance of children and adults on a fused rhyming dichotic word test using neutral, positive and negative words. The results were analysed according to emotion and ear presentation. The authors hypothesized that activation of anterior hemispheric areas mediated emotional valence (i.e. negative stimuli (right hemisphere) and positive stimuli (left hemisphere) while posterior areas mediated arousal as well as valence. Based on this hypothesis it was predicted that emotion and ear presentation create different computational loads and subsequent ear advantages. Although this activation theory will not be reviewed in the course of this discussion, the relevant findings were that adults were lateralized as predicted but that children's lateralization patterns differed based on computational load and directed attention conditions (Pollack & Wiser Fries, 2001). This study suggests that developmental changes may occur in the processing of emotion and that the age of the participant appears to affect lateralization patterns for emotional material.

This influence of age can also be seen when examining laterality of visual nonverbal tasks that do not involve emotional content. Ballantyne and Pollack (2000) used a facial recognition test that required children 6 to 16 to match a face to one of four presented. They found that by six years of age a left hemispace advantage was present and at 10 years of age it was more prominent but after this age no differences were found in terms of the degree of the advantage (Ballantyne & Trauner, 2000). This finding suggests that there is a developmental course to the lateralization of nonverbal material. Taken together with Pollack & Wismer Fries (2001) study it can be concluded that the lateralization of nonverbal material in children may not be as clear cut as the findings with the adult population and therefore could be subject to developmental factors. The age of participants in the present study may then in part explain why overall ear advantages or differences between groups were not found.

Related to the question of the implications of age on lateralization of emotional intonation are the difficulties children appeared to have with measures of emotional recognition in the present study. Children in this study had higher rates of errors for the angry and scared intonations as opposed to happy or sad. This finding is similar to previous literature which has found that both cross cultural groups and children (with and without ADHD) more accurately identify pictures of happiness and sadness than pictures displaying fear (Biehl, Matsumoto, Ekman & Hearn, 1997; Singh, Ellis, Witon, Singh, Leung, Pang & Donald,1998). This difficulty discerning angry and scared was seen initially when the participants were asked to identify the emotional expression on the four faces that were presented. For the majority of children the researcher had to clarify which was angry and scared or help them with the response. These four faces were then used for the remainder of the test and the children were expected to point to the face that corresponded to the emotion in the voice. Although the recognition of basic emotion is assumed to be developed by this age, studies using adults may avoid such a confound because identification of emotion would be a well-practised skill.

When responses were reanalyzed with angry and scared removed, no differences were found between groups but an left ear advantage was found for NLD and VLD groups. The most questionable aspect of this finding is that a left ear advantage was not seen in the control group and a trend toward an left ear advantage was not apparent as the mean correct response was greater for the right ear than the left ear. These incongruent findings suggest that item removal did not increase the validity of the test for this age group. However, Patel & Robert (2001) did find a left ear advantage for emotional material, though less robust than verbal material in both controls and dyslexics which suggests a left ear advantage for affective material is possible in the learning disabilities population.

Returning to the present study and the use of the Emotional Recognition test to measure lateralization for this age group, children were given instructions prior to the test that the emotionally intoned nonsense syllables were "not real words" and they "don't have to worry about what the voices say". Children generally found this test amusing and the boys in particular would state when syllables resembled words. Sporadic identification of words in a nonverbal test suggests that at points these children could have been exercising linguistic or left hemisphere skills. This may have led to reduced ear advantage and contributed to a lack of differences across groups. The influence of both hemispheres on the same task as a function of the demands placed on the individual can be seen in studies involving both adults and children (Bryden, Free, Gagne, & Groff, 1991;Saxby & Bryden, 1984). These studies required participants, in an alternating fashion, to attend to the semantic meaning or the tone of the voice in which word was said. In both studies the participants demonstrated a LEA when directed to listen to emotions while demonstrating a REA when asked to understand the content. If the children in the present study were attending to both semantic information and prosody it would be expected that both hemispheres would have been involved in the task and reduced the left ear advantage.

Measures that avoid nonsense syllables and the possibility of interference through linguistic ability (such as those that use sounds such as shrieking, laughing and crying or neutral words such as digits) might be more suited to children. Though not emotional stimuli, an early study by Knox & Kimura (1970) that involved children aged five to eight and used environmental and animal sounds found a significant left ear advantage. Therefore, anomalous findings encountered in this study might by related to both the age of the participants and the measures of lateralization employed.

The second nonverbal measure of lateralization in this study involved music. Similar to the findings for the recognition of emotional stimuli no significant ear advantages were found in any of the groups of children tested. The lack of an expected ear advantage might again be related to the age of the participants as studies examining lateralization measures of musical stimuli have only involved university student or adults. Though music is assumed to be processed in the right hemisphere it appears to be affected by the experience of the individual. For instance, studies have found that musicians and non musicians differ in terms of lateralization of music stimuli with non musicians demonstrating a typical left ear advantage and musicians having a less significant or opposite ear affect (Avraham & Irving, 1985). Ear advantage in this later group was also found to vary with the complexity of the task (Peretz & Gudanski, 1982). This is not to imply that the participants in the present study were possibly affected by their musical experience but rather that experiential factors, age related or not, can influence ear advantage for musical stimuli. Findings regarding the lateralization of music appear to be generally more tenuous and since no music lateralization studies to date have employed children, age could be a factor with this population.

Besides the absence of studies investigating music lateralization in children, questions regarding the validity of the measure used in the present study can be put forth on the basis of researcher observations. Several times over the course of testing participants enquired as to what they were supposed to be attending to in order to differentiate the musical pieces. Questions they would often ask involved whether or not they should be focussing on the "speed of the piece" or whether or not the piece they were hearing was higher or lower than the comparison piece. At the time of testing they were directed to listen to the whole piece and decide if it was the same or different. In hindsight, however, it appears as though these children were asking about two distinct dimension of music: rhythm and pitch (Dennis & Hopyan, 2001). Rhythm "is a pattern of onset times and duration of sound" and melody "is a pattern of sound pitches" (Dennis & Hopyan, 2001). These dimensions have been found to be processed in distinct neural substrates. Melody has been found to be lateralized to the right temporal lobe while rhythm is processed in the auditory cortex of both the right and left temporal lobes (Denis & Hopyan, 2001). Though the differentiation of the melodies was the purpose of the present measure, these children's questions made it appear as if they were attempting to differentiate the pieces based on different criteria and possibly involving different hemispheres. It could be postulated, that this bilateral involvement is related to the lack of ear advantage found across all groups and specifically the controls.

Although no ear advantage was found for music across groups a significant difference in lateralization scores was found between children with nonverbal and verbal learning disabilities. Even though NLD children had the highest lateralization scores and were significantly different from VLD children they did not demonstrate a significant left ear advantage for musical material. The lack of even a trend toward higher lateralization scores in the control group makes these findings suspect and calls into question both the validity of nonverbal lateralization measures in this age group and the small sample.

High lateralization scores in the NLD group could also be explained by examining both the musical abilities and neuropsychological underpinnings of NLD child and a syndrome that is similar to NLD.

Across groups the number of correct responses on the musical differentiation task was related to higher lateralization scores. Based on this sample then, one of two relationships can be assumed: either that musical abilities influenced lateralization scores or that lateralization to the right hemisphere influenced the ability to differentiate pieces of music. Regardless of the direction of this relationship the ability to differentiate music is related to more right hemisphere lateralized responses. Although NLD children have not been found to have weaknesses in melody recognition the majority of their weaker skills are mediated by the right hemisphere and it was predicted that the perception of music would not be lateralized as strongly to the right hemisphere as it would in the other groups tested. This prediction fits with the White Matter Model which proposes that white matter (long myelinated fibers) more predominant in the right hemisphere and responsible for communication across modes would be disrupted. Higher positive lateralization scores in the NLD group and the relationship between lateralization and accuracy on the music differentiation task negates the expectations of the White Matter Model as it would be expected that right hemisphere areas or connections responsible for musical recognition would be compromised.

Examination of Williams Syndrome, a genetic disorder with similar neuropsychological assets and deficits to NLD, may further elucidate the finding of higher music lateralization scores in the NLD group and its relationship to music recognition. Children with Williams Syndrome (WS) though often mentally retarded, have a cognitive profile similar to children with NLD with strengths in verbal abilities and weaknesses in spatial cognition and visual motor abilities. However, relative to their intelligence WS individuals have quite developed musical abilities, are able to identify prosody and are considered hypersociable (Don, Schellenberg, & Rourke, 1999). A study by (Reiss, Eliex, Schmitt, Straus, Lai, Jones & Bellugi, 2000) using

MRIs have found that children with WS have relatively preserved grey matter coupled with a disproportionate reduction in white matter which is not unlike the neuroanatomy proposed in the White Matter Model. Therefore, WS children are a clinical example where right hemisphere functions are generally less efficient but right hemisphere skills such as musical abilities and prosodic recognition may be preserved.

Preservation of musical abilities may also be a function of whether these skills fall under the domain of intermodal or intramodel communication. Rudimentary skills, such as the recognition of music or prosody may be localized to specific right hemisphere brain regions carried out mainly by intermodal communication or short myelinated fiber of the gray matter versus more complex skills that would necessitate involvement of long myelinated fibers of the white matter. If this is the case, these skills in NLD children would be preserved and lateralization may be unaffected.

Apart from the idea that these skills may be preserved it may also be put forth that neuropsychological assets in auditory perception found both in WS and NLD may create a situation whereby information coming in from the auditory channel is favored. It could be that strengths in auditory perception and weaknesses in visual perception cause these children to gravitate to all information, right hemisphere dominated or not, coming from the auditory channel and that this would strengthen corresponding brain areas (Don et al., 1999).

In sum, lateralization of emotional intonation and musical stimuli did not support this study's predictions. Constraints related to both the size of the sample and the applicability of lateralization measures for this population were duely noted as well as the possibility that children with NLD like WS children may possess isolated right hemisphere skills despite suspected white matter damage.

Though the results of lateralization of nonverbal material did not follow the expected patterns across groups, findings from the verbal dichotic listening task were found to be more in line with previous literature. In the present study no statistically significant differences existed across groups but controls and NLD children demonstrated the expected right ear advantages for verbal material, which suggests the typical left hemisphere processing of basic words, while children with verbal learning disabilities showed no such advantage.

Much research has been dedicated to children with learning disabilities (specifically reading disabilities) based on the assumption that problems in reading may be reflected in the absence of an ear advantage. Results to date have been variable. Based on the ear advantage found in the present study some of this variability may be the result of the failure to adequately separate out subtypes. Although NLD children are strong in phonetics areas, specifically single word reading, they do present with difficulties in reading comprehension. In addition, children may often have primary problems in reading but also have difficulty in math and therefore not fall cleanly into either the verbal or nonverbal subtype. The possible failure of not classifying children based on purely phonological delays may have influenced the degree of right ear advantage found in previous studies. Separation based on LD subtypes rather then categorizations such as dyslexic or reading disabled may lead to more meaningful findings with regards to lateralization of verbal material.

Replications of the REA for verbal material in both NLD children and the control group make sense as lateralization of basic words to the left hemisphere has been well established across children and adults (Kimura, 1961). The literature on lateralization, of nonverbal functions (i.e., emotion and music) are generally more tenuous than verbal functions (i.e., words) (Patel & Licht, 2000). Related to this is the finding that lateralization of nonverbal functions appear to be influenced by age while lateralization of verbal functions appears less influenced by development. In the last two decades research using evoked response, autopsy examinations and intracarotid sodium amytal injections in infants have found that lateralization of language functions are essentially completed at, or soon after, after birth (Wood, 1983). Previously, it was the thought that language was bilaterally represented at birth and gradually moved toward left hemisphere specialization with maturation. This was termed the developmental maturation hypothesis. This hypothesis was formulated on studies from children with crossed aphasia which occurs when children are unable to speak after lesions to the right hemisphere. The language deficits in these children were assumed to provide proof that the right hemisphere is bilaterally involved with early speech. However when these studies were reanalyzed to take into account left handedness (which may predispose a child to right hemisphere language) and the decreasing prevalence of crossed aphasia, the validity of the developmental maturation hypothesis with regards to the non-aphasic population is questionable (Wood, 1983). Though no hypothesis has been confirmed it appears that age operates as more of a confound with regards to lateralization of nonverbal material in contrast to verbal material. This may explain the pattern of results found in the present study.

The second objective of this study was to examine the behavioral presentations of LD subtypes as compared to the control children. Though clinically significant differences were not found when comparing all three groups, a trend toward significance was found on social measures between the NLD and controls. When these latter groups were compared independent of the VLD group, NLD children were found to have significantly lower social skills. Overall NLD children were described by teachers as having a lower level of skills in all the three domains assessed namely: cooperative behavior, assertive behavior and self control behavior.

This trend fits with both Rourke's clinical description and preliminary studies that have found that these children are less effective at interpreting nonverbal cues in social situations (Ozols & Rourke, 1985)(Loveland, 1990). No differences were found across groups in terms of internalizing and externalizing behavior.

Social behavior in the learning disabled population has received a lot of attention and problems with social interaction were once assumed to be a characteristic of the LD child (Forness & Kavale, 1996) Recent research has found that, when academic achievement levels were considered, children with learning disabilities were not different in social behavior from their low achieving peers. It has, further, indicated that social skill difficulties in this population appear to be mediated by achievement in that academic competence often reflects peer status hence social success (Vaughan, Zaragoza, Hogan & Walker, 1993). The present study attempted to examine the relationship between academic competence and social behavior to find out whether social skills differences between NLD and controls were possibly an artifact of teacher ratings of academic competence in the classroom and subsequent peer acceptance. This was thought to be particularly imperative as children in the control group were found to have significantly higher overall IQ's than NLD and VLD children and were in turn assumed to have higher levels of academic achievement. As previous research indicates, the present study found that overall, and in each group, social skills were related to academic competence with the strongest relationship existing for the control group. This suggests that lower social skills in the NLD group are in some way related to their poor academic success which may be a function of their overall intellectual ability.

Though only a trend toward less social skills was found in the NLD population, the teacher questionnaire employed may not have captured the true nature or severity of their deficit. Most

NLD children in the present study were talkative and outgoing with the researcher as might be expected given their documented verbal strengths. Considering these strengths, the rudimentary skills involved in assertive, self control and co-operative behavior, measured by the teacher social skills rating system may have appeared relatively intact. For instance, many of the SSRS questions asked whether these children wanted to be around others (i.e., cooperate with peers, join ongoing activities), initiate social interactions (i.e., get along with people who are different, introduce himself/herself without being told), respond appropriately to situations at school (i.e., control temper in conflict situation with adults and peers, respond appropriately to being hit or pushed) and follow instructions (i.e,. follow directions, attend to instructions). Though these basic skills may be somewhat affected in NLD children, their neuropsychological strengths and weaknesses as well as their clinical presentations suggest that higher order skills such as the ability to flexibly reference context or another person's mind state would be more notably impaired. Therefore, these children would not necessarily appear to be less social but instead have subtler deficits in their ability to read social situations. If so, one would expect that social problems may occur later in the elementary school years when peers are less likely to tolerate verbosity and social relationships begin to rely on higher order abstract reasoning skills such as theory of mind. Theory of mind is the ability to infer another's mental states (i.e., thoughts, beliefs, desires and intentions), use this information in order to interpret another's actions and then predict another's forthcoming behavior (Baron-Cohen, 1995). Inclusion of a social skills measure that centres around these skills may offer a more valid description of NLD social behavioral deficits.

Social difficulties that are related to theory of mind can be seen in Williams syndrome (WS), a genetic disorder discussed previously and Aspergers Syndrome (AS) a pervasive developmental disorder in which children have impairments in social interaction and ritualistic and repetitive behavior in the context of average intellectual skills and above average to superior mechanical language skills (Schopler & Mesibov, 1998). WS and AS are both clinical entities that have similar neuropsychological profiles to children with NLD, namely strengths in mechanical language skills and weaknesses in visual spatial awareness and nonverbal problem solving (Rourke & Fuerst, 1996). Though findings are preliminary, WS and AS syndromes, are also suspected to have white matter disruption in the form of less white matter and deficient white matter pathways, respectively (Berthier, 1994; Lincoln, Corchesne, Allen, & Ene, 1998; Reiss et. al, 2000). AS and WS are clinical presentations that appear to differ from children with NLD as AS children have more clinically significant repetitive and ritualistic behavior while WS children lack such rigidity but are mentally retarded (Don et al. 1999; Schopler & Mesibov, 1998). Based on these constellation of characteristics NLD children fall somewhere between; namely they present with difficulties adapting to novel situations and have intellectual quotients that fall into the Low Average range or above.

Despite this clinical variation, all three groups appear to have similar social skills as they are verbose and willing to make social initiations but their social behaviors do not seem to be governed by context or another person's reaction. For instance, children with WS are noted for their "hypersociability" to the point that they will inappropriately socially approach strangers while a child with AS will talk at length to another person about a subject but will fail to consider the other person's interest level or need for contribution. Both of these descriptions involve social initiations but neither are functional in terms of socially acceptable relations. Examining these clinical entities suggests that future studies of the NLD population might benefit by including measures that directly tap theory of mind.

Though no differences were found in internalizing and externalizing behavior among the groups, internalizing behaviors were found to decrease in the present sample with age. When analyzed by group this relationship was only found to be significant for VLD children. Such a relationship, therefore, could be explained by literature that has documented higher rates of externalizing symptomology as opposed to internalizing symptomology in VLD children (Rourke, 1995).

Rourke (1995) suggests that NLD children experience more rejection with increasing age and that these experiences summate into a higher risk of internalizing disorders. A recent study by Pelletier, Ahmad and Rourke (2001) studied internalizing psychopathology across children aged 9 to 12 and 13 to 15 classified as either having a Basic Phonological Processing Disorder (verbal learning disability) or a nonverbal learning disability and found that internalizing symptomology increased and became clinically significant in children classified as NLD between the ages of 13 to 15. Since the oldest NLD child was 13 years of age, the failure of the present study to find differences between NLD and controls on internalizing behavior may have been related in part to the age of the sample. Rourke (1995) has also suggested that even though internalizing symptoms progressively worsen in these children with age they often initially present with externalizing symptoms at younger ages. This matches the finding in the present study that cooperative behavior was the least frequently endorsed social skill in NLD population. Future longitudinal studies that empirically validate the progression of the NLD behavioral presentations across the life span would be valuable for both diagnosis and treatment of the learning disability subtypes.

<u>Limitations and Future Research</u>

One of the more apparent limitations was the small sample size. Low return for the social skills questionnaire further limited findings for social functioning across groups. This small sample may have contributed to the fact that only a trend toward lower social skills was found in NLD children. Increasing the sample size might clarify significant and non significant relationships as well as increasing the generizability of the results.

Related to small sample size were the difficulties recruiting subjects and subsequently the less stringent criteria used to classify children as NLD. Though all children in the experimental group had a diagnosis of a learning disability, subtypes were not identified in the learning assessment and instead had to be determined by the researcher. Many children recruited were found to be unclassifiable and failed to fit into either classification. The finding that many children were unclassifiable was also found in a study by Pelletier et al. (2001) where 46.8 percent of their sample did not meet criteria for either VLD and NLD classifications even when children meeting both probable and definite subtypes were included.

In the present study, classifying children with VLD was straightforward as their Performance/Verbal spilt reflected their achievement patterns. Classification was not so straightforward with the NLD children as they presented with the Performance/Verbal split but did not always have the clinically predicted achievements patterns. Often in the NLD group low scores were found in the expected achievements areas but they did not demonstrate the relative strengths in achievement that were described in the literature (ie., spelling and single words reading) and instead had low scores in a number of academic areas. This was further complicated by the fact that different achievement tests were used across schools and different scores were available for each participant. For instance, inclusion of two of the NLD children was based on deficits in reading comprehension together with high information scores but the latter score was not available for all children included in the study.

Difficulties in finding children for the NLD groups makes sense when considering the prevalence of the disorder. Research on clinical samples has reported that no more than ten percent of children that are learning disabled are of the nonverbal subtype (Denckla, 1991). Given this low prevalence together with the less stringent academic criteria used in the present study it is likely that children classified as NLD were not as pure or homogenous as the clinical entity reported by Rourke. Harnadek and Rourke (1994) recommend completion of a full neuropsychological battery, in addition, to the WISC and WRAT in order to diagnosis a child with NLD. This includes: a target test to assess Visual-Perceptual-Organization, a grooved peg board to examine psychomotor deficits and a sensory perceptual test to measure tactile-perceptual difficulties. The present study relied on previous learning assessments for classification and the measures specified above were not included. Since additional testing was not feasible, subsequent results found in the present study were most likely affected by a lesser degree of disability in the NLD subtype. If clinical criteria were more stringently followed it would be expected that differences may become more pronounced across groups. Future research should include more stringent classifications.

It was also postulated in the discussion that lack of significant results may have been a function of the lack of applicability of the measures used. The research base using nonverbal measures of lateralization have provided limited data on children and more recent studies suggest the influence of maturational factors. Additional research on emotional lateralization in typically developing children would appear beneficial before employing these measures with different clinical populations in order to provide an adequate comparison group to interpret results.

Another limitation of the present study, related to maturational factors, is the failure to use directed attention techniques. Direct attention techniques have been used to control for subject initiated attentional factors as research has found that right handed individuals tend to attend more to right visual and auditory field (Hugdahl & Anderson, 1986). Likewise, recent research with learning disabled children that employed such techniques has found that they did not demonstrate an REA in response to verbal material because they were more likely than the normal children to have atypical attentional shifts and therefore involve both hemispheres in verbal processing (Orbzut & Boliek, 1988).

Due to the time restrictions the present study did not employ directed attention procedures. Dividing the dichotic tests into directed left, directed right and free recall conditions would have greatly reduced the items in each condition, hence the reliability of the findings. In addition, increasing the length of the measure was not seen as viable because the testing session was already quite long. In hindsight, however, inclusion of directed attention techniques would have allowed for a better comparison of present results with previous findings in two ways. It would have permitted for a more adequate comparison with previous research on verbal processing in the learning disabilities population and allowed further examination of the lack of right ear advantage in the VLD group. As well, it may have provided greater understanding of the maturational effects on nonverbal lateralization as Pollack and Wismer Fries (2001) found that children as compared to adults appeared to be more susceptible to volitional shifts in attention. Use of directed attention techniques may have also eliminated multiple task influences (i. e., processing the meaning and emotion of the nonsense syllables in the Emotion Recognition Task). In addition, this technique may have reduced the natural impulsivity and inattention assumed to be present when testing children as the time lapse between dichotic listening items would have not existed if the researcher was directing the participants attention. Inclusion of these techniques in future studies may help with continuity of research findings in the learning disabilities population and the control of attentional shifts to which children are assumed to be more susceptible.

Implications and Conclusions

The main purpose of this study was to investigate lateralization of nonverbal and verbal information as well as behavioral presentations across learning disabilities subtypes. It was hoped that a relationship between anomalies in lateralization of non verbal material specific to the NLD population would be found as it would coincide with the clinical descriptions of these children and provide indirect proof of the White Matter Model. Failure to find predicted results for emotional and musical material in both LD populations and the control group raise the possibility of an influence of age on nonverbal processes. As well, the findings highlight the inherent challenges of attributing specific emotional qualities to particular areas of the brain especially in a developing organism such as a child.

Lateralization of verbal phenomena to the left hemisphere is a finding that has been replicated by numerous studies with children, adults and the brain damaged population. The present study's results fit with the expected REA for verbal material in all groups except children with verbal learning disabilities. The lack of REA in the VLD group suggest that these children when categorized based on their PIQ>VIQ split and deficits in reading and spelling did exhibit anomalies in lateralization. Such a finding supports the role of learning disability subtyping in the studies of verbal processing.

In terms of behavior a trend was found toward greater social skills deficits in NLD children. Such a finding matches clinical descriptions of this subtype and opens up questions, concerning both the specific nature of these social deficits and their developmental course. Further examination of the relationship between social functioning and academic competence in the NLD child relative to the VLD child may also be of importance in determining how much the severity of the academic deficits influences the NLD social profile. Implications of continuing such research will provide additional quantifiable attributes that can be used in assessment and the focus of treatment of NLD across the lifespan.

In sum, the present study suggests that children with nonverbal learning disabilities are in some way different with regards to their social functioning. The nature and severity of these deficits, however, remain to be elucidated. It also suggests that lateralization of verbal material becomes clearer when learning disability subtypes are considered and that lateralization of nonverbal material appears to be prone to the influence of maturational factors. Together these findings are a reminder of the complexity of the human brain and the many confounding factors related to the individual when trying to better understand the brain's role in specific skills.

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Appendix A

Child Behavior Checklist Parent Report (Achenbach & Edelbrock, 1991)

Please Print

CHILD BEHAVIOR CHECKLIST FOR AGES 4–18

For office use only
ID #

CHILD'S FULL NAME — FIRST — MIDDLE — LAST

SEX ☐ Boy ☐ Girl — AGE — ETHNIC GROUP OR RACE

TODAY'S DATE Mo. ____ Date ____ Yr. ____ — CHILD'S BIRTHDATE Mo. ____ Date ____ Yr. ____

GRADE IN SCHOOL ____

NOT ATTENDING SCHOOL ☐

Please fill out this form to reflect *your* view of the child's behavior even if other people might not agree. Feel free to print additional comments beside each item and in the spaces provided on page 2.

PARENTS' USUAL TYPE OF WORK, even if not working now. *(Please be specific—for example, auto mechanic, high school teacher, homemaker, laborer, lathe operator, shoe salesman, army sergeant.)*

FATHER'S TYPE OF WORK: ____

MOTHER'S TYPE OF WORK: ____

THIS FORM FILLED OUT BY:

☐ Mother (full name) ____

☐ Father (full name) ____

☐ Other—full name & relationship to child: ____

I. Please list the sports your child most likes to take part in. For example: swimming, baseball, skating, skate boarding, bike riding, fishing, etc.

☐ None

	Compared to others of the same age, about how much time does he/she spend in each?				Compared to others of the same age, how well does he/she do each one?			
	Don't Know	Less Than Average	Average	More Than Average	Don't Know	Below Average	Average	Above Average
a. ____	☐	☐	☐	☐	☐	☐	☐	☐
b. ____	☐	☐	☐	☐	☐	☐	☐	☐
c. ____	☐	☐	☐	☐	☐	☐	☐	☐

II. Please list your child's favorite hobbies, activities, and games, other than sports. For example: stamps, dolls, books, piano, crafts, cars, singing, etc. (Do *not* include listening to radio or TV.)

☐ None

	Compared to others of the same age, about how much time does he/she spend in each?				Compared to others of the same age, how well does he/she do each one?			
	Don't Know	Less Than Average	Average	More Than Average	Don't Know	Below Average	Average	Above Average
a. ____	☐	☐	☐	☐	☐	☐	☐	☐
b. ____	☐	☐	☐	☐	☐	☐	☐	☐
c. ____	☐	☐	☐	☐	☐	☐	☐	☐

III. Please list any organizations, clubs, teams, or groups your child belongs to.

☐ None

	Compared to others of the same age, how active is he/she in each?			
	Don't Know	Less Active	Average	More Active
a. ____	☐	☐	☐	☐
b. ____	☐	☐	☐	☐
c. ____	☐	☐	☐	☐

IV. Please list any jobs or chores your child has. For example: paper route, babysitting, making bed, working in store, etc. (Include *both* paid and unpaid jobs and chores.)

☐ None

	Compared to others of the same age, how well does he/she carry them out?			
	Don't Know	Below Average	Average	Above Average
a. ____	☐	☐	☐	☐
b. ____	☐	☐	☐	☐
c. ____	☐	☐	☐	☐

 4-86 Edition

PAGE 1

Please Print

V. 1. About how many close friends does your child have? (Do *not* include brothers & sisters) ☐ None ☐ 1 ☐ 2 or 3 ☐ 4 or more

2. About how many times a week does your child do things with any friends outside of regular school hours? (Do *not* include brothers & sisters) ☐ Less than 1 ☐ 1 or 2 ☐ 3 or more

VI. Compared to others of his/her age, how well does your child:

	Worse	About Average	Better	
a. Get along with his/her brothers & sisters?	☐	☐	☐	☐ Has no brothers or sisters
b. Get along with other kids?	☐	☐	☐	
c. Behave with his/her parents?	☐	☐	☐	
d. Play and work alone?	☐	☐	☐	

VII. 1. For ages 6 and older—performance in academic subjects. ☐ Does not attend school because ______

Check a box for each subject that child takes	Failing	Below Average	Average	Above Average
a. Reading, English, or Language Arts	☐	☐	☐	☐
b. History or Social Studies	☐	☐	☐	☐
c. Arithmetic or Math	☐	☐	☐	☐
d. Science	☐	☐	☐	☐
e. ______	☐	☐	☐	☐
f. ______	☐	☐	☐	☐
g. ______	☐	☐	☐	☐

Other academic subjects—for example: computer courses, foreign language, business. Do *not* include gym, shop, driver's ed., etc.

2. Does your child receive special remedial services or attend a special class or special school? ☐ No ☐ Yes—kind of services, class, or school:

3. Has your child repeated any grades? ☐ No ☐ Yes—grades and reasons:

4. Has your child had any academic or other problems in school? ☐ No ☐ Yes—please describe:

When did these problems start?

Have these problems ended? ☐ No ☐ Yes—when?

Does your child have any illness or disability (either physical or mental)? ☐ No ☐ Yes—please describe:

What concerns you most about your child?

Please describe the best things about your child:

Below is a list of items that describe children and youth. For each item that describes your child *now or within the past 6 months*, please circle the *2* if the item is *very true or often true* of your child. Circle the *1* if the item is *somewhat or sometimes true* of your child. If the item is *not true* of your child, circle the *0*. Please answer all items as well as you can, even if some do not seem to apply to your child.

Please Print

0 = Not True (as far as you know) 1 = Somewhat or Sometimes True 2 = Very True or Often True

0 1 2 1. Acts too young for his/her age
0 1 2 2. Allergy (describe): ______________

____

0 1 2 3. Argues a lot
0 1 2 4. Asthma

0 1 2 5. Behaves like opposite sex
0 1 2 6. Bowel movements outside toilet

0 1 2 7. Bragging, boasting
0 1 2 8. Can't concentrate, can't pay attention for long

0 1 2 9. Can't get his/her mind off certain thoughts; obsessions (describe): ______________

____

0 1 2 10. Can't sit still, restless, or hyperactive

0 1 2 11. Clings to adults or too dependent
0 1 2 12. Complains of loneliness

0 1 2 13. Confused or seems to be in a fog
0 1 2 14. Cries a lot

0 1 2 15. Cruel to animals
0 1 2 16. Cruelty, bullying, or meanness to others

0 1 2 17. Day-dreams or gets lost in his/her thoughts
0 1 2 18. Deliberately harms self or attempts suicide

0 1 2 19. Demands a lot of attention
0 1 2 20. Destroys his/her own things

0 1 2 21. Destroys things belonging to his/her family or others
0 1 2 22. Disobedient at home

0 1 2 23. Disobedient at school
0 1 2 24. Doesn't eat well

0 1 2 25. Doesn't get along with other kids
0 1 2 26. Doesn't seem to feel guilty after misbehaving

0 1 2 27. Easily jealous
0 1 2 28. Eats or drinks things that are not food – *don't* include sweets (describe): ______________

____

0 1 2 29. Fears certain animals, situations, or places, other than school (describe): ______________

____

0 1 2 30. Fears going to school

0 1 2 31. Fears he/she might think or do something bad

0 1 2 32. Feels he/she has to be perfect
0 1 2 33. Feels or complains that no one loves him/her

0 1 2 34. Feels others are out to get him/her
0 1 2 35. Feels worthless or inferior

0 1 2 36. Gets hurt a lot, accident-prone
0 1 2 37. Gets in many fights

0 1 2 38. Gets teased a lot
0 1 2 39. Hangs around with others who get in trouble

0 1 2 40. Hears sounds or voices that aren't there (describe): ______________

____

0 1 2 41. Impulsive or acts without thinking

0 1 2 42. Would rather be alone than with others
0 1 2 43. Lying or cheating

0 1 2 44. Bites fingernails
0 1 2 45. Nervous, highstrung, or tense

0 1 2 46. Nervous movements or twitching (describe):

____

____

0 1 2 47. Nightmares

0 1 2 48. Not liked by other kids
0 1 2 49. Constipated, doesn't move bowels

0 1 2 50. Too fearful or anxious
0 1 2 51. Feels dizzy

0 1 2 52. Feels too guilty
0 1 2 53. Overeating

0 1 2 54. Overtired
0 1 2 55. Overweight

56. Physical problems *without known medical cause:*

0 1 2 a. Aches or pains (*not* stomach or headaches)
0 1 2 b. Headaches
0 1 2 c. Nausea, feels sick
0 1 2 d. Problems with eyes (*not* if corrected by glasses) (describe): ______________
0 1 2 e. Rashes or other skin problems
0 1 2 f. Stomachaches or cramps
0 1 2 g. Vomiting, throwing up
0 1 2 h. Other (describe): ______________

____

PAGE 3

Please see other side

Please Print

0 = Not True (as far as you know) 1 = Somewhat or Sometimes True 2 = Very True or Often True

0 1 2 57. Physically attacks people
0 1 2 58. Picks nose, skin, or other parts of body (describe): ______
0 1 2 59. Plays with own sex parts in public
0 1 2 60. Plays with own sex parts too much
0 1 2 61. Poor school work
0 1 2 62. Poorly coordinated or clumsy
0 1 2 63. Prefers being with older kids
0 1 2 64. Prefers being with younger kids
0 1 2 65. Refuses to talk
0 1 2 66. Repeats certain acts over and over; compulsions (describe): ______
0 1 2 67. Runs away from home
0 1 2 68. Screams a lot
0 1 2 69. Secretive, keeps things to self
0 1 2 70. Sees things that aren't there (describe): ______
0 1 2 71. Self-conscious or easily embarrassed
0 1 2 72. Sets fires
0 1 2 73. Sexual problems (describe): ______
0 1 2 74. Showing off or clowning
0 1 2 75. Shy or timid
0 1 2 76. Sleeps less than most kids
0 1 2 77. Sleeps more than most kids during day and/or night (describe): ______
0 1 2 78. Smears or plays with bowel movements
0 1 2 79. Speech problem (describe): ______
0 1 2 80. Stares blankly
0 1 2 81. Steals at home
0 1 2 82. Steals outside the home
0 1 2 83. Stores up things he/she doesn't need (describe): ______
0 1 2 84. Strange behavior (describe): ______
0 1 2 85. Strange ideas (describe): ______
0 1 2 86. Stubborn, sullen, or irritable
0 1 2 87. Sudden changes in mood or feelings
0 1 2 88. Sulks a lot
0 1 2 89. Suspicious
0 1 2 90. Swearing or obscene language
0 1 2 91. Talks about killing self
0 1 2 92. Talks or walks in sleep (describe): ______
0 1 2 93. Talks too much
0 1 2 94. Teases a lot
0 1 2 95. Temper tantrums or hot temper
0 1 2 96. Thinks about sex too much
0 1 2 97. Threatens people
0 1 2 98. Thumb-sucking
0 1 2 99. Too concerned with neatness or cleanliness
0 1 2 100. Trouble sleeping (describe): ______
0 1 2 101. Truancy, skips school
0 1 2 102. Underactive, slow moving, or lacks energy
0 1 2 103. Unhappy, sad, or depressed
0 1 2 104. Unusually loud
0 1 2 105. Uses alcohol or drugs for nonmedical purposes (describe): ______
0 1 2 106. Vandalism
0 1 2 107. Wets self during the day
0 1 2 108. Wets the bed
0 1 2 109. Whining
0 1 2 110. Wishes to be of opposite sex
0 1 2 111. Withdrawn, doesn't get involved with others
0 1 2 112. Worries

113. Please write in any problems your child has that were not listed above:

0 1 2 ______
0 1 2 ______
0 1 2 ______

PLEASE BE SURE YOU HAVE ANSWERED ALL ITEMS. UNDERLINE ANY YOU ARE CONCERNED ABOUT.

Appendix B

Social Skill Rating System Teacher Form (Elementary and Secondary School Form) (Gresham & Elliott, 1990)

Social Skills Rating System

Grades K-6

Social Skills Questionnaire

Frank M. Gresham and Stephen N. Elliott

Directions

This questionnaire is designed to measure **how often** a student exhibits certain social skills and **how important** those skills are for success in *your* classroom. Ratings of problem behaviors and academic competence are also requested. First, complete the information about the student and yourself.

Student Information

Student's name ____________ (First) ____________ (Middle) ____________ (Last) Date ______ (Month / Day / Year)

School ______________________ City ______________________ State ______

Grade ______________ Birth date ______________ (Month / Day / Year) Sex: ☐ Female ☐ Male

Ethnic group (optional)

- ☐ Asian
- ☐ Black
- ☐ Hispanic
- ☐ Indian (Native American)
- ☐ White
- ☐ Other ______________

Is this student handicapped? ☐ Yes ☐ No

If handicapped, this student is classified as:

- ☐ Learning-disabled
- ☐ Behavior-disordered
- ☐ Mentally handicapped
- ☐ Other handicap (specify) ______________

Teacher Information

Teacher's name ____________ (First) ____________ (Middle) ____________ (Last) Sex: ☐ Female ☐ Male

What is your assignment?

☐ Regular ☐ Resource ☐ Self-contained ☐ Other (specify) ______________

AGS

A 10 9 8 7 6

Form: TE

Next, read each item on pages 2 and 3 (items 1 - 48) and think about this student's behavior during the past month or two. Decide **how often** the student does the behavior described.

If the student **never** does this behavior, circle the **0**.
If the student **sometimes** does this behavior, circle the **1**.
If the student **very often** does this behavior, circle the **2**.

For items 1 - 30, you should also rate **how important** each of these behaviors is for success in *your* classroom.

If the behavior is **not important** for success in your classroom, circle the **0**.
If the behavior is **important** for success in your classroom, circle the **1**.
If the behavior is **critical** for success in your classroom, circle the **2**.

Here are two examples:

	How Often? Never	Sometimes	Very Often	How Important? Not Important	Important	Critical
Shows empathy for peers.	0	1	(2)	0	(1)	2
Asks questions of you when unsure of what to do in schoolwork.	0	(1)	2	0	1	(2)

*This student **very often** shows empathy for classmates. Also, this student **sometimes** asks questions when unsure of schoolwork. This teacher thinks that showing empathy is **important** for success in his or her classroom and that asking questions is **critical** for success.*

Please do not skip any items. In some cases you may not have observed the student perform a particular behavior. Make an estimate of the degree to which you think the student would probably perform that behavior.

FOR OFFICE USE ONLY How Often? C	A	S	Social Skills	How Often? Never	Sometimes	Very Often	How Important? Not Important	Important	Critical
			1. Controls temper in conflict situations with peers.	0	1	2	0	1	2
			2. Introduces herself or himself to new people without being told.	0	1	2	0	1	2
			3. Appropriately questions rules that may be unfair.	0	1	2	0	1	2
			4. Compromises in conflict situations by changing own ideas to reach agreement.	0	1	2	0	1	2
			5. Responds appropriately to peer pressure.	0	1	2	0	1	2
			6. Says nice things about himself or herself when appropriate.	0	1	2	0	1	2
			7. Invites others to join in activities.	0	1	2	0	1	2
			8. Uses free time in an acceptable way.	0	1	2	0	1	2
			9. Finishes class assignments within time limits.	0	1	2	0	1	2
			10. Makes friends easily.	0	1	2	0	1	2
			11. Responds appropriately to teasing by peers.	0	1	2	0	1	2
			12. Controls temper in conflict situations with adults.	0	1	2	0	1	2
			13. Receives criticism well.	0	1	2	0	1	2
			14. Initiates conversations with peers.	0	1	2	0	1	2
			15. Uses time appropriately while waiting for help.	0	1	2	0	1	2
			16. Produces correct schoolwork.	0	1	2	0	1	2
C	A	S	SUMS OF HOW OFTEN COLUMNS						

FOR OFFICE USE ONLY How Often? C	A	S	Social Skills (cont.)	How Often? Never	Sometimes	Very Often	How Important? Not Important	Important	Critical
			17. Appropriately tells you when he or she thinks you have treated him or her unfairly.	0	1	2	0	1	2
			18. Accepts peers' ideas for group activities.	0	1	2	0	1	2
			19. Gives compliments to peers.	0	1	2	0	1	2
			20. Follows your directions.	0	1	2	0	1	2
			21. Puts work materials or school property away.	0	1	2	0	1	2
			22. Cooperates with peers without prompting.	0	1	2	0	1	2
			23. Volunteers to help peers with classroom tasks.	0	1	2	0	1	2
			24. Joins ongoing activity or group without being told to do so.	0	1	2	0	1	2
			25. Responds appropriately when pushed or hit by other children.	0	1	2	0	1	2
			26. Ignores peer distractions when doing class work.	0	1	2	0	1	2
			27. Keeps desk clean and neat without being reminded.	0	1	2	0	1	2
			28. Attends to your instructions.	0	1	2	0	1	2
			29. Easily makes transition from one classroom activity to another.	0	1	2	0	1	2
			30. Gets along with people who are different.	0	1	2	0	1	2
C	A	S	SUMS OF HOW OFTEN COLUMNS						

FOR OFFICE USE ONLY How Often? E	I	H	Problem Behaviors	How Often? Never	Sometimes	Very Often
			31. Fights with others.	0	1	2
			32. Has low self-esteem.	0	1	2
			33. Threatens or bullies others.	0	1	2
			34. Appears lonely.	0	1	2
			35. Is easily distracted.	0	1	2
			36. Interrupts conversations of others.	0	1	2
			37. Disturbs ongoing activities.	0	1	2
			38. Shows anxiety about being with a group of children.	0	1	2
			39. Is easily embarrassed.	0	1	2
			40. Doesn't listen to what others say.	0	1	2
			41. Argues with others.	0	1	2
			42. Talks back to adults when corrected.	0	1	2
			43. Gets angry easily.	0	1	2
			44. Has temper tantrums.	0	1	2
			45. Likes to be alone.	0	1	2
			46. Acts sad or depressed.	0	1	2
			47. Acts impulsively.	0	1	2
			48. Fidgets or moves excessively.	0	1	2
E	I	H	SUMS OF HOW OFTEN COLUMNS			

Do not make importance ratings for items 31 - 48

Go on to Page 4. ➡

Academic Competence

The next nine items require your judgments of this student's academic or learning behaviors as observed in your classroom. Compare the student with other children who are in the same classroom.

Rate all items using a scale of 1 to 5. Circle the number that best represents your judgment. The number 1 indicates the lowest or least favorable performance, placing the student in the lowest 10% of the class. Number 5 indicates the highest or most favorable performance, placing the student in the highest 10% compared with other students in the classroom.

FOR OFFICE USE ONLY		Lowest 10%	Next Lowest 20%	Middle 40%	Next Highest 20%	Highest 10%
	49. Compared with other children in my classroom, the **overall academic performance** of this child is:	1	2	3	4	5
	50. In **reading**, how does this child compare with other students?	1	2	3	4	5
	51. In **mathematics**, how does this child compare with other students?	1	2	3	4	5
	52. In terms of grade-level expectations, this child's skills in **reading** are:	1	2	3	4	5
	53. In terms of grade-level expectations, this child's skills in **mathematics** are:	1	2	3	4	5
	54. This child's **overall motivation** to succeed academically is:	1	2	3	4	5
	55. This child's **parental encouragement** to succeed academically is:	1	2	3	4	5
	56. Compared with other children in my classroom this child's **intellectual functioning** is:	1	2	3	4	5
	57. Compared with other children in my classroom this child's **overall classroom behavior** is:	1	2	3	4	5
AC	SUM OF COLUMN					

Stop. Please check to be sure all items have been marked.

FOR OFFICE USE ONLY

SUMMARY

SOCIAL SKILLS		PROBLEM BEHAVIORS		ACADEMIC COMPETENCE	
HOW OFTEN? TOTAL (sums from p. 2) (sums from p. 3)	BEHAVIOR LEVEL (see Appendix A) Fewer / Average / More	HOW OFTEN? TOTAL (sums from page 3)	BEHAVIOR LEVEL (see Appendix A) Fewer / Average / More	RATING TOTAL (sum from page 4)	COMPETENCE LEVEL (see Appendix A) Below / Average / Above
C + =		E		Total AC	
A + =		I			
S + =		H			
Total (C + A + S)		Total (E + I + H)			
(see Appendix B) Standard Score	Percentile Rank	(see Appendix B) Standard Score	Percentile Rank	(see Appendix B) Standard Score	Percentile Rank
(see Appendix E) SEM ±	Confidence Level 68% ☐ 95% ☐	(see Appendix E) SEM ±	Confidence Level 68% ☐ 95% ☐	(see Appendix E) SEM ±	Confidence Level 68% ☐ 95% ☐
Confidence Band (standard scores)	to	Confidence Band (standard scores)	to	Confidence Band (standard scores)	to

Norms used: ☐ Handicapped ☐ Nonhandicapped

Note: To obtain a detailed analysis of this student's Social Skills strengths and weaknesses, complete the Assessment-Intervention Record.

Teacher Form
Secondary Level

Social Skills Rating System

Grades 7-12

Social Skills Questionnaire

Frank M. Gresham and Stephen N. Elliott

Directions

This questionnaire is designed to measure how often a student exhibits certain social skills and how important those skills are for success in *your* classroom. Ratings of problem behaviors and academic competence are also requested. First, complete the information about the student and yourself.

Student Information

Student's name ______________________________ (First / Middle / Last) Date ____________ (Month / Day / Year)

School ______________________ City ______________ State ______

Grade ______________ Birth date ______________ (Month / Day / Year) Sex: ☐ Female ☐ Male

Ethnic group (optional)

- ☐ Asian
- ☐ Black
- ☐ Hispanic
- ☐ Indian (Native American)
- ☐ White
- ☐ Other ______________

Is this student handicapped? ☐ Yes ☐ No

If handicapped, this student is classified as:

- ☐ Learning-disabled
- ☐ Behavior-disordered
- ☐ Mentally handicapped
- ☐ Other handicap (specify) ______________

Teacher Information

Teacher's name ______________________________ (First / Middle / Last) Sex: ☐ Female ☐ Male

What is your assignment?

☐ Regular ☐ Resource ☐ Self-contained ☐ Other (specify) ______________

AGS®

A 10 9 8 7 6

Form: TS

Next, read each item on pages 2 and 3 (items 1 - 42) and think about this student's behavior during the past month or two. Decide **how often** the student does the behavior described.

- If the student **never** does this behavior, circle the **0**.
- If the student **sometimes** does this behavior, circle the **1**.
- If the student **very often** does this behavior, circle the **2**.

For items 1 - 30, you should also rate **how important** each of these behaviors is for success in *your* classroom.

- If the behavior is **not important** for success in your classroom, circle the **0**.
- If the behavior is **important** for success in your classroom, circle the **1**.
- If the behavior is **critical** for success in your classroom, circle the **2**.

Here are two examples:

	How Often?			How Important?		
	Never	Sometimes	Very Often	Not Important	Important	Critical
Shows empathy for peers.	0	1	(2)	0	(1)	2
Asks questions of you when unsure of what to do in schoolwork.	0	(1)	2	0	1	(2)

*This student **very often** shows empathy for classmates. Also, this student **sometimes** asks questions when unsure of schoolwork. This teacher thinks that showing empathy is **important** for success in his or her classroom and that asking questions is **critical** for success.*

Please do not skip any items. In some cases you may not have observed the student perform a particular behavior. Make an estimate of the degree to which you think the student would probably perform that behavior.

FOR OFFICE USE ONLY How Often? C	A	S	Social Skills	How Often? Never	Sometimes	Very Often	How Important? Not Important	Important	Critical
			1. Produces correct schoolwork.	0	1	2	0	1	2
			2. Keeps his or her work area clean without being reminded.	0	1	2	0	1	2
			3. Responds appropriately to physical aggression from peers.	0	1	2	0	1	2
			4. Initiates conversations with peers.	0	1	2	0	1	2
			5. Volunteers to help peers on classroom tasks.	0	1	2	0	1	2
			6. Politely refuses unreasonable requests from others.	0	1	2	0	1	2
			7. Appropriately questions rules that may be unfair.	0	1	2	0	1	2
			8. Responds appropriately to teasing by peers.	0	1	2	0	1	2
			9. Accepts peers' ideas for group activities.	0	1	2	0	1	2
			10. Appropriately expresses feelings when wronged.	0	1	2	0	1	2
			11. Receives criticism well.	0	1	2	0	1	2
			12. Attends to your instructions.	0	1	2	0	1	2
			13. Uses time appropriately while waiting for your help.	0	1	2	0	1	2
			14. Introduces himself or herself to new people without being told to.	0	1	2	0	1	2
			15. Compromises in conflict situations by changing own ideas to reach agreement.	0	1	2	0	1	2
C	A	S	SUMS OF HOW OFTEN COLUMNS						

FOR OFFICE USE ONLY How Often? C	A	S	Social Skills (cont.)	How Often? Never	Sometimes	Very Often	How Important? Not Important	Important	Critical
			16. Acknowledges compliments or praise from peers.	0	1	2	0	1	2
			17. Easily makes transition from one classroom activity to another.	0	1	2	0	1	2
			18. Controls temper in conflict situations with peers.	0	1	2	0	1	2
			19. Finishes class assignments within time limits.	0	1	2	0	1	2
			20. Listens to classmates when they present their work or ideas.	0	1	2	0	1	2
			21. Appears confident in social interactions with opposite-sex peers.	0	1	2	0	1	2
			22. Invites others to join in activities.	0	1	2	0	1	2
			23. Controls temper in conflict situations with adults.	0	1	2	0	1	2
			24. Ignores peer distractions when doing class work.	0	1	2	0	1	2
			25. Stands up for peers when they have been unfairly criticized.	0	1	2	0	1	2
			26. Puts work materials or school property away.	0	1	2	0	1	2
			27. Appropriately tells you when he or she thinks you have treated him or her unfairly.	0	1	2	0	1	2
			28. Gives compliments to members of the opposite sex.	0	1	2	0	1	2
			29. Complies with your directions.	0	1	2	0	1	2
			30. Responds appropriately to peer pressure.	0	1	2	0	1	2
C	A	S	SUMS OF HOW OFTEN COLUMNS						

FOR OFFICE USE ONLY How Often? E	I	Problem Behaviors	How Often? Never	Sometimes	Very Often
		31. Likes to be alone.	0	1	2
		32. Fights with others.	0	1	2
		33. Is easily embarrassed.	0	1	2
		34. Argues with others.	0	1	2
		35. Threatens or bullies others.	0	1	2
		36. Talks back to adults when corrected.	0	1	2
		37. Has temper tantrums.	0	1	2
		38. Appears lonely.	0	1	2
		39. Gets angry easily.	0	1	2
		40. Shows anxiety about being with a group of children.	0	1	2
		41. Acts sad or depressed.	0	1	2
		42. Has low self-esteem.	0	1	2
E	I	SUMS OF HOW OFTEN COLUMNS			

Do not make importance ratings for items 31 - 42

Go on to Page 4. ➡

Academic Competence

The next nine items require your judgments of this student's academic or learning behaviors as observed in your classroom. Compare the student with other children who are in the same classroom.

Rate all items using a scale of 1 to 5. Circle the number that best represents your judgment. The number 1 indicates the lowest or least favorable performance, placing the student in the lowest 10% of the class. Number 5 indicates the highest or most favorable performance, placing the student in the highest 10% compared with other students in the classroom.

FOR OFFICE USE ONLY		Lowest 10%	Next Lowest 20%	Middle 40%	Next Highest 20%	Highest 10%
	43. Compared with other children in my classroom, the **overall academic performance** of this child is:	1	2	3	4	5
	44. In **reading**, how does this child compare with other students?	1	2	3	4	5
	45. In **mathematics**, how does this child compare with other students?	1	2	3	4	5
	46. In terms of grade-level expectations, this child's skills in **reading** are:	1	2	3	4	5
	47. In terms of grade-level expectations, this child's skills in **mathematics** are:	1	2	3	4	5
	48. This child's **overall motivation** to succeed academically is:	1	2	3	4	5
	49. This child's **parental encouragement** to succeed academically is:	1	2	3	4	5
	50. Compared with other children in my classroom this child's **intellectual functioning** is:	1	2	3	4	5
	51. Compared with other children in my classroom this child's **overall classroom behavior** is:	1	2	3	4	5
AC	SUM OF COLUMN					

Stop. Please check to be sure all items have been marked.

FOR OFFICE USE ONLY

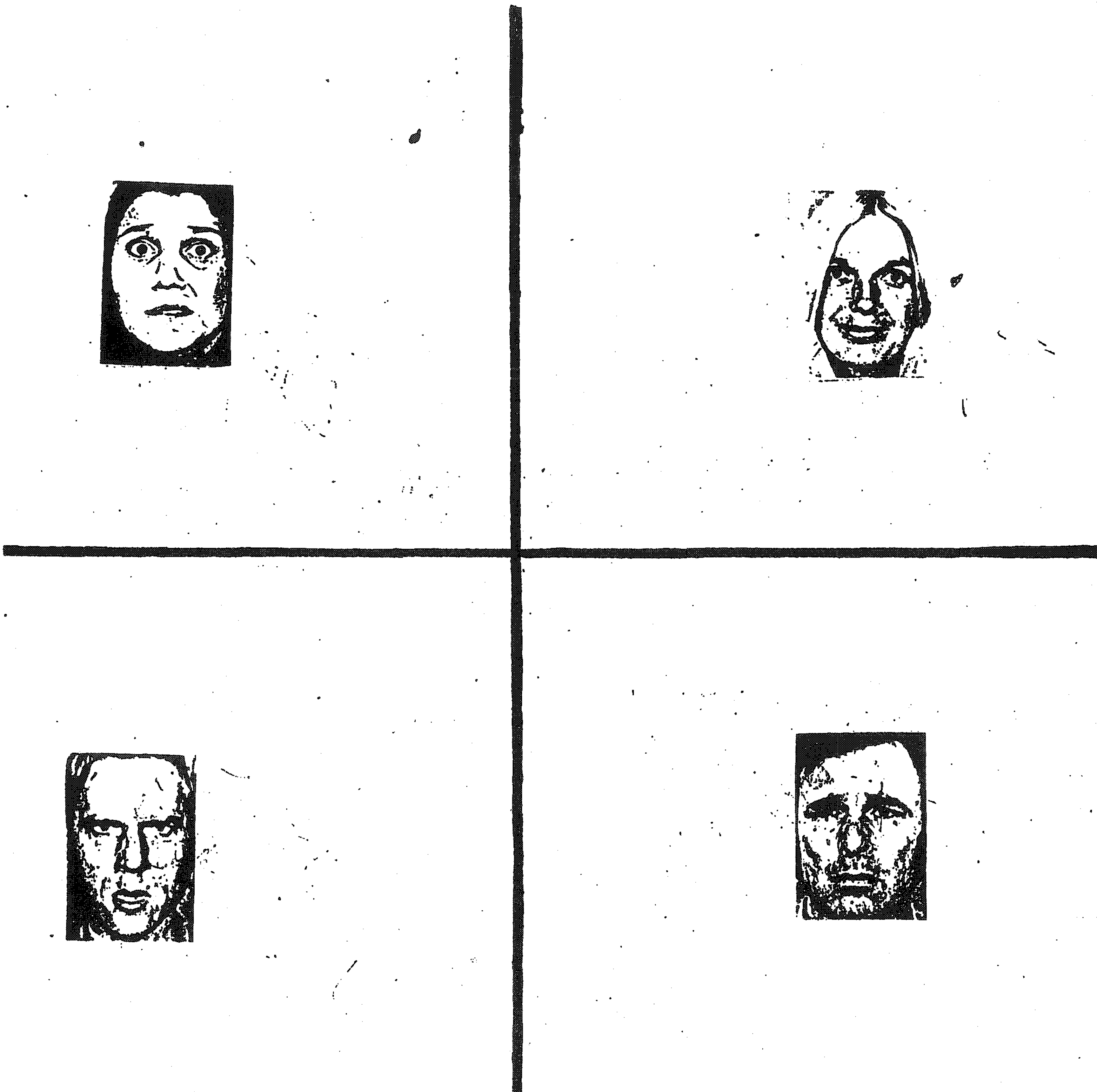
SUMMARY

SOCIAL SKILLS		PROBLEM BEHAVIORS		ACADEMIC COMPETENCE	
HOW OFTEN? TOTAL (sums from p. 2) (sums from p. 3)	BEHAVIOR LEVEL (see Appendix A) Fewer / Average / More	HOW OFTEN? TOTAL (sums from page 3)	BEHAVIOR LEVEL (see Appendix A) Fewer / Average / More	RATING TOTAL (sum from page 4)	COMPETENCE LEVEL (see Appendix A) Below / Average / Above
C + =		E		Total AC	
A + =		I			
S + =		Total (E + I)			
Total (C + A + S)					
(see Appendix B) Standard Score	Percentile Rank	*(see Appendix B)* Standard Score	Percentile Rank	*(see Appendix B)* Standard Score	Percentile Rank
(see Appendix E) SEM ±	Confidence Level 68% ☐ 95% ☐	*(see Appendix E)* SEM ±	Confidence Level 68% ☐ 95% ☐	*(see Appendix E)* SEM ±	Confidence Level 68% ☐ 95% ☐
Confidence Band (standard scores)	to	Confidence Band (standard scores)	to	Confidence Band (standard scores)	to

Note: To obtain a detailed analysis of this student's Social Skills strengths and weaknesses, complete the Assessment-Intervention Record.

Appendix C

Facial Expression Identification Sheet (Ekman & Friesen, 1975)



Appendix D

Dichotic Emotion Recognition Test Score Form (Mountain, 1993)

Visual/Auditory Recogntion Test

For the next part you are going to hear number of different voices. The words that are being spoken are not real words-don't worry about what the voices say- just point to the emotion on the face that is the same as the emotion in the voice.

#	Emotion	#	Emotion
1	A S H F	25	A S H F
2	A S H F	26	A S H F
3	A S H F	27	A S H F
4	A S H F	28	A S H F
5	A S H F	29	A S H F
6	A S H F	30	A S H F
7	A S H F	31	A S H F
8	A S H F	32	A S H F
9	A S H F	33	A S H F
10	A S H F	34	A S H F
11	A S H F	35	A S H F
12	A S H F	36	A S H F
13	A S H F	37	A S H F
14	A S H F	38	A S H F
15	A S H F	39	A S H F
16	A S H F	40	A S H F
17	A S H F	41	A S H F
18	A S H F	42	A S H F
19	A S H F	43	A S H F
20	A S H F	44	A S H F
21	A S H F	45	A S H F
22	A S H F	46	A S H F
23	A S H F	47	A S H F
24	A S H F	48	A S H F

Appendix E

Dichotic Word Test Score Form (Spreen & Strauss, 1991)

DICHOTIC LISTENING - WORDS

NEUROPSYCHOLOGY LABORATORY - UNIVERSITY OF VICTORIA

	RIGHT EAR (RIGHT HEADPHONE)			LEFT EAR (LEFT HEADPHONE)		
PRACTICE WORDS						
1.	DIG	BOY	FEED	NUMB	PAD	HOPE
TEST WORDS						
1.	PACK	TENT	HAT	PART	TEA	COW
2.	FAME	SUM	BOND	FUR	SALE	BEE
3.	DUCK	SHIP	GAS	DECK	SHOE	GUN
4.	VINE	ZONE	MOB	VANE	ZOO	MEAL
5.	NOSE	PRIDE	TRACK	NAME	PLATE	TRAIL
6.	COAST	FLIGHT	SAKE	CORN	FLEET	SUNK
7.	BOWL	DAMP	GOOD	BELL	DEED	GAME
8.	SHINE	VENT	ZEST	SHEEP	VAST	ZEAL
9.	MASS	NINE	PIN	MILL	NAIL	PACE
10.	TIN	CLOTH	FAITH	TORN	CLOCK	FRESH

REVERSE HEADPHONES

	RIGHT EAR (LEFT HEADPHONE)			LEFT EAR (RIGHT HEADPHONE)		
11.	SPEAK	BARK	NEED	SPIT	BELT	NIGHT
12.	SHORE	GUEST	VAULT	SHELL	GUARD	VOTE
13.	THROUGH	MAP	NOTE	THERE	MAD	NICK
14.	PAL	TONGUE	CREAM	PIG	TEETH	CRUST
15.	FLAG	SEND	BLOWN	FAULT	SAND	BRAIN
16.	DAWN	GIVE	SHIFT	DITCH	GLOW	SHIRT
17.	VIM	THEN	MINK	VIEW	THIS	MOUTH
18.	NOUN	PAN	TOP	NOON	PORK	TAN
19.	COOP	FOG	STYLE	CORD	FIT	STAMP
20.	BIRTH	NECK	GRAIN	BAND	NOISE	GLOVE
21.	SHAME	VERB	THAT	SHOOT	VOICE	THAN
22.	MALE	NUDGE	COOP	MINE	NICE	CORD

Appendix F

Dichotic Music Listening Test Score Form (Spreen & Strauss, 1991)

MUSIC

NAME:__________ AGE:__________

TESTER:__________ DATE OF BIRTH:__________

TOP Channel - R - L ear DATE OF TEST:__________

BOTTOM Channel L - R ear SCORE: RIGHT EAR__________

LEFT EAR__________

Circle Correct Response

1.	S	D	17.	S	D	33.	S	D
2.	S	D	18.	S	D	34.	S	D
3.	S	D	19.	S	D	35.	S	D
4.	S	D	20.	S	D	36.	S	D
5.	S	D	21.	S	D	37.	S	D
6.	S	D	22.	S	D	38.	S	D
7.	S	D	23.	S	D	39.	S	D
8.	S	D	24.	S	D	40.	S	D
9.	S	D	25.	S	D	41.	S	D
10.	S	D	26.	S	D	42.	S	D
11.	S	D	27.	S	D	43.	S	D
12.	S	D	28.	S	D	44.	S	D
13.	S	D	29.	S	D	45.	S	D
14.	S	D	30.	S	D	46.	S	D
15.	S	D	31.	S	D	47.	S	D
16.	S	D	32.	S	D	48.	S	D

Appendix G

Handedness Questionnaire Score Form (Korkman, Kirk, & Kemp, 1998)

Handedness

Use materials listed in Manual

Item	Hand Used	
1. Point to the yellow one.	R	L
2. Put the ball on a peg.	R	L
3. Here's a square. You take it.	R	L
4. Toss it into the box.	R	L
5. (Hand used to hold pencil for Design Copying subtest.)	R	L
	Total R:	Total L:
	Preferred Hand (circle one): Right	Left

Appendix H

Recruitment Letter

To Mrs/Mr. ______________________

I Heather McDonald, under the supervision of Dr. Chuck Netley, am conducting a study entitled "The Lateralization of Emotional Intonation In Children With Non-Verbal Learning Disabilities", in partial fulfillment of the MA Clinical Psychology program at Lakehead University. This letter is a request to allow your son/daughter to participate in a study examining how children with learning disabilities process emotionally laden material specifically tone of voice. The purpose of this study is to better understand how emotional information is processed and whether this relates to the comprehension of social cues in children with learning disabilities.

Your son or daughter's name was selected to participate in this study because he/she is between the ages of nine and fourteen and has been identified in the Ontario School Record as meeting criteria for a learning disability. Participation in this study entails a twenty minute session in which your son or daughter will be asked to complete a listening task in addition to requesting his/her teacher to complete a checklist regarding school behavior.

Please note that if you are willing to let your son or daughter participate you are free to withdraw at any time and that all results will be kept confidential and securely stored at Lakehead University for seven years. Also be assured that at no time in the report will an individual be identified. However in appreciation of your participation a brief report of your child's testing results will be provided if desired. In addition, once the study has been completed you are welcome to a general summary of the results. If participation in this study is of interest and you would like to volunteer or inquire further please contact Heather McDonald at 344-7894.

Sincerely,

Heather L. McDonald

M.A. Candidate, Clinical Psychology

Appendix I

Consent Package

Consent for Participation

My signature on this form indicates that I consent to my child's participation in a study by Heather McDonald, on processing of emotional intonation in children with learning disabilities and that I understand the following:

1. I am an volunteer and can withdraw from the study at any time.
2. There is no apparent risk of physical or psychological harm.
3. The data I provide will remain confidential.
4. I will receive a summary of the project, upon request, following the completion of the project.
5. I will receive a brief report, upon request, regarding results my child's performance.

____ _________________________

Signature of Parent/Guardian Date

____

Check if:

If you would like a summary of the results once the research is completed
If you would like a brief report of your child's testing results

If either are indicated please provide the following information:
Name:____
Address:____
Or, e-mail:____

____

Authorization to Obtain Record Information

I hereby authorize Heather McDonald from Lakehead University to obtain the following information which pertain to:

____

Name of Participant

____

Date of Birth

Name of School

____

Type of Record

Social Skill Questionnaire Teacher Form

Ontario School Record- Learning Assessment

AUTHORIZED BY: ____________________ ____________________

Relationship to Participant

SIGNATURES: ____________________ Date:__________________

____

Youth Signature 12 +

Appendix J

Learning Disabilities and Control Participant Report Template

LEARNING DISABILITIES RESEARCH REPORT (Learning Disabilities Participant)

NAME: **AGE:**
SCHOOL: **DATE OF TESTING:**

PURPOSE OF REPORT:

The purpose of this report is to communicate to parents the results of the participant's testing session. This testing session was completed by Heather McDonald, a Lakehead University master's student in clinical psychology, as part of a study entitled "The Lateralization of Emotional Intonation In Children with Non-Verbal Learning Disabilities". This report is not a psychological assessment and only reflects the child's performance on the measures used for the study.

MEASURES USED:

Dichotic Emotion Recognition Test
Dichotic Music Test
Dichotic Word Test
Child Behavior Checklist
Social Skills Rating System
NEPSY- Handedness Questionnaire

DEFINITION OF TERMS:

Dichotic Listening Test- This is a test that requires the participant to listen through ear phones and report two competing messages simultaneously arriving at the right and left ear. A **right ear advantage (REA)** (ie. reporting more right ear material than left) in this procedure is assumed to indicate left hemisphere specialization while a **left ear advantage (LEA)** denotes the preferential processing of the right hemisphere. Typically verbal materials such as words are processed in the left hemisphere while non verbal materials such as music and basic emotions (happy, sad, angry, scared) are processed in the right hemisphere.

Child Behavior Checklist- This is a checklist designed to obtain parent's perception of their children's competencies and problematic behavior.

Social Skills Rating System-This rating system completed by the child's teacher measures **prosocial skills, problem behaviors** and **academic competence.** In this questionnaire **prosocial skills** are defined by three subscales: **cooperation** which measures behaviors such as helping others, sharing and following rules, **assertion** which measures initiating behaviors such as asking others questions, introducing oneself and responding to the actions of others and **self control** which taps that ability to handle conflictual situation such as teasing as well as being able to compromise and take turns with peers.

Handedness Questionnaire- This is a subtest that involves five activities completed by the participant that requires the identification of the preferred hand.

OBSERVATIONS:

SESSION RESULTS:

The **Child Behavior Checklist**

The **Social Skills Rating System**

The **Dichotic Listening Task** was completed by the participant. He demonstrated a______ **ear advantage** for music, emotionally laden material and words when compared to the study sample.

The **Handedness Questionnaire** indicates that on the activities tested that the participant has a _____ hand preference.

....

Heather L. McDonald, H.B.A.
M.A. Student, Clinical Psychology
Lakehead University

....

Chuck Netley, PHD. C. Psych.
Registered Psychologist

LEARNING DISABILITIES RESEARCH REPORT (Control)	
NAME:	AGE:
SCHOOL:	DATE OF TESTING:

PURPOSE OF REPORT:

The purpose of this report is to communicate to parents the results of the participant's testing session. This testing session was completed by Heather McDonald, a Lakehead University master's student in clinical psychology, as part of a study entitled "The Lateralization of Emotional Intonation In Children with Non-Verbal Learning Disabilities". This report is not a psychological assessment and only reflects the child's performance on the measures used for the study.

MEASURES USED:

Wechsler Intelligence Scale For Children (WISC-III) (4 subtests)
Dichotic Emotion Recognition Test
Dichotic Music Test
Dichotic Word Test
Child Behavior Checklist
Social Skills Rating System
NEPSY- Handedness Questionnaire

DEFINITION OF TERMS:

Wechsler Intelligence Scale for Children is a clinical instrument used to measure intellectual ability in children. It is composed of thirteen subtests that either fall into one of two areas: Verbal or Performance. The Verbal Area includes subtests that measure language mediated skills while the Performance Area includes subtests that measure perceptual-motor skills. Four subtests were selected two from the **Verbal Scale (Similarities and Vocabulary)** and two from the **Performance Scales (Block Design and Object Assembly)**. These were selected because out of all the subtests they are most related to overall intelligence. Since the participant was selected for the control group these subtests were used as a screener to ensure he or she was not at risk for a learning disability. The subtests used and what they measure is listed below.

Verbal Scale

Similarities- is a subtest that measures verbal concept formation which is the ability to organize, abstract and find a relationship between two verbal concepts.

Vocabulary- is a subtest that measures word knowledge which is related to the child's fund of information, complexity of ideas, memory and language development.

Performance Scale

Block Design-is a subtest that measures nonverbal concept formation which requires perceptual organization, spatial visualization and abstract conceptualization.

Object Assembly- is a subtest that measures visual organizational ability this involves perceptual skills and visual motor co-ordination.

Dichotic Listening Test- This is a test that requires the participant to listen through ear phones and report two competing messages simultaneously arriving at the right and left ear. A **right ear advantage (REA)** (ie. reporting more right ear material than left) in this procedure is assumed to indicate left hemisphere specialization while a **left ear advantage (LEA)** denotes the preferential processing of the right hemisphere. Typically verbal materials such as words are processed in the left hemisphere while non verbal materials such as music and basic emotions (happy, sad, angry, scared) are processed in the right hemisphere.

Child Behavior Checklist- This is a checklist designed to obtain parent's perception of their children's competencies and problematic behavior.

Social Skills Rating System-This rating system completed by the child's teacher measures **prosocial skills, problem behaviors** and **academic competence.** In this questionnaire **prosocial skills** are defined by three subscales: **cooperation** which measures behaviors such as helping others, sharing and following rules, **assertion** which measures initiating behaviors such as asking others questions, introducing oneself and responding to the actions of others and **self control** which taps that ability to handle conflictual situation such as teasing as well as being able to compromise and take turns with peers.

Handedness Questionnaire- This is a subtest that involves five activities completed by the participant that requires the identification of the preferred hand.

OBSERVATIONS:

SESSION RESULTS:

The **Weschler Intelligence Scales** were completed by the participant. He scored in the_________ Range on all the subtests administered. The following is the a list of the scores and the percentile ranks for all subtests completed. The percentile rank means that the child tested, when compared to other children in their age group that have taken the test, scored the same or better than the percentage reported.

Verbal Scale Similarities Vocabulary		
Performance Scale Block Design Object Assembly		

The **Child Behavior Checklist**

The **Social Skills Rating System**

The **Dichotic Listening Task** was completed by the participant. He demonstrated a_________ **ear advantage** for music, emotionally laden material and words when compared to the study sample.

The **Handedness Questionnaire** indicates that on the activities tested that the participant has a _________hand preference.

....

Heather L. McDonald, H.B.A.
M.A. Student, Clinical Psychology
Lakehead University

Chuck Netley, PHD. C. Psych
Registered Psychologist