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APPENDIX A

AUTHORS ACKNOWLEDGING RELATIONSHIPS BETWEEN DISORDERS AND PROBLEMS

The authors which acknowledged a relationship between two or more disorders or problems are outlined in the table in this appendix. The columns as well as the rows indicate central auditory processing disorders, learning disabilities, language disorders and sensory integration problems were each cell contains the particular authors which suggest the relationship in consideration.



	Central Auditory Processing Disorders	Learning Disabilities	Language Disorders	Sensory Integration Problems
Central Auditory Processing Disorders		• ASHA, 1996 • Bellis and Ferre, 1999 • Bench and Maule, 1997 • Cacace and McFarland, 1998 • Chermak, et.al., 1999 • Cherry, 1992 • DeConde Johnson, et.al., 1997 • DSM-IV, 1994 • Elliott, et.al., 1989 • Jerger, et.al., 1987 • Katz and Kusnierczyk, 1993 • Katz and Wilde, 1985 • Keith, 1988 • Keith and Novak, 1984 • Musiek and Chermak, 1995 • Musiek and Lamb, 1994 • Musiek, et.al., 1985 • Musiek, et.al., 1990 • Perez, et.al., 1995 • Rampp, 1980 • Robin, et.al., 1989 • Roeser and Downs, 1988 • Willeford, 1985 • Young and Protti-Patterson, 1984 • Young, 1985	• ASHA, 1996 • Bellis and Ferre, 1999 • Cacace and McFarland, 1998 • Campbell, 1993 • Chermak, et.al., 1999 • Cherry, 1992 • Cline, 1988 • DeConde Johnson, et.al., 1997 • Elliott and Hammer, 1993 • Elliott, et.al., 1989 • Gordon and Ward, 1995 • Helzer, et.al., 1996 • Jerger, et.al., 1988 • Katz, 1992 • Keith, 1988 • Keith and Novak, 1984 • Keith, et.al., 1989 • Keller, 1992 • Koay, 1992 • Lasky and Katz, 1983 • Lynch, et.al., 1992 • Merzenich, et.al., 1996 • Musiek and Chermak, 1995 • Musiek, et.al., 1990 • Perez, et.al., 1995 • Robin, et.al., 1989 • Roeser and Downs, 1988 • Silman and Silverman, 1991 • Sloan, 1986 • Sloan, 1992 • Sloan, 1998 • Tallal, et.al., 1981 • Tallal, et.al., 1996 • Young and Protti-Patterson, 1984 • Young, 1985	• Ayres, 1983 • Cacace and McFarland, 1998 • Fisher and Murray, 1991 • Welsh, et.al., 1996



	Central Auditory Processing Disorders	Learning Disabilities	Language Disorders	Sensory Integration Problems
Learning Disabilities	• ASHA, 1996 • Bellis and Ferre, 1999 • Bench and Maule, 1997 • Cacace and McFarland, 1998 • Chermak, et.al., 1999 • Cherry, 1992 • DeConde Johnson, et.al., 1997 • DSM-IV, 1994 • Elliott, et.al., 1989 • Jerger, et.al., 1987 • Katz and Kusnierczyk, 1993 • Katz and Wilde, 1985 • Keith, 1988 • Keith and Novak, 1984 • Musiek and Chermak, 1995 • Musiek and Lamb, 1994 • Musiek, et.al., 1985 • Musiek, et.al., 1990 • Perez, et.al., 1995 • Robin, et.al., 1989 • Roeser and Downs, 1988 • Willeford, 1985 • Young and Protti-Patterson, 1984 • Young, 1985		• Bellis and Ferre, 1999 • Bernstein Young and Protti-Patterson, 1984 • Stark, 1985 • Chase, 1996 • DSM-IV, 1994	• Ayres, 1983 • Battin, 1988 • Chase, 1996 • DSM-IV, 1994 • Felmingham and Jakobson, 1995 • Fisher and Murray, 1991 • Katz and Kusnierczyk, 1993 • Roley, 1998



	Central Auditory Processing Disorders	Learning Disabilities	Language Disorders	Sensory Integration Problems
Language Disorders	• ASHA, 1996 • Bellis and Ferre, 1999 • Cacace and McFarland, 1998 • Campbell, 1993 • Chermak, et.al., 1999 • Cherry, 1992 • Cline, 1988 • DeConde Johnson, et.al., 1997 • Elliott and Hammer, 1993 • Elliott, et.al., 1989 • Gordon and Ward, 1995 • Helzer, et.al., 1996 • Jerger, et.al., 1988 • Katz, 1992 • Keith, 1988 • Keith and Novak, 1984 • Keith, et.al., 1989 • Keller, 1992 • Koay, 1992 • Lasky and Katz, 1983 • Lynch, et.al., 1992 • Merzenich, et.al., 1996 • Musiek and Chermak, 1995 • Musiek, et.al., 1990 • Perez, et.al., 1995 • Robin, et.al., 1989 • Roeser and Downs, 1988 • Silman and Silverman, 1991 • Sloan, 1986 • Sloan, 1992 • Sloan, 1998 • Tallal, et.al., 1981 • Tallal, et.al., 1996 • Young and Protti-Patterson, 1984 • Young, 1985	• Bernstein and Stark, 1985 • Chase, 1996 • DSM-IV, 1994		• Ayres, 1983 • Bernstein and Stark, 1985 • DSM-IV, 1994 • Fisher and Murray, 1991



	Central Auditory Processing Disorders	Learning Disabilities	Language Disorders	Sensory Integration Problems
Central Auditory Processing Disorders and Learning Disabilities			• ASHA, 1994 • Battin, 1988 • Bellis and Ferre, 1999 • Bench and Maule, 1997 • Bernstein and Stark, 1985 • DSM-IV, 1994 • Elliott, et.al., 1989 • Kamhi and Beasley, 1985 • Katz and Kusnierczyk, 1993 • Keith and Novak, 1984 • Keith and Stromberg, 1985 • Keith, 1984 • Keith, 1988 • McSporran, 1997 • Rampp, 1980 • Rees, 1981 • Sanger, et.al., 1987 • Sloan, 1992	• Ayres, 1983 • Bernstein and Stark, 1985 • Cacace and McFarland, 1998 • Fisher and Murray, 1991



	Central Auditory Processing Disorders	Learning Disabilities	Language Disorders	Sensory Integration Problems
Central Auditory Processing Disorders and Language Disabilities		• ASHA, 1996 • Battin, 1988 • Bellis and Ferre, 1999 • Bench and Maule, 1997 • Bernstein and Stark, 1985 • DSM-IV, 1994 • Elliott, et.al., 1989 • Rampp, 1980 • Kamhi and Beasley, 1985 • Katz and Kusnierczyk, 1993 • Keith and Novak, 1984 • Keith and Stromberg, 1985 • Keith, 1984 • Keith, 1988 • McSporran, 1997 • Rampp, 1980 • Rees, 1981 • Sanger, et.al., 1987 • Sanger, et.al., 1990 • Sloan, 1992		• Ayres, 1983 • Bernstein and Stark, 1985 • Cacace and McFarland, 1998 • Fisher and Murray, 1991
Central Auditory Processing Disorders and Sensory Integration Problems		• Ayres, 1983 • Cacace and McFarland, 1998 • Fisher and Murray, 1991	• Ayres, 1983 • Cacace and McFarland, 1998 • Fisher and Murray, 1991	
Learning Disabilities and Language Disabilities	• DSM-IV, 1994 • DeConde Johnson, et.al., 1997 • Elliott, et.al., 1989 • Kahmi and Beasley, 1985 • Sanger, et.al., 1987 • Sanger, et.al., 1990			• Ayres, 1983 • Fisher and Murray, 1991



	Central Auditory Processing Disorders	Learning Disabilities	Language Disorders	Sensory Integration Problems
Learning Disabilities and Sensory Integration Problems	• Ayres, 1983 • DSM-IV, 1994 • Fisher and Murray, 1991			
Sensory Integration Problems	• Ayres, 1983 • Cacace and McFarland, 1998 • Fisher and Murray, 1991 • Welsh, et.al., 1996	• Ayres, 1983 • Battin, 1988 • Chase, 1996 • DSM-IV, 1994 • Felmingham and Jacobson, 1995 • Fisher and Murray, 1991 • Katz and Kusnierczyk, 1993 • Roley, 1998	• Ayres, 1983 • Fisher and Murray, 1991	

APPENDIX B

TEST MATERIAL USED BY PROFESSIONALS CONDUCTING THE TEST BATTERY

Tests and assessment procedures used by the communication pathologist

A battery of tests is used during initial assessment of children applying for admission in the school. The selection of which particular test or sub-test will be used depends on the age of the child. The battery of tests to follow up and re-assess a child is selected to provide information on progress in therapy. Following is an outline of the tests used by the speech-language pathologists. The test results from sub-tests from these tests were selected to be used in this study.

Formal tests used by the communication pathologists (For more information, refer to Nicolosi, et.al., (1989).

Test	Description	Developed by
Test of Auditory Perceptual Skills – Revised	Identifies auditory perceptual difficulties and language /learning problems Sub-tests used: • Auditory discrimination • Sequential memory • Word memory • Interpreting directions • Auditory processing	Gardner
Peabody Picture Vocabulary Test	Measures vocabulary comprehension	Dunn



Test	Description	Developed by
Illinois Test of Psycholinguistic Abilities	Assesses aspects of language processing. Sub-tests used: • Auditory reception • Auditory closure • Verbal ability • Sequential memory • Sound blending • Auditory analysis • Grammatical closure	Kirk, McCarthy and Kirk
Detroit Test of Learning Aptitude	Assesses auditory memory	Baker and Leland
Auditory Discrimination Test	Assesses auditory discrimination	Wepman
Auditory Analysis Test	Assesses auditory analysis abilities	Rosner and Simon
Reynell developmental language scale- Revised	Measures language reception and expression	Reynell and Huntley
Clinical Evaluation of Language Fundamentals - Revised	Measures language skills in the areas of; • Semantics • Syntax • Phonology • Memory	Semel, Wiig and Secord
Test of Language Competence	Measures specific language abilities, namely; • Understanding ambiguous sentences • Recreating sentences • Making inferences • Understanding metaphoric sentences	Wigg and Secord

Tests and assessment procedures used by the occupational therapist

The occupational therapists selected and executed their test battery on the same basis as the speech-language therapists. The following table is an outline of the tests used by the occupational therapists.

Assessment tools used by the occupational therapists (For more information refer to Clark and Allen, 1985).

Test	Sub-tests	Developed by
Developmental Test of Visual Perception - 2	Measures visual perception skills important to school readiness, namely; • Eye-hand co-ordination • Figure-ground perception • Perception of shape constancy • Perception of position in space • Perception of spatial relationships	Frostig
Southern California Sensory Integration Tests	Clinical observations of neuro-psychological patterns of disorder, namely; • Visual perceptual functions • Somato-sensory functions • Motor manifestations of postural and bilateral integration	Ayres
Test of visual-motor integration	Measures visual-motor integration	Beery



Name	I Q	Birth date	Evaluation 1
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Name	I Q	Birth date	Evaluation 1	Evaluation 2	Dom eye	Dom ear	Dom foot	Dom hand	Medical	Medication	Aud memory	Aud discrim	Aud sequencing	Aud blending	Aud closure	Aud analysis	Lang recep	Verbal expres	Concentration	Tactile defens	Sens intergra	Balance	Bilateral integra	Eye movement	Fine motor	Body awareness	Motor plan	Vis motor intrgra	Vis motor co-ordina	Spatial percep	Fig-ground perc	Vis closure	Form constancy	High cog process	Emotion
	104	85.10.15	96.10.28																															0	
	103	92.11.16	98.01.25	l		r	r		1	0	1	1	0	0	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0
	106	92.11.16	98.01.25	r			r	r	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
	102	88.03.31	92.08.04	l	r		r	r	1	0	1	1	1	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
									1	0	1	0	0	0	1	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1
	87	91.11.07	97.01.30						1	0	0	1	0	1	1	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1
	103	85.08.30	93.02.22						1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
									1	1	1	0	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	94	91.05.12	97.11.20	l			r	r	1	0	1	0	1	0	1	1	1	1	0	0	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1
	93	90.07.23	95.11	l+r	r		r	r	1	0	1	0	1	1	1	1	1	1	1	0	1	0	0	0	1	1	1	0	1	1	1	1	1	1	1
									1	0	1	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	1	
	94	85.05.30	92.11.08	r	r		r	r	0	0	1	1	1	0	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1
									0	1	1	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	116	87.09.30	97.02.28	l	l		r	r	1	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
									1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	120	89.09.21	97.04.15						1	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
				r	r		r	r	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	114	89.06.19	96.08.21				r	r	1	1	1	1	0	0	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0
									1	1	1	0	0	0	0	0	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	95	91.02.21	97.08.05						1	0	1	1	0	1	1	1	1	1	1	0	0	0	1	1	1	0	1	1	1	1	1	1	0	1	1
	101	91.05.29	97.10.03						1	0	1	0	1	0	1	0	1	0	1	0	1	0	0	1	0	1	0	0	1	0	0	1	0	0	1
	101	88.10.26	97.11.20	r	r		r	r	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	0	0	1	1	1	1
	105	91.03.06	97.06.17				r		0	1	1	1	1	0	0	1	1	0	1	1	1	1	0	1	1	1		1	1	1	1	1	1	0	0
									0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	95	91.08.21	97.08.28	r	r		r	r	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	122	88.10.07	96.11.13				r		1	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0
									1	1	1	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	117	90.11.25	97.05.07	l			r		1	1	1	0	1	1	1	1	1	1	1	0	0	1	0	0	0	1	1	1	1	1	0	1	0	1	1
									1	1	1	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX D

DERIVATION OF MULTIPLE INHERITANCE CLASS STRUCTURE

The following algorithm is used to derive the multiple inheritance class structures.

Step 1: Arrange the table entries horizontally (problems) and vertically (subjects) to achieve the maximum size groupings from left to right. Label each column uniquely.

Step 2: Remove the most left column from the table.

Step 3: If there is still one or more columns left to process, repeat Steps 1, 2 and 3. If there is no column left, continue with Step 4.

Step 4: For each group (column) derived by means of Step 1, determine the number of problems contained in the group, as well as the number of subjects grouped into this group.

Step 5: Arrange the groups into a table in the sequence of descending number of problems in the group.

Step 6: Group the problems into three-member-groups, working from left to right.

Step 7: Group the three-member-groups into six-member groups, working from left to right.

Step 8: Group the six-member-groups into twelve-member groups, working from left to right.

Step 9: Construct the multiple inheritance tree by selecting the three-member-groups as the parent groups, the six-member-groups as the children groups, and the twelve-member-groups as the grand-children groups. (Only include groups with more than or equal to five members).

Step 10: Draw the multiple inheritance tree.