NO. L040820
VANCOUVER REGISTRY

IN THE SUPREME COURT OF BRITISH COLUMBIA

BETWEEN:

JUSTIN McGIVERN-ROBERSON, an infant by his Guardian Ad Litem LYNNE McGIVERN and the said LYNNE McGIVERN

PLAINTIFFS

AND:

HER MAJESTY THE QUEEN IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA

DEFENDANT

Brought Under the Class Proceedings Act

A F F I D A V I T

I, **LINDA SIEGEL**, University Professor, of #2501 Scarfe Building, 2125 Main Mall, University of British Columbia, in the City of Vancouver, in the Province of British Columbia, **MAKE OATH AND SAY AS FOLLOWS:**

Qualifications

1. I am, and have been for approximately 10 years, a Professor at the University of British Columbia in the Department of Educational & Counselling Psychology and Special Education where I hold the Dorothy C. Lam Chair in Special Education. I have a BA degree from Queens College of the City University of New York and an MS and PHD from Yale University.

2. I have published approximately 150 articles and book chapters in the area of learning disabilities and neuropsychology. I have taught at the University of Missouri, McMaster University Medical Centre, Ontario Institute for Studies in Education of the University of Toronto and at the University of British Columbia.

3. I have done educational consulting work in Canada, the United States, Argentina, Hong Kong, China, Sweden, The Netherlands and New Zealand, Spain and Australia.

4. I have over thirty years of experience conducting research, clinical assessments and interviews with people with dyslexia and other learning disabilities.

5. A copy of my curriculum vitae, updated to November 2005, is attached hereto and marked **Exhibit "A"** to this my Affidavit.

Identification of Dyslexia

6. Dyslexia is a significant difficulty in the acquisition of accurate and fluent reading skills. It is usually accompanied by difficulties with spelling and written work. Virtually all dyslexics have difficulty with phonological processing or the association of sounds with letters and most have significant visual memory problems as well.

7. Dyslexia is detected through a series of tests. These tests include tests of word recognition (ie. the ability to read words), the ability to sound out words, usually tested by asking the individual to read what are called "psuedo words" (ie pronounceable combinations of letters that can be read if one knows the sounds of the language in question), and tests of spelling and language comprehension (ie. the ability to understand what one has read). The speed of reading is also tested.

8. There are a variety of educational programs and instructional techniques available to assist dyslexic students in achieving educational goals and standards that are available to other students. However, if the dyslexic students needs are to be met, accurate assessment and diagnosis on a timely basis is essential.

9. Attached hereto and marked **Exhibit "B"** to this my affidavit is a chapter of materials written by me and included in a volume entitled **"Emerging Themes In Cognitive Development Vol II: Competencies".** This material provides a written in depth description of the condition **dyslexia.**

Education System Deficiency

10. Based on my extensive experience with dyslexic people in the Province of British Columbia and in other jurisdictions it is my opinion that within the public educational system in this Province there is, what amounts to, a form of systemic discrimination against dyslexic students through the government's failure to provide proper testing and appropriate remedial education programs for dyslexic students in the school system.

Justin McGivern-Roberson

11. Some time in the fall of 2002 the Plaintiff, Lynne McGivern, came to me and asked me to conduct an assessment of her son, the infant Plaintiff, Justin McGivern-Roberson ("Justin") to determine whether or not he was suffering from a learning disability. She advised me at that time that she and Justin had come to British Columbia in 1997 when he was about to enter Grade 4, that he had significant problems related to his attendance in several schools, that he had been labeled by most of his teachers as being stupid, lazy and a behavioural problem and that, as far as she was aware, he had never been tested to determine whether or not he was suffering from a learning disability notwithstanding her many requests to his teachers and other educational authorities that this be done.

12. I have never seen any documentation, nor have I ever received any information whatsoever which would lead me to conclude that Justin, prior to his mother bringing him to my office in the fall of 2002, had ever been tested with a view to determining the existence of a learning disability.

13. In November 2002, under my supervision, Justin was tested for the presence of a learning disability and it was determined, as a result of that assessment, that he did indeed have a learning disability, namely, dyslexia. Attached hereto and marked **Exhibit "C"** to this my Affidavit is a copy of the report written by me to Justin's mother, Lynne McGivern, dated November 17th, 2002, prepared by me reporting on the testing of Justin at that time and the results obtained.

14. The results of the 2002 testing were brought to the attention of the Vancouver School Board which deemed the assessment to be incomplete because it did not include intelligence testing. This had been omitted because intelligence tests are not necessary for a diagnosis of a learning disability.

15. Because of the Vancouver School Board's reluctance to accept the testing conducted in November 2002, a further testing was conducted, including the previously omitted intelligence assessment, under my supervision. At the time of this second assessment the presence of Justin's learning disability, specifically **dyslexia** was confirmed. Attached hereto and marked **Exhibit "D"** to this my Affidavit is a copy of the WISC III Assessment Report for Justin McGivern-Roberson dated December 10th, 2003.

16. I have been informed by the Plaintiff, Lynne McGivern and verily believe that the results of both of the assessments of Justin which were made under my supervision were forwarded to the Vancouver School Board but that notwithstanding the diagnosis of **dyslexia** no steps were ever taken to provide

Justin with the remedial education which he desperately needed in the circumstances.

SWORN BEFORE ME, at the City of Vancouver, in the Province of British Columbia, this day of March, 2006.)

_____

LINDA SIEGEL

_____

A Commissioner for taking Affidavits within the Province of British Columbia.

Classaction/dyslexia/certification/2006-03-14Aff/LindaSeigel

This is **Exhibit "A"** mentioned and referred to in the affidavit of Linda Siegel sworn before me at the City of Vancouver, in the Province of British Columbia, this day of March, 2006.

Name: _____
A commissioner for taking Affidavits for British Columbia.

CURRICULUM VITAE

Last Updated: **November, 2005**

Name: Linda S. Siegel, Ph.D.

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Degrees:

B. A. 1963 Queens College, New York, NY
M.S. 1964 Yale University, New Haven, CT
Ph.D. 1966 Yale University, New Haven, CT

Employment:

1966-1968 Assistant Professor, Department of Education, Psychology
University of Missouri Columbia, MO.

1968-1974 Assistant Professor, Department of Psychiatry
McMaster University Medical Centre, Hamilton, Ontario

1974-1981 Associate Professor, Department of Psychiatry
McMaster University Medical Centre, Hamilton, Ontario

1981-1984 Professor, Department of Psychiatry
McMaster University Medical Centre, Hamilton, Ontario

1987-1991 Executive Head, Graduate Studies
O.I.S.E., Toronto, Ontario

1984-1996 Professor, Department of Instruction & Special Education, Applied Psychology
Ontario Institute for Studies in Education, Toronto, Ontario

1996-present Dorothy C. Lam Chair in Special Education, UBC

1996-2002 Director, Problem-Based Learning Program in Teacher Education, UBC

1998- present Faculty Associate - Centre for Applied Ethics, UBC

2002-2004 Associate Dean, Office of Graduate Programs and Research, Faculty of Education, UBC

Awards:

2004	Honorary Doctorate, Goteborg University, Sweden
2004	Kersten Hesselgren Fellowship, Sweden
2003	Distinguished University Scholar, UBC
2003	Killam Research Fellowship
2002	YWCA Women of Distinction Award, Education Training and Development, Vancouver, BC.
1997-1999	Killam Research Fellowship
1991-1993	Senior Research Fellowship, Ontario Mental Health Foundation

Professional Activities:

Editorial:

1972-1977	Editorial Board, Developmental Psychology
1977-1980	Editorial Board, Child Development
1980-1983	Associate Editor, Child Development
1982-	Guest Editor, Seminars in Perinatology
1988-1994	Editorial Board, Infants and Young Children
1989-present	Editorial Board, Reading and Writing: An Interdisciplinary Journal
1990-1996	Editor, International Journal of Behavioral Development
1996-	Guest Editor, Dyslexia
1998-present	Editorial Board, Educational Psychology
1998-present	Editorial Board, Canadian Journal of Behavioural Science
1999-present	Editorial Board, Journal of Learning Disabilities
1999-present	Editorial Board, Learning Disabilities Quarterly
2000-present	Editorial Board, Dyslexia
2002-present	Advisory Editor, British Journal of Educational Psychology

Publications:

Refereed Journal Articles:

Chiappe, P. & Siegel, L. S. (in press). The development of reading for Canadian children from diverse linguistic backgrounds: A longitudinal study. Elementary School Journal

Lipka, O., Lesaux, N. K., & Siegel, L. S. (in press). Retrospective analyses of the reading development of a group of grade 4 disabled readers: Risk status and profiles over 5 years, Journal of Learning Disabilities.

Vukovic, R. & Siegel, L. S. (in press). The double deficit hypothesis: A comprehensive review of the evidence. Journal of Learning Disabilities

Lesaux, N.K., Lipka, O., & Siegel, L.S. (in press). Investigating cognitive and linguistic abilities that Influence the reading comprehension skills of children from diverse linguistic backgrounds, Reading & Writing: An Interdisciplinary Journal.

Lipka, O., Siegel, L. S., & Vukovic, R. K. (2005). The literacy skills of English Language learners in Lessons from research. Learning Disabilities Research and Practice, *20*, 39-49.

Siegel, L. S. & Smythe, Ian, S. (2005) Reflections on research on reading disability with special attention to gender issues. Journal of Learning Disabilities 5**,** 472-477.

D'Angiulli, A. & Siegel, L. S. (2004). Schooling, socioeconomic context and literacy development. Educational Psychology, 24, 867-883.

D'Angiulli, A & Siegel, L. S. (2004). Early literacy instruction, SES, and reading development in English language learners and children with English as a first language. Learning Disabilities: Research and Practice, 19, 202-213.

Passolunghi, M.C.& Siegel, L.S. (2004). Working memory and access to numerical information in children with disability in mathematics. Journal of Experimental Child Psychology, 88, 348-367.

Abu Rabia, S. & Siegel, L. S. (2003). Reading skills in three orthographies: The case of Trilingual Arabic-Hebrew-English speaking Arab children. Reading and Writing, 16, 611-634.

D'Angiulli, A. & Siegel, L. S. (2003). Cognitive functioning as measured by the WISC-R: Do children with LD have distinctive patterns of performance? Journal of Learning Disabilities, 36, 48-58.

Jimenez, J. E., Siegel, L. S. & Rodrigo Lopez, M. (2003). The relationship between IQ and reading disabilities in English-speaking Canadian and Spanish children. Journal of Learning Disabilities, 36, 15-23.

Lesaux, N.K. & Siegel, L.S. (2003). The development of reading in children who speak English as a second language. Developmental Psychology, 25, 1005-1019.

Lucangeli, D., Tressoldi, P.E., Bendotti, M., Bonanomi,, M. & Siegel, L.S. (2003). Effective Strategies for Mental and Written Arithmetic Calculation from the Third to the Fifth Grade. Educational Psychology, 23, 507-520.

Siegel, L. S. (2003). IQ-discrepancy definitions and the diagnosis of LD: Introduction to the Special Issue. Journal of Learning Disabilities, 36, 2-3.

Sprenger-Charolles, L., Siegel, L. S., Bechennec, D., & Serniclaes, W. (2003). Development of phonological and orthographic processing in reading aloud, in silent reading, and in spelling: A four year longitudinal study. Journal of Experimental Child Psychology, 84, 194-217.

Abu Rabia, S. & Siegel, L. S. (2002). Reading, syntactic, orthographic and working memory skills of bilingual Arabic-English speaking children. Journal of Psycholinguistic Research, 31, 661-678.

Chiappe, P., Siegel, L. S. & Wade-Woolley, L. (2002). Linguistic diversity and the development of reading skills: A longitudinal study. Scientific Study of Reading, 6, 369-400.

Chiappe, P., Siegel, L. S., & Gottardo, A. (2002). Reading-related skills of kindergartners from diverse linguistic backgrounds. Applied Psycholinguistics, 23, 95-116.

Chiappe, P., Stringer, R., Siegel, L. S., & Stanovich, K. E. (2002). Why the timing deficit

hypothesis does not explain reading disability in adults. Reading and Writing: An Interdisciplinary Journal, 15, 73-107.

D'Angiulli, A., Siegel, L. S., & Serra, E. (2002). The development of reading in English and Italian in bilingual children. Applied Psycholinguistics, 22, 479-507.

Gang, M. & Siegel, L.S. (2002). Sound-symbol learning in children with dyslexia. Journal of Learning Disabilities, 35, 137-157.

Molfese, V., Karp, K., and Siegel, L. (2002) Recommendations for writing successful proposals from the reviewer's perspective. SRA Journal, 33, 21-24.

Bredberg, E., & Siegel, L. S. (2001). Learning disabilities and behavior therapy: A review of practice and a view to the future. Behavior Therapy, 32, 651-666.

Chan, C.K.K. & Siegel, L. S. (2001). Phonological processing in reading Chinese among normally achieving and poor readers. Journal of Experimental Child Psychology, 80, 23-43.

Chiappe, P., Chiappe, D.L., & Siegel, L. S. (2001). Speech perception, lexicality and reading skill. Journal of Experimental Child Psychology, 80, 58-74.

Gottardo, A., Yan, B., Siegel, L. S., Wade-Woolley, L. (2001). Factors related to English reading performance in children with Chinese as a first language: More evidence of cross-language transfer of phonological processing. Journal of Educational Psychology, 93, 530-542.

Passolunghi, M. & Siegel, L. S. (2001). Short-term memory, working memory, and inhibitory control in children with difficulties in arithmetic problem solving. Journal of Experimental Child Psychology, 80, 44-57.

Gunderson, L. & Siegel, L. S. (2001). The evils of the use of IQ tests to define learning disabilities in first and second-language learners. The Reading Teacher, 55, 48-55.

Swanson, H. L. & Siegel, L. S. (2001). Learning disabilities as a working memory deficit. Issues in Education, 7, 1-48, 127-154.

Vandervelden, M.C. & Siegel, L. S. (2001). Phonological processing in written word learning: Assessment for students who use AAC. Augmentative and Alternative Communication, 17, 37-51.

Chiappe, P., Hasher, L., & Siegel, L. S. (2000). Working memory, inhibitory control and reading disability. Memory and Cognition, 28, 8-17.

Geva, E. & Siegel, L. S. (2000). Orthographic and cognitive factors in the concurrent development of basic reading skill in two languages. Reading and Writing: An Interdisciplinary Journal, 12, 1-30.

Vandervelden, M. C. & Siegel, L. S. (1999). Phonological processing and literacy in non-speaking and speech impaired students. Augmentative and Alternative Communication, 15, 191-211.

Gottardo, A., Chiappe, P., Siegel, L. S., & Stanovich, K. E. (1999). Patterns of word and nonword processing in skilled and less-skilled readers. Reading and Writing: An Interdisciplinary Journal, 11, 465-487.

Chiappe, P., & Siegel, L. S. (1999). Phonological awareness and reading acquisition in English- and Punjabi-speaking Canadian children. Journal of Educational Psychology, 91, 20-28.

Siegel, L. S. (1999). Issues in the definition and diagnosis of learning disabilities: A Perspective on *Guckenberger v. Boston University.* Journal of Learning Disabilities, 32, 304-319.

Siegel, L. S., & Himel, N. (1998). Socioeconomic status, age and the classification of dyslexics and poor readers: the dangers of using IQ scores in the definition of reading disability. Dyslexia, 4, 90-104.

Sprenger-Charolles, L., Siegel, L. S., & Bonnet, P. (1998). Reading and spelling acquisition in French: The role of phonological mediation and orthographic factors. Journal of Experimental Child Psychology, 68, 134-165

Sprenger-Charolles, L., Siegel, L. S., & Béchennec, D. (1998). Phonological mediation and semantic and orthographic factors in silent reading in French. Scientific Studies of Reading, 2, 3-29.

Alma, N., Gautieron, S., Latulippe, L., Siegel, L. S., Belec, M-D., & Lemay, S. (1997). Adaptation française de la section III du Test for Auditory Comprehension of Language - Revised et développement de normes régionales. Journal of Speech-Language Pathology & Audiology, 21, 212-222.

Biemiller, A., & Siegel, L. S. (1997). A longitudinal study of the effects of the Bridge Reading Program for children at risk for reading failure. Learning Disabilities Quarterly, 20, 83-92.

Fried, P.A., Watkinson, B., & Siegel, L. S. (1997). Reading and language in 9-12 year olds prenatally exposed to marijuana. Neurotoxicology and Teratology, 19, 171-183.

Gottardo, A., Siegel, L. S. & Stanovich, K. E. (1997). The assessment of adults with reading disabilities: what can we learn from experimental tasks? Journal of Research in Reading, 20, 42-54.

McBride, H. & Siegel, L. S. (1997). Learning disabilities and adolescent suicide. Journal of Learning Disabilities, 30, 652-659.

So, D., & Siegel, L. S. (1997). Learning to read Chinese: Semantic, syntactic, phonological and working memory skills in normally achieving and poor Chinese readers. Reading and Writing: An Interdisciplinary Journal, 9, 1-21.

Sprenger-Charolles, L. & Siegel, L. S. (1997). A longitudinal study of the effects of syllabic structures on the development of reading and spelling skills in French. Applied Psycholinguistics, 18, 485-505.

Stanovich, K. E., Siegel, L. S., & Gottardo, A. (1997). Converging evidence for phonological and surface subtypes of reading disability. Journal of Educational Psychology, 89, 114-

127.

Vandervelden, M. C. & Siegel, L. S. (1997). Teaching phonological processing skills in early literacy: A developmental approach. Learning Disabilities Quarterly, 20, 63-81.

Wade-Wooley L. & Siegel, L.S. (1997). The spelling performance of ESL and native speakers of English as a function of reading skill. Reading and Writing: An Interdisciplinary Journal, 9, 387-406.

Barwick, M. A., & Siegel, L. S. (1996). Learning difficulties in adolescent clients of a shelter for runaway and homeless street youths. Journal of Research on Adolescence, 6, 649-670.

Corkum, P. V., Schacher, R.J., & Siegel, L. S. (1996). Performance on the continuous performance task and the impact of reward. Journal of Attention Disorders, 1, 163-172.

Gottardo, A., Stanovich, K. E., & Siegel, L. S. (1996). The relationships between phonological sensitivity, syntactic processing, and verbal working memory in the reading performance of third grade children. Journal of Experimental Child Psychology, 63, 563-582.

Lennox, C., & Siegel, L. S. (1996). The development of phonological rules and visual strategies in average and poor spellers. Journal of Experimental Child Psychology, 62, 60-83.

Tal, N. F., & Siegel, L. S. (1996). Pseudoword reading errors of poor, dyslexic and normally achieving readers on multisyllable pseudowords. Applied Psycholinguistics, 17, 215-232.

Abu Rabia, S., & Siegel, L. S. (1995). Different orthographies different context effects: The effects of Arabic sentence context in skilled and poor readers. Reading Psychology: An International Quarterly, 16, 1-19.

Da Fontoura, H.A., & Siegel, L. S. (1995). Reading, syntactic, and working memory skills of bilingual Portuguese-English Canadian children. Reading and Writing: An Interdisciplinary Journal, 7, 139-153.

Corkum, P., & Siegel, L. (1995). Debate and argument: Reply to Dr. Koelega: Is the Continuous Performance Task useful in research with ADHD children? Comments on a review. Journal of Child Psychology and Psychiatry, 36, 1487-1493.

Siegel, L. S. (1995). Fuzzy trace theory: A new conceptualization of memory. Learning and Individual Differences, 7, 95-98.

Siegel, L. S. (1995). Does the IQ God exist?. The Alberta Journal of Educational Research, 41, 283-288.

Siegel, L. S., Cooper, D. C., Fitzhardinge, P. M., & Ash, A. J. (1995). The use of the Mental Development Index of the Bayley Scale to diagnose language delay in 2-year old high-risk infants. Infant Behavior and Development, 18, 483-486.

Siegel, L. S., Share, D., & Geva, E. (1995). Evidence for superior orthographic skills in dyslexics. Psychological Science, 6, 250-254.

Vandervelden, M. C. & Siegel, L. S. (1995). Phonological recoding and phonemic awareness in

early literacy: A developmental approach. Reading Research Quarterly, 30, 854-875.

Bernhard, J. K., & Siegel, L. S. (1994). Increasing internal locus of control for a disadvantaged group: A computer intervention. Computers in the Schools, 11, 59-78.

Shafrir, U., & Siegel, L. S. (1994). Preference for visual scanning strategies versus phonological rehearsal in university students with reading disabilities. Journal of Learning Disabilities, 27, 583-588.

Shafrir, U., & Siegel, L. S. (1994). Subtypes of learning disabilities in adolescents and adults. Journal of Learning Disabilities, 27, 123-134.

Siegel, L. S. (1994). The long term prognosis of preterm infants: Conceptual, methodological and ethical issues. Human Nature, 5, 103-126.

Siegel, L. S. (1994). Working memory and reading: A life-span perspective. International Journal of Behavioral Development, 17, 109-124

Stanovich, K. E., & Siegel, L. S. (1994). The phenotypic performance profile of reading-disabled children: A regression-based test of the phonological-core variable-difference model. Journal of Educational Psychology, 86, 24-53.

Tal, N. F., Siegel, L. S., & Maraun, M. (1994). Reading comprehension: The role of question type and reading ability. Reading and Writing: An Interdisciplinary Journal, 6, 387-402.

Corkum, P., & Siegel, L. S. (1993). Is the continuous performance task a valuable research tool for use with children with attention-deficit-hyperactivity disorder? Journal of Child Psychology and Psychiatry, 34, 1217-1239.

Girolametto, L., Tannock, R., & Siegel, L. (1993). Consumer-oriented evaluation of interactive language intervention. American Journal of Speech-Language Pathology, 2, 41-51.

Lennox, C., & Siegel, L. S. (1993). Visual and phonological spelling errors in subtypes of children with learning disabilities. Applied Psycholinguistics, 14, 473-488.

Siegel, L. S. (1993). Phonological processing deficits as the basis of a reading disability. Developmental Review, 13, 246-257.

Siegel, L. S. (1993). Amazing new discovery: Piaget was wrong! Canadian Psychology, 34, 239-245.

Siegel, L. S., & Wiener, J. (1993). Canadian special education policies: Children with learning disabilities in a bilingual and multicultural society. Social Policy Report, 7, 1-16.

Siegel, L. S. (1992). An evaluation of the discrepancy definition of dyslexia. Journal of Learning Disabilities, 25, 618-629.

Tannock, R., Girolametto, L., & Siegel, L. S. (1992). Language intervention with developmentally delayed children: Effects of an interactive approach. American Journal on Mental Retardation, 97, 145-160.

Miner, M., & Siegel, L. (1992). William Butler Yeats: Dyslexic? Journal of Learning Disabilities,

25, 372-375.

Wiener, J., & Siegel, L. (1992). A Canadian perspective on learning disabilities. Journal of Learning Disabilities, 25, 340-350, 371.

Cunningham, C. E., Siegel, L. S., & Offord, D. R. (1991). A dose-response analysis of the effects of methylphenidate on the peer interactions and simulated classroom performance of ADD children with and without conduct problems. Journal of Child Psychology and Psychiatry, 32, 439-452.

Siegel, L. S. (1991). The identification of learning disabilities: Issues in psychoeducational assessment. Education and Law Journal, 3, 301-313.

Morton, L. L., & Siegel, L. S. (1991). Left ear dichotic listening performance on consonant-vowel combinations and digits in subtypes of reading disabled children. Brain and Language, 40, 162-191.

Yau, M., Siegel, L. S., & Ziegler, S. (1991). Laptop computers and the learning disabled student. ERS Spectrum, 9, 22-30.

Shafrir, U., Siegel, L. S., & Chee, M. A. (1990). Learning disability, inferential skills and post-failure reflectivity. Journal of Learning Disabilities, 23, 506-513, 517.

Szatmari, P., Offord, D. R., Siegel, L. S., Finlayson, M. A. J., & Tuff, L. (1990). The clinical significance of neurocognitive impairments among children with psychiatric disorders: Diagnosis and situational specificity. Journal of Child Psychology and Psychiatry, 31, 287-299.

Morton, L. L., Kershner, J. R., & Siegel, L. S. (1990). The potential for therapeutic applications of music on problems related to memory and attention. Journal of Music Therapy, 27, 195-208.

Siegel, L. S. (1989). Why we do not need IQ test scores in the definition and analyses of learning disability. Journal of Learning Disabilities, 22, 514-518.

Siegel, L. S. & Ryan, E. B. (1989). The development of working memory in normally achieving and subtypes of learning disabled children. Child Development, 60, 973-980.

Siegel, L. S. (1989). IQ is irrelevant to the definition of learning disabilities. Journal of Learning Disabilities, 22, 469-478, 486.

Siegel, L. S. & Ryan, E. B. (1989). Subtypes of developmental dyslexia: The influence of definitional variables. Reading and Writing: An Interdisciplinary Journal, 1, 257-287.

Siegel, L. S. & Faux, D. (1989). Acquisition of certain grapheme-phoneme correspondences in normally achieving and disabled readers. Reading and Writing: An Interdisciplinary Journal, 1, 37-52.

Bradley, R. H., Caldwell, B. M., Rock, S. L., Ramey, C. T., Barnard, K. E., Gray, C., Hammond, M. A., Mitchell, S., Gottfried, A. W., Siegel, L. S., & Johnson, D. L. (1989). Home environment and cognitive development in the first three years of life: A collaborative study involving six cites and three ethnic groups in North America. Developmental

Psychology, 25, 217-235.

Siegel, L. S. (1988). A system for the early detection of learning disabilities. Canadian Journal of Special Education, 4, 115-122.

Morton, L. L., & Siegel, L. S. (1988). Summer vacation effects on aspects of written language in the learning disabled. Canadian Journal of School Psychology, 3, 9-18.

Malone, M. A., Kershner, J. R., Siegel, L. S. (1988). The effects of methylphenidate on levels of processing and laterality in children with attention deficit disorder. Journal of Abnormal Child Psychology, 16, 379-395.

Siegel, L. S. (1988). Evidence that IQ scores are irrelevant to the definition and analysis of reading disability. Canadian Journal of Psychology, 42, 201-215.

Siegel, L. S. (1988). Definitional and theoretical issues and research on learning disabilities. Journal of Learning Disabilities, 21, 264-266.

Siegel, L. S. (1988). Agatha Christie's learning disability. Canadian Psychology, 29, 213-216.

Cunningham, C. E., Benness, B. B., & Siegel, L. S. (1988). Family functioning, time allocation, and parental depression in the families of normal and ADDH children. Journal of Clinical Child Psychology, 17, 169-177.

Clark, M. L., Cheyne, J. A., Cunningham, C. E., & Siegel, L. S. (1988). Dyadic peer interaction and task orientation in attention-deficit-disordered children. Journal of Abnormal Child Psychology, 16, 1-15.

Siegel, L. S., & Ryan, E. B. (1988). Development of grammatical sensitivity, phonological, and short-term memory skills in normally achieving and learning disabled children. Developmental Psychology, 24, 28-37.

McCabe, A. E., & Siegel, L. S. (1987). The stability of training effects in young children's class inclusion reasoning. Merrill-Palmer Quarterly, 33, 187-194.

Cunningham, C. E., & Siegel, L. S. (1987). Peer interactions of normal and attention-deficit-disordered boys during free play, cooperative task, and simulated classroom situations. Journal of Abnormal Child Psychology, 29, 453-475.

Siegel, L. S. (1986). Phonological deficits in children with a reading disability. Canadian Journal of Special Education, 2, 45-54.

Cunningham, C. E., Siegel, L. S., & Offord, D. (1985). A developmental dose/response analysis of the effects of methylphenidate on the peer interactions of attention deficit disordered boys. Journal of Child Psychology and Psychiatry, 26, 955-971.

Cunningham, C. E., Siegel, L. S., van der Spuy, H. I. J., Clark, M. L., & Bow, S. J. (1985). The behavioral and linguistic interactions of specifically language delayed and normal boys with their mothers. Child Development, 56, 1389-1403.

Siegel, L. S. (1985). Deep dyslexia in childhood? Brain and Language, 26, 16-27.

Siegel, L. S. (1985). Deep dyslexia and developmental dyslexia: A parallel. Language Sciences, 7, 53-72.

Siegel, L. S., Cunningham, C. E., & van der Spuy, H. I. J. (1985). Interactions of language-delayed and normal preschool boys with their peers. Journal of Child Psychology and Psychiatry, 26, 77-84.

Siegel, L. S. (1984). A longitudinal study of a hyperlexic child: Hyperlexia as a language disorder. Neuropsychologia, 22, 577-585.

Siegel, L. S., & Ryan, E. B. (1984). Reading disability as a language disorder. Remedial and Special Education, 5, 28-33.

Gilbert, J. R., Feldman, W., Siegel, L. S., Mills, D., Dunnett, C., & Stoddart, G. (1984). How many well baby visits are necessary in the first two years of life? Canadian Medical Association Journal, 130, 857-861.

Siegel, L. S. (1984). On the adequacy of the Wide Range Achievement Test (WRAT): A reply to Snart, Dennis, and Brailsford. Canadian Psychology, 25, 73-74.

Siegel, L. S., & Linder, B. A. (1984). Short term memory processes in children with reading and arithmetic learning disabilities. Developmental Psychology, 20, 200-207.

Siegel, L. S. (1983). Correction for prematurity and its consequences for the assessment of very low birthweight infants. Child Development, 54, 1176-1188.

Siegel, L. S. & Feldman, W. (1983). Non-dyslexic children with combined writing and arithmetic difficulties. Clinical Pediatrics, 22, 241-244.

Siegel, L. S. (1982). Reproductive, perinatal, and environmental factors as predictors of the cognitive and language development of preterm infants. Child Development, 53, 963-973.

Siegel, L. S. (1982). Early cognitive and environmental correlates of language development at 4 years. International Journal of Behavioral Development, 5, 433-444.

Siegel, L. S. (1982). Reproductive, perinatal and environmental factors as predictors of development of preterm (<1501 grams) and fullterm children at 5 years. Seminars in Perinatology, 6, 274-279.

Siegel, L. S., Saigal, S., Rosenbaum, P., Morton, R. A., Young, A., Berenbaum, S., & Stoskopf, B. (1982). Predictors of development in preterm and fullterm infants: A model for detecting the "at risk" child. Journal of Pediatric Psychology, 7, 135 148.

McCabe, A. E., Siegel, L. S., Spence, I., & Wilkinson, A. (1982). Class inclusion reasoning: Patterns of performance from three to eight years. Child Development, 53, 780-785.

Siegel, L. S., Lees, A., Allan, L., & Bolton, B. (1981). Nonverbal assessment of Piagetian concepts in preschool children with impaired language development. Educational Psychology, 1, 153-158.

Siegel, L. S. (1981). Infant tests as predictors of cognitive and language development at two

years. Child Development, 52, 545-557.

Gilbert, J. R., Feldman, W., Mills, D. A., Siegel, L. S., Dunnett, C. W., Stoddart, C., & Duncan, T. (1980). How many well baby visits? A randomized trial in progress. Canadian Family Physician, 26, 1178-1181.

Siegel, L. S. (1979). Le jeune enfant est-il vraiment "pre-operatoire"?. Bulletin de Psychologie, 33, 637-644.

Siegel, L. S. (1979). Infant perceptual, cognitive, and motor behaviors as predictors of subsequent cognitive and language development. Canadian Journal of Psychology, 33, 382-395.

Maurer, D., Siegel, L. S., Lewis, T., Kristofferson, M., Levy, B. A., & Barnes, R. (1979). Long-term memory improvement? Child Development, 50, 106-118.

Buckley, N., Siegel, L. S., & Ness, S. (1979). Egocentrism, empathy, and altruistic behavior in young children. Developmental Psychology, 15, 329-330.

Siegel, L. S., McCabe, A. E., Brand, J., & Matthews, J. (1978). Evidence for the understanding of class inclusion in the preschool child: Linguistic factors and training effects. Child Development, 49, 688-693.

Siegel, L. S. (1977). Children's and adolescent's reactions to the assassination of Martin Luther King: A study of political socialization. Developmental Psychology, 13, 284-285.

Siegel, L. S. (1977). The cognitive basis of the comprehension and production of relational terminology. Journal of Experimental Child Psychology, 24, 40-52.

Baron, J., Lawson, G., & Siegel, L. S. (1975). Effects of training and set size on children's judgments of number and length. Developmental Psychology, 11, 583-588.

Siegel, L. S. (1974). The development of number concepts: Ordering and correspondence operations and the role of length cues. Developmental Psychology, 10, 907-912.

Lawson, G. Baron, J., & Siegel, L. S. (1974). The role of number and length cues in children's quantitative judgments. Child Development, 45, 731-736.

Siegel, L. S. (1974). Heterogeneity and spatial factors as determinants of numeration ability. Child Development, 45, 532-534.

Siegel, L. S. (1973). The role of spatial arrangement and heterogeneity in the development of concepts of numerical equivalence. Canadian Journal of Psychology, 27, 351-355.

Siegel, L. S. (1972). The development of concepts of numerical magnitude. Psychonomic Science, 28, 245-246.

Siegel, L. S. (1972). The development of the concept of seriation. Developmental Psychology, 6, 135.137.

Siegel, L. S. (1971). The development of the understanding of certain number concepts. Developmental Psychology, 5, 362-363.

Siegel, L. S. (1971). The sequence of development of certain number concepts in preschool children. Developmental Psychology, 5, 357-361.

Siegel, L. S., & Forbes, W. H. (1970). Rule structure and proportion of positive instances as determinants of concept attainment in children. Developmental Psychology, 3, 271.

Siegel, L. S., & Downey, J.L. (1970). The relative effectiveness of positive and negative information feedback in a concept attainment task. Psychonomic Science, 19, 105-106.

Siegel, L. S. (1969). Concept attainment as a function of amount and form of information. Journal of Experimental Psychology, 81, 464-468.

Siegel, L. S. & Goldstein, A.G. (1969). Conservation of number in young children: Recency vs. relational strategies. Developmental Psychology, 1, 128-130.

Siegel, L. S. (1968). The role of experience in judgments of complexity of random shapes. Canadian Journal of Psychology, 22, 474-483.

Siegel, L. S. (1968). The development of the ability to process information. Journal of Experimental Child Psychology, 6, 368-383.

Wagner, A. R., Siegel, L. S., & Fein, G. C. (1967). Extinction of conditioned fear as a function of percentage of reinforcement. Journal of Comparative and Physiological Psychology, 63, 160-164.

Book Chapters:

Lipka, O., & Siegel, L. S. (in press) Learning disabilities Behavioral and emotional disorders in adolescents: Nature, assessment, and treatment. In D.A. Wolfe & E.J. Marsh (Eds) NY Guilford.

Gunderson, L. & Siegel, L. S. (2005) The evils of the use of IQ tests to define learning disabilities in first- and second-language learners. In S.J. Barreutine & S.M. Stokes (Eds) Reading Assessment: Principles and practices for elementary teachers. International Reading Association Newark, Delaware, 26-29.

Siegel, L. S. & Smythe, I. (2004) Dyslexia and English as an additional language (EAL): towards a greater understanding. In G. Reid & A. Fawcett (Eds). Dyslexia in Context: Research, Policy and Practice, 132-146. London & Philadelphia: Whurr Publishers.

Siegel, L. S. (2004) Bilingualism and reading. In T. Nunes and P. Bryant (Eds). Handbook of Children's Literacy, 673-690. Dordrecht, Netherelands: Kluwer Academic Publishers.

Siegel, L. S. (2003). Dyslexia in Canada. In I. Smythe, J. Everatt, and R. Salter. (Eds.) The international book of dyslexia: a cross-language comparison and practice guide, 38-42. London: John Wiley & Sons Ltd.

Siegel, L. S. (2003). History and development of inclusive education in Canada. In Inclusive Education in the New Millennium, 2-10. Hong Kong & Macao: Education Convergence and the Association for Childhood Education.

Siegel, L. S. (2003). Personal Injury claims and learning disabilities. In I. Z. Schultz and D. O. Brady (Eds.) Psychological Injuries at Trial, 1231-1247. Chicago, IL: ABA Publishing.

Siegel, L. S. (2003). Basic cognitive processes and reading disabilities. In H. L. Swanson, K. R. Harris & S. Graham (Eds.) Handbook of Learning Disabilities, 158-181. New York, NY: Guilford Press.

Siegel, L. S. (2003). Learning disabilities. In W. M. Reynolds, G. E. Miller & I. B. Weiner (Eds.) Handbook of Psychology, 455-486. Hoboken, NJ: Wiley & Sons.

Siegel, L. S. (2002). Bilingualism and reading. In L. Verhoeven, C. Elbro & P. Reitsma (Eds.) Precursors of Functional Literacy, 287-302. Philadelphia, PA: John Benjamins.

Chiappe, P., Siegel, L.S. & Hasher, L. (2002). Working memory, inhibition and reading skill. In S. Shohov (Ed.) Advances in psychology research, vol. 9, 30-51. Huntington, NY: Nova Science.

Siegel, L. S. (1999). Learning disabilities: the roads we have traversed and the path to the future. In R. J. Sternberg & L. Spear-Swerling (Eds.). Perspectives on learning disabilities: Biological, cognitive, contextual. Boulder, CO: Westview Press.

Siegel, L. S. (1998). Phonological processing deficits and reading disabilities. In L. Ehri & J. Metsala (Eds.), Word recognition in beginning literacy, 141-160. New Jersey: Erlbaum.

Lennox, C., & Siegel, L. S. (1998). Phonological and orthographic processes in good and poor spellers. In M. Joshi & C. Hulme (Eds.), Reading and Spelling: Development and Disorders, 395-404. New Jersey: Erlbaum.

Siegel, L. S. (1998). The discrepancy formula: Its use and abuse. In Shapiro, B. K., Accardo, P. J., and Capute, A. J. (Eds). Specific reading disability: a view of the spectrum, 123-135. Timonium, MD: York Press, Inc.

Stanovich, K. E., & Siegel, L. S. (1998). The role of IQ in the diagnosis of reading disorders: the quest for a subtype based on aptitude/achievement discrepancy. In J. Rispens, T. A. van Yperen, & W. Yule (Eds.), Perspectives on the Classification of Specific Developmental Disorders, 105-136. The Netherlands: Kluwer Academic Publishers.

Sprenger-Charolles, Siegel, L., & Béchennec, D. (1997). L'Acquisition de la lecture et de l'écriture en français: étude longitudinale. In L. Rieben, M. Fayol, & C. Perfetti, (Eds.) Des orthographes et leur acquisition, 359-384. Lausanne, Switzerland: Delachaux et Niestlé S. A.

Sprenger-Charolles, L., Siegel, L. S., & Béchennec, D. (1997). Beginning reading and spelling acquisition in French: A longitudinal study. In C. Perfetti, L. Rieben & M. Fayol (Eds.) Learning to Spell: Research, Theory, and Practice Across Language, (pp. 339-359). New Jersey: Erlbaum.

Siegel, L. S., LeNormand, M-T, & Plaza, M. (1997). Trastornos específícos de apredizaje de la lectura. Dislexias. In J. Narbona & C. Chevrie-Muller (Eds.) El lenguaje del niño, (307-325). Barcelona, Spain: Masson, S.A.

Stanovich, K. E., Siegel, L. S., Gottardo, A., Chiappe, P., & Sidhu, R. (1997). Subtypes of developmental dyslexia: differences in phonological and orthographic coding. In Benita

Blachman (Ed.) Foundations of Reading Acquisition and Dyslexia, (pp. 115-141). Mahwah, NJ: Lawrence Erlbaum Associates.

Stanovich, K. E., Siegel, L. S., & Gottardo, A. (1997). Progress in the search for dyslexia subtypes. In C. Hulme & M. Snowling (Eds.) Dyslexia: Biology, Cognition, and Intervention, (pp. 108-130). London: Whurr Publishing, 1997.

Vandervelden M. C. & Siegel, L. S. (1997). The assessment of phonological processing in early literacy: a developmental approach. In S. M. Clancy Dollinger & L. F. DiLalla (Eds.) Assessment and Intervention: Issues across the life span, (pp. 77-101). Mahwah, NJ: Lawrence Erlbaum Associates.

Siegel. L. S. (1996). Diagnosi e riabilitazione dei disturbi dell' apprendimento. In G. Stella (Ed.) La Dislessia, (pp119-133). Milano, Italy: Franco Angeli.

Siegel, L. S., Le Normand, M-T., & Plaza, M. (1996). Troubles specifiques d'apprentissage de la lecture: Les dyslexies. In C. Chevrie-Muller & J. Narbona (Eds.) Le language de l'enfant: Aspects normaux et pathologiques, (pp. 309-326). Paris: Masson.

Siegel, L. S., Le Normand, M-T., & Plaza, M. (1997). Trastornos específicos de aprendizaje de la lectura. Dislexias. In Juan Narbona & Claude Chevrie-Muller, El lenguaje del niño: Desarrollo normal, evaluación y trastornos, (pp. 307-325). Barcelona, Spain: Masson.

Vandervelden, M. C., & Siegel, L. S. (1996). Phonological recoding deficits and dyslexia: A developmental perspective. In J. H. Beitchman, N. J. Cohen, M.M. Konstantareas, & R. Tannock (Eds.), Language, learning, and behaviour disorders: Developmental, biological, and clinical perspectives, (pp. 224-246). Cambridge, UK: Cambridge University Press.

Lennox, C., & Siegel, L. S. (1995). Development of orthographic and phonological processes in normal and disabled reading. In V. W. Berninger (Ed.), The varieties of orthographic knowledge II: Relationships to phonology, reading, and writing (pp. 151-175). Dordrecht, The Netherlands: Kluwer Academic Publishers.

Smith, S. D., & Siegel, L. S. (1995). War and peace: The socialization of children. In R.A. Hinde & H. E. Watson (Eds.), War: A Cruel Necessity? The bases of institutionalized violence (pp. 106-117). London: Tauris Academic Studies.

Lennox, C., & Siegel, L. S. (1994). The role of phonological and orthographic processes in learning to spell. In G. D. A. Brown, & N. C. Ellis (Eds.), Handbook of spelling: Theory, process and intervention (pp. 94-109). Sussex, U.K.: John Wiley.

Siegel, L. S. (1994). Assessment of cognitive and language functioning: A developmental perspective. In S. L. Friedman & H. C. Haywood (Eds.), Developmental follow-up: Concepts, domains, and methods (pp. 217-233). San Diego: Academic Press.

Siegel, L. S. (1994). Phonological processing deficits as the basis of developmental dyslexia: Implications for remediation. In M. J. Riddoch & G. W. Humphreys (Eds.), Cognitive neuropsychology and cognitive rehabilitation (pp. 379-400). Hove: Erlbaum.

Toth, G., & Siegel, L. S. (1994) A critical evaluation of the IQ-achievement discrepancy based definition of dyslexia. In K. P. van den Bos, L. S. Siegel, D. J. Bakker, & D. L. Share

(Eds.), Current directions in dyslexia research (pp. 45-70). Lisse, The Netherlands: Swets & Zeitlinger.

Siegel, L. S. (1993). Alice in IQ land or why IQ is still irrelevant to learning disabilities. In R. M. Joshi and C. K. Leong (Eds.). Reading disabilities: Diagnosis and component processes (pp. 71-84). Kluwer: Dordrecht, The Netherlands.

Siegel, L. S. (1993). Commentary on R. S. Johnston's chapter, "The role of memory in learning to read, write and spell: A review of recent research." In G. M. Davies & R. H. Logie (Eds.), Memory in Everyday Life (pp. 85-90). Amsterdam: North Holland.

Siegel, L. S. (1993). The cognitive basis of dyslexia. In R. Pasnak & M. L. Howe (Eds.), Emerging themes in cognitive development Vol. II: Competencies (pp. 33-52). NY: Springer-Verlag.

Siegel, L. S. (1993). The development of reading. In H. W. Reese (Ed.), Advances in child development and behavior, (Vol. 24, pp. 63-97). San Diego: Academic Press.

Metsala, J., & Siegel, L. S (1992). Patterns of atypical reading development: Attributes and underlying reading processes. In S. Segalowitz & I. Rapin (Eds.), Handbook of Neuropsychology (Vol. 7, pp. 187-210). Amsterdam: Elsevier.

Barsky, V. E. & Siegel, L. S. (1992). Predicting future cognitive, academic, and behavioral outcomes for very low birthweight (<1500 grams) infants. In S. L. Friedman & M. Sigman (Eds.) The psychological development of low birthweight children: Advances in applied development psychology. Norwood, NJ: Ablex.

Siegel, L. S. (1992). A multivariate model for the early detection of learning disabilities. In C. W. Greenbaum & J. G. Auerbach (Eds.), Longitudinal studies of children at psychological risk: Cross-national perspectives. Norwood, NJ: Ablex.

Siegel, L. S. (1992). Infant motor, cognitive, and language behaviors as predictors of achievement at school age. In C. Rovee-Collier & L. Lipsitt (Eds.), Advances in infancy research, Vol. 7. Norwood, NJ: Ablex.

Siegel, L. S., & Metsala, J. (1992). An alternative to the food processor approach to subtypes of learning disabilities. In. N. N. Singh & I. L. Beale (Eds.), Learning disabilities: Nature, theory, and treatment (pp. 44-60). N.Y.: Springer-Verlag.

Siegel, L. S. (1991). On the maturation of developmental psychology. In F. S. Kessel, M. H. Bornstein, & A. J. Sameroff (Eds.), Contemporary constructions of the child: Essays in honor of William Kessen. Hillsdale, NJ: Erlbaum.

Morrison, S. R. & Siegel, L. S. (1991). Learning disabilities: A critical review of definitional and assessment issues. In J. E. Obrzut & G. W. Hynd (Eds.), Neuropsychological foundations of learning disabilities: A handbook of issues, methods, and practice (pp.79-97). San Diego: Academic Press.

Morrison, S. R. & Siegel, L. S. (1991). Arithmetic disability: Theoretical considerations and empirical evidence for this subtype. In L.V. Feagans, E. J. Short, & L. Meltzer (Eds.). Subtypes of learning disabilities: Theoretical perspectives and research (pp. 189-208) Hillsdale, NJ.: Erlbaum.

Tannock, R., Girolametto, L., & Siegel, L. (1990). Are the social-communicative and linguistic skills of developmentally delayed children enhanced by a conversation model of language intervention? In L. B. Olswarg, C. K. Thompson, S. F. Warren, & N. J. Minghetti (Eds.), Treatment Efficacy Research in Communication Disorders (pp. 115-123). Rockville, MD: American Speech-Language Hearing Foundation.

Siegel, L. S. (1990). IQ and learning disabilities: R.I.P. In H. L. Swanson & B. Keogh (Eds.). Learning disabilities: Theoretical and research issues (pp. 111-128). Hillsdale, NJ: Erlbaum.

Miller, J., & Siegel, L. S. (1989). Cognitive and social factors as predictors of normal and atypical language development. In S. von Tetzchner, L. S. Siegel, & L. Smith (Eds.). The social and cognitive aspects of normal and atypical language development, New York: Springer-Verlag.

Siegel, L. S. (1989). A reconceptualization of prediction from infant test scores. In M. Bornstein & N. Krasnegor (Eds.) Stability and continuity in mental development. Hillsdale, NJ: Erlbaum.

Siegel, L. S. (1989). Detection of learning disabilities in infancy using a risk index. In N. W. Paul (Ed.) Research in infant assessment. White Plains, N.Y.: March of Dimes Birth Defects Foundation.

Siegel, L. S., & Heaven, R. (1986). Categorizing learning disabilities. In S. Ceci (Ed.), Handbook of cognitive, social, and neuropsychological aspects of learning disabilities, Vol. 1 (pp. 95-121). Hillsdale, N. J.: Erlbaum.

Siegel, L. S., Levey, P., & Ferris, H. (1985). Subtypes of developmental dyslexia: Do they exist? In F. J. Morrison, C. Lord, & D. P. Keating (Eds.), Applied developmental psychology, Vol. 2, (pp. 169-190). New York: Academic Press.

Siegel, L. S. (1985). A risk index to predict learning problems in preterm and fullterm children. In W. K. Frankenburg, R. N. Emde & J. W. Sullivan (Eds.), Early identification of children at risk: An international perspective. New York: Plenum.

Siegel, L. S. (1985). Biological and environmental variables as predictors of intellectual functioning at 6 years. In S. Harel & N. Anastasiow (Eds.), The at-risk infant: Psycho/socio/medical aspects. Baltimore, Md.: Brookes.

Siegel, L. S. (1985). Psycholinguistic aspects of reading disabilities. In L. S. Siegel & F. J. Morrison (Eds.), Cognitive development in atypical children (pp. 45-65). New York: Springer-Verlag.

Siegel, L. S., & Cunningham, C. E. (1984). Social interactions: A transactional approach with illustrations from children with developmental problems. In A. Doyle, D. Gold & D. S. Moskowitz (Eds.), Children in families under stress. San Francisco: Jossey Bass.

Siegel, L. S. (1984). Home environmental influences on cognitive development in preterm and fullterm children. In A. W. Gottfried (Ed.), Home environment and early cognitive development. New York: Academic Press.

Van der Spuy, H. I. J., Cunningham, J., Siegel, L. S., Elbard, H., Nielsen, E., & Richards, J. (1983). Evaluation of a treatment program for children with specific language delay. In H. D. Rosler, J. P. Das, & I. Wald (Eds.), Mental and language retardation - Diagnosis, development, rehabilitation. Berlin: VEB Deutcher Verlag der Wissenschaften.

Siegel, L. S. (1983). Child health and development in English Canada 1790-1850. In C. G. Roland (Ed.), Health, disease and medicine: Essays in Canadian history (pp. 360-380). Agincourt, Ontario: Clarke Irwin.

Siegel, L. S. (1983). The prediction of possible learning disabilities in preterm and fullterm infants. In T. Field & A. Sostek (Eds.), Infants born at risk: Physiological, psychological, perceptual processes. New York: Grune & Stratton.

Linder, B. A., & Siegel, L. S. (1983). The learning paradigm as a technique for investigating cognitive development. In J. Bisanz, G. Bisanz, & R. Kail (Eds.), Learning in children. New York: Springer-Verlag.

Siegel, L. S. (1982). The discrepancy between cognitive and linguistic abilities in the young child. In F. Lowenthal, F. Vandamme & J. Cordier (Eds.), Language acquisition. New York: Plenum Press.

Siegel, L. S. (1982). The development of quantity concepts. Perceptual and linguistic factors. In C. J. Brainerd (Ed.), Children's logical and mathematical cognition. New York: Springer-Verlag.

Siegel, L. S., & Hodkin, B. (1982). The garden path to the understanding of cognitive development: Has Piaget led us into the poison ivy? In S. Modgil & C. Modgil, The taming of Piaget: Crossfires and crosscurrents. London, England: National Foundation for Research.

Siegel, L. S. (1981). "One of the family." In A different understanding: Normal needs of children with disabilities. TV Ontario, Ontario Education Communications Authority, Toronto.

Siegel, L. S. (1981). The use of a Piagetian analysis of infant development to predict cognitive and language development: at two years. In M. P. Friedman (Ed.), Intelligence and learning. New York: Plenum.

Siegel, L. S. (1978). The relationship of language and thought in the preoperational child: A reconsideration of nonverbal alternatives to Piagetian tasks. In L. S. Siegel & C. J. Brainerd, Alternatives to Piaget: Critical essays on the theory. New York: Academic Press.

Siegel, L. S. (1977). Cognitive development. Chapter for B. McCandless and R. Trotter, Children, New York: Holt, Rinehart & Winston.

Book Reviews:

Siegel, L. S. (2000). Manufacturing Debate: The Reading Pseudowars. Review of Gerald Coles Reading Lessons: The Debate Over Literacy. Contemporary Psychology, 45, 33-35.

Siegel, L. S. (1999). The complexity of learning disabilities. Review of B. Wong (Ed.) Learning about learning disabilities: 2nd Edition. San Diego: Academic Press, 1998. Canadian Journal of Experimental Psychology, 52, 52-54.

Siegel, L. S. (1998). Review of Otfried Spreen and Esther Strauss, A Compendium of Neuropsychological Tests (2nd Ed.). Oxford University Press, 1998. 736 pages. Annals of the Royal College and Surgeons of Canada.

Siegel, L. S. (1998). Learning to talk and communicate. Review of Paula Menyuk, Jacqueline W. Liebergott, & Martin C. Schultz, Early language development in full-term and premature infants. Hillsdale, NJ: Erlbaum, 1995. Contemporary Psychology, 43, 339-340.

Siegel, L. S. (1995). Review of A. Vyt, H. Bloch, and M. Bornstein (Eds.), Child development a la carte. Early child development in the French tradition: Contributions from current research. Contemporary Psychology, 40, 1084-1085.

Siegel, L. S. (1992). Review of B. P. Rourke (Ed.), Neuropsychological validation of learning disability subtypes. Contemporary Psychology, 37, 579-580.

Siegel, L. S. (1991). Review of D. J. Johnson and J. W. Blalock (Eds.), Adults with learning disabilities: Clinical studies, (1987) Clinical Neuropsychologist, 5, 377-379.

Siegel, L. S. (1989). Vulnerability, resilience, and the developing child. Review of S. Escalona, Critical Issues in the Early Development of Premature Infants. Contemporary Psychology, 34, 604-605.

Levin, M. A., & Siegel, L. S. (1988). Review of H. Mehan, A. Hertweck, and J. L. Meihls, Handicapping the Handicapped. Curriculum Inquiry, 18, 343-353.

Siegel, L. S. (1987). Review of M. Wright, Compensatory Education in the Preschool. Canadian Psychology, 28, 350-351.

Siegel, L. S. (1986). Reply to Leong. Canadian Psychology, 27, 311-312.

Siegel, L. S. (1985). Review of S. Chess and A. Thomas (Eds.), Annual Progress in Child Psychiatry and Child Development 1983. Canadian Journal of Psychiatry, 30, 458-459.

Siegel, L. S. (1985). Biological and cognitive perspectives in infancy. Review of L. P. Lipsitt and C. Rovee-Collier (Eds.), Advances in Infancy Research. Contemporary Psychology, 30, 815-816.

Siegel, L. S. (1985). Review of J. Downing and C. K. Leong (Eds.), Psychology of Reading. Canadian Psychology, 26, 300-301.

Siegel L. S. (1984). Grinning, gazing, glowering and grimacing. Contemporary Psychology, 29, 148-149. Book review of R. S. Feldman (Ed.), Development of non-verbal behavior in children.

Siegel, L. S. (1983). Advancing through development. Contemporary Psychology, 28, 906-907. Book review of M. E. Lamb and A. L. Brown (Eds.), Advances in developmental psychology: Vol. 2.

Siegel, L. S. (1980). Thinking: What develops? Contemporary Psychology, 25, 938-939. Book review of Herbert B. Klausmeier and Associates. Cognitive learning and Development: Information processing and Piagetian perspectives.

Books:

van den Bos, K. P., Siegel, L. S., Bakker, D. J., & Share, D. L. (Eds.) (1994). Current directions in dyslexia research . Lisse, the Netherlands: Swets & Zeitlinger.

von Tetzchner, S., Siegel, L. S., & Smith, L. (1989). The social and cognitive aspects of normal and atypical language development, New York: Springer-Verlag.

Siegel, L. S., & Morrison, F. J. (1985). Cognitive development in atypical children. New York: Springer-Verlag.

Siegel, L. S., & Brainerd, C. J. (1978). Alternatives to Piaget: Critical essays on the theory. New York: Academic Press.

Newspaper Articles:

Siegel, L. S. Ben Johnson case questions validity of IQ tests. Toronto Star, June 1989, p. A15.

Organizational:

1975	Appointed Fellow, Division 7, American Psychological Association
1979-1987	Society for Research in Child Development Program Committee
1980	Appointed Fellow, Canadian Psychological Association
1983-1985	Chair, Program Committee, SRCD 1985
1985-1986	President, Developmental Section, Canadian Psychological Association
1985-1991	Member of the Governing Council, SRCD
1989-1992 1998-2002	Member, Executive Committee, International Academy for Research in Learning Disabilities
1991-1994	Chair, Scientific Affairs Committee, Canadian Psychological Association
1991-1997	Member, Board of Directors and Executive, Canadian Psychological Association

Other:

1994-1998	Member, Women's Faculty Awards Review Committee, NSERC

1994	Member, Scholarship and Fellowship Selection Committee, Natural Sciences and Engineering Research Council (NSERC)
1993	Member, Psychology Committee, Social Sciences and Humanities Research Council (SSHRC)
1986-1990	Member, Psychology Grant Selection Committee, Natural Sciences and Engineering Research Council (NSERC)
1986-1991	Member, Medical Research Council (MRC) Studentship Committee
1988-1990	Consultant, FAO-UNDP project on Improving Postgraduate Education, India.
1989-1991	Member, Review Committee, Ontario Graduate Scholarships.
1996-1997	Member, Tri-council Working Group on Ethics in Human Experimentation
2002-2003	Special Grant Review Panel, Institute of Educational Services (US Government)
2002-2003	Special Grant Review Panel, NICHD
2002-2005	Member National Panel on Literacy Development of Language Minority Children and Youth
2004-2005	Member, SSHRC Grant Selection Committee - Education
2005-2008	Member Scholarships and Fellowships Selection Committee NSERC
2005	Member, NICHD Panel to Review Learning Disability Research Centres

UBC:

1998-2002	UBC President's Senior Appointments Committee
1998-2001	Member, UBC Faculty Awards Committee
1997-present	Adjudication Committee, Peter Wall Institute for Advanced Studies
2002-2003	Member, UBC Behavioural Research Ethics Board
2002-2004	UBC Policy Committee, Faculty of Education

Other publications:

Siegel, L.S. (2005) Early identification and intervention to prevent dyslexia: A system that works for English first language and ESL speakers Dyslexi 10, 26-29.

Siegel, L. S., Albercht, G., Jette, A. & Petrie, H. (2001). An Evaluation of Swedish Disability Research. Report for the Swedish Council for Working Life and Social Research.

Siegel, L. S. & Ladyman, S. (2000). Review of Special Education in British Columbia. Report for the Province of British Columbia, Ministry of Education, 2000.

Siegel, L. S. (2000). Adolescent suicide and learning disabilities: a causal connection? Lifenotes: A Suicide Prevention and Community Health Newsletter, 5, 2, 8-9

Report to the British Columbia Ministry of Education - Assessing The Individual Learning Needs of Students with Linguistic and Culturally Different Backgrounds. With L. Gunderson. B.C. Ministry of Education, 1998- 1999

Siegel, L. S. (1995). Debate & argument: Reply to Dr. Koelega: Is the continuous performance task useful in research with ADHD children? Comments on a review. Journal of Child Psychology and Psychiatry, 36, 1487-1493.

Siegel, L. S. (1993). The discrepancy definition of dyslexia. Newsletter of Division 2 of the American Speech-Language-Hearing Association, 3, 7-11.

Siegel, L. S. (1991). IQ is irrelevant to the definition of learning disabilities. Abstract: The Year Book of Psychiatry and Applied Mental Health. 76-78.

Siegel, L. S. (1991). Learning disabilities: The past and the future. National: A publication of the Learning Disabilities Association of Canada, 28, 39-40.

Siegel, L. S. (1991). Interview about learning disabilities. The Ontario Psychologist, 8-9.

Siegel, L. S. (1990). Siegel's reply. Journal of Learning Disabilities, 23, 268-269, 319.

Siegel, L. S. (1989). Forward to Molfese, V. J. Perinatal risk and infant development. New York: Guilford Press.

Siegel, L. S. (1987). Pediatric psychology in Canada. Newsletter of the Society of Pediatric Psychology, 11, 5-7.

Submitted Manuscripts:

Low, P. B. & Siegel, L. S. (2005) A comparison of the cognitive processes of underlying reading comprehension in native English and ESL Speakers.

Manuscripts Under Review:

Vukovic, R. K., & Siegel, L. S. (2005). Cognitive processing skills and reading comprehension: The role of phonological awareness, rapid naming, and working memory.

Vukovic, R. K., & Siegel, L. S. (2005). The role of working memory in reading comprehension difficulties.

Research Grants:

The development of number and logical concepts in young children. Medical Research Council of Canada, 1969-76.

The role of perinatal factors in subsequent language and cognitive development of high risk infants. The Ontario Mental Health Foundation, 1975-1979, 1980-1984.

Family communication patterns, cognitive components and social factors related to developmental language delay. With H. I. J. van der Spuy and C. Cunningham (Principal Investigator). The Ontario Mental Health Foundation, 1977-1985.

Psychosocial and developmental factors correlated with failure to thrive children below the age of three. With M. Spinner (Principal Investigator), G. Brykowych, W. M. Wilson and H. R. Morrison. Medical Research Council of Canada, 1979-1981.

The effects of methylphenidate (Ritalin) on the social behaviour of hyperactive children. With C. Cunningham (Principal Investigator), Health & Welfare of Canada, 1979-1985.

Short-term memory processes in children with learning disabilities. Natural Sciences and Engineering Research Council, 1981-1988.

Early identification of children at-risk for subsequent learning disabilities. OISE Research Grant. 1986-1987.

Efficacy of a conversational model of language intervention with specifically language delayed and developmentally delayed children. Ontario Mental Health Foundation. 1987-1989.

Early identification of infants at risk for developmental problems. With D. Cooper and P. Fitzhardinge. Hospital for Sick Children Foundation. 1987-1989.

Predictors of Specific Learning Disabilities: A Prospective Study of "At-Risk" Children from Birth to School Age with D. Cooper & P. Fitzhardinge, Atkinson Charitable Foundation, 1988.

Memory language phonological skills and reading. Natural Sciences and Engineering Research Council, 1988-1991.

Early Identification of Learning Disabilities Using Brainstem Auditory Evoked Responses, Perinatal, and Demographic Factors. With D. Cooper and P. Fitzhardinge. Ontario Mental Health Foundation, 1990-1993.

Standardization of the French-language Adaptation of Section III (Elaborated Sentences) of the Test for Auditory Comprehension of Language-Revised. With N. Alma, S. Gautheron, L. Latulippe, and M-N. Olivier. Ontario Ministry of Education, 5/92 to 5/93.

The Prediction and Remediation of Learning Disabilities. SSHRC Grant, 1994-1997.

Speech impairments, phonological processing deficits, and early literacy. With M. Vandervelden. Hospital for Sick Children Foundation, October 1995 - September 1997

The Development of Reading Skills. Natural Sciences and Engineering Research Council, 1991-1996, renewal award 1996-2001.

Phonological Awareness and Syntactic Skills in Bilingual Farsi-English Speaking and

Cantonese-English Speaking children. UBC Humanities and Social Sciences Research Grant, 1997-1998

Understanding Speech Perception Factors in the Reading Failure of ESL Speakers. UBC Humanities and Social Sciences Research Grant, 1998-2000 - $2,000

Assessing The Individual Learning Needs of Students with Linguistic and Culturally Different Backgrounds. With L. Gunderson. BC Ministry of Education, 1998- 1999 - $22,600.

Teaching and Learning Enhancement. Problem Based Learning, 1999 - $24,500

Early Detection of Language Disorders in Genetically and Perinatally High Risk Infants. Co-investigator with Janet Werker (principal investigator), Barbara Bernhardt and Carolyn Johnson. Collaborative Health Research Project Grant, Natural Sciences and Engineering Research Council, 2002-2005 - $295,095.

The development of phonological and orthographic skills in normal and disabled readers. Natural Sciences and Engineering Research Council of Canada, 2002-2006 - $225,000.

Early Identification and Intervention for Reading Difficulties Using a Teacher and Classroom Based Model. Canadian Language and Literacy Research Network. 2003

Early Identification and Intervention for Reading Difficulties Using a Teacher and Classroom Based Model. Canadian Language and Literacy Research Network. 2004 - $26,000.

Childhood/Adolescents/Young Adults Cancer Survivorship Research Program. BC Cancer Agency. Mary McBride (Principal Investigator) 2005-2008 $1,536,156.

Child and Youth Developmental Trajectories Unit (CYDTRU). Co-investigator with Clyde Hertzman (Principal Investigator). Michael Smith Foundation for Health Research Grant, MSFHR Research Unit Infrastructure Program, 06/2004 – 06/2009 -$1,000,000

Understanding Dyslexics: Who are the Treatment Resisters? IDA Research Grant Award 2005 – 2006 U $15, 000.00 US

Cognitive components of Mathematical Disabilities. Laurie Ford co-investigator. SSHRC 2005-2008 $126,000

Magnetic Resonance Imaging of Neurodevelopment in Children. Co-investigator with Christian Beaulieu (Principal investigator) and Linda Phillips. Both C. Beaulieu and L. Phillips are at the University of Alberta. Canadian Language and Literacy Research Network. 2005 $50,000.

The development of computerized assessment techniques for minority language children, children in immigrant families and aboriginal children. Canadian Language and Literacy Research Network 2005-2006 $50,000.

Neuropsychology of Long Term Childhood Cancer Survivors. Grand Development Award. 2005 $4,250

This is **Exhibit "B"** mentioned and referred to in the affidavit of Linda Siegel sworn before me at the City of Vancouver, in the Province of British Columbia, this day of March, 2006.

_____

Name: _____
A commissioner for taking Affidavits for British Columbia.

Siegel, L. S. (1993). The cognitive basis of dyslexia. In R. Pasnak & M. L. Howe (Eds.), Emerging themes in cognitive development Vol II: Competencies (pp. 33-52) NY: Springer-Verlag.

2 The Cognitive Basis of Dyslexia

LINDA S. SIEGEL

Dyslexia is a condition in which individuals, despite average or above average intelligence, have great difficulty in learning to read. Dyslexia is a diagnosis by exclusion; dyslexics have average or above average IQ test scores, have had adequate instruction in reading, and do not have neurological problems such as seizure disorders or significant emotional disturbances that might be considered to be responsible for their difficulty in acquiring reading skills. There has been much discussion of, and controversy about, this disorder. In this chapter, I will review some of these controversial and definitional issues, and present a model of the underlying nature of the cognitive deficits involved in dyslexia. I will examine the empirical evidence for this model by reviewing a number of studies of dyslexic and normal readers.

Definitional Issues

There are three major issues in the definition of dyslexia that are critical to the understanding of this disorder. The first issue involves the nature of the reading process and the appropriate way to measure reading. The second is the role of intelligence, operationally defined by IQ test scores, in the definition of dyslexia, and the third issue involves the nature of the dyslexic population, specifically the degree of homogeneity and whether there are distinctive subtypes within this population.

The Measurement of Reading

Reading has been measured in a variety of ways (for an extended discussion see Siegel & Heaven, 1986). There are four types of material that are typically found in reading tests: nonwords (also called pseudowords), single words, sentences, and paragraphs. Pseudowords are pronounceable combinations of letters that are not real English words, and the reading of these pseudowords is a test of the acquisition of grapheme–phoneme

conversion (GPC) rules. It is important to note that these pseudowords can be read only by the application of these GPC rules and not from visual memory, because, by definition, these pseudowords have never been seen before because they do not exist as words in the English language. Tests with single words involve the reading of isolated words and are called tests of word recognition. The words may be decoded; that is, read with the application of GPC rules, or they may be recognized through direct visual access with no intermediate phonological coding. The reading of sentences and paragraphs may involve the use of cues from the surrounding context and does not allow the determination of whether or not the correct reading involves a good guess because individual words are often predictable from the context. The issue of generalization from context is not relevant with words or pseudowords because there is no context. On these grounds, single-word or pseudoword reading represents purer tests of reading skill uncontaminated by guessing from surrounding context.

Paragraph and sentence reading tests are usually reading comprehension tests. Reading "comprehension" tests, as they are currently constructed, have a number of serious conceptual and methodological problems. First of all, most of the questions involve merely searching the text for the correct verbatim phrase rather than making an inference (Tal & Siegel, 1990). A number of the questions can be answered without reading the passage (Tal & Siegel, 1990). As these tests are timed, speed rather than quality of reading is probably being measured. For example, Biemiller and Siegel (1991) found that by giving children a little extra time their reading scores increased dramatically. However, the most serious problem with the use of low scores on reading comprehension tests as an operational definition of dyslexia is that it does not yield a clear and consistent picture of dyslexia. Specifically, children with a low score on a reading comprehension test and good word recognition skills are not different from normal readers on syntax and phonological processing tasks (Siegel & Ryan, 1989a). On the other hand, if dyslexia is defined on the basis of poor word recognition skills, children with dyslexia have significantly poorer phonological processing, syntactic awareness, and short-term and working memory skills than normal readers. For these reasons, it is important to use poor word recognition skills, and not poor "comprehension" skills, as the operational definition of dyslexia.

The Role of Intelligence

Although intelligence, or more properly IQ, has been conceptualized as an important part of the definition of dyslexia in that individuals must have average or above average IQ scores to be considered dyslexic and, even further, in some definitions have significantly lower reading scores than would be predicted by their IQ, recent accounts of dyslexia suggest

that intelligence may not be a central construct. These issues are summarized in Siegel (1988b, 1989a, 1989b, 1990a, 1990b). For example, instead of emphasizing intelligence, Stanovich (1988a, 1988b) has proposed that a deficit in phonological processing is the core deficit of a reading disability. Stanovich characterized phonological processing as a modular function that "is not under the direction of higher level cognitive structures and is not supplemented by real world knowledge." Furthermore, according to Stanovich's model, phonological processing "may fail without disrupting the operations of central processes that do not depend on its output, and also that efficiently functioning central processes cannot remedy a module that is functioning inefficiently" (Stanovich, 1988b, p. 158). This theory would predict that a phonological processing deficit should be characteristic of all disabled readers, and that phonological processing deficits should be independent of general cognitive ability (operationally defined as IQ test scores). Regarding the first prediction, there is ample evidence, described later in this chapter, that difficulty with phonological processing is a pervasive characteristic of dyslexics. Regarding the second prediction, phonological processing should show a much stronger correlation with reading skills than general cognitive ability. Further, IQ scores should not contribute a significant amount of independent variance to the prediction of reading skills.

There is evidence from a number of sources that phonological processing skills are independent of general cognitive abilities. Reading disabled children at all IQ levels show equal difficulty with phonological processing tasks such as pseudoword reading, recognizing the visual form of a pseudoword, pseudoword spelling, and a phonological lexical task that involves distinguishing which of two pseudowords sounds like a real word (e.g., *kake-dake*, *joak-joap*) (Siegel, 1988a). That is, when reading disabled children at four IQ levels, <80, 80–90, 91–109, >109, were compared, there were no significant differences among these groups on tasks that involved phonological processing skills. All the reading disabled children performed at a level significantly below that of normally achieving children but there were no significant differences among the reading disabled groups, despite significant differences in IQ. The significance of this finding is that if phonological processing ability is impaired, as it was in these reading disabled children, even high levels of cognitive functioning cannot compensate for the deficit.

The traditional definition of an individual with dyslexia is one where there must be a discrepancy between the IQ and the reading score, such that the reading score is significantly lower than would be predicted by the IQ. That is, the reading score must be, in some way, "unexpected." For children who have low IQ scores and are poor readers, the expectation is that their poor reading skills are in some way related to their low IQ scores so their reading failure is not unexpected. A consequence of these assumptions is that children who are poor readers and who have high IQ

scores are different from those who are poor readers and who have lower IQ scores. In order to examine these assumptions, I studied the differences between dyslexic children, children whose reading scores were significantly below their IQ, and poor readers, whose reading scores were not below the level that would be predicted from their IQ, on any of a variety of phonological processing, language, and memory tasks (Siegel, 1991). I found no differences between these two groups on tasks that were related to reading, syntactic awareness, and verbal short-term and working memory. However, both groups demonstrated significantly poorer performance than normal readers. These results suggest that high IQ scores do not protect an individual from reading problems or influence the nature of the reading problems when they occur.

Another approach to examining these issues involves comparing the relative contributions of IQ and pseudoword reading, one of the best measures of phonological processing skills, to word recognition and reading comprehension. If phonological skills contribute most of the variance and IQ scores contribute little independent variance, then this finding would suggest that phonological processing is the key component of reading and that general cognitive ability is not a significant factor. If, on the other hand, IQ is a significant correlate independent of phonological processing, this finding would suggest that IQ is important. When

TABLE 2.1 Results of the multiple regression analyses.

WRAT Reading n = 1106		
Order of entry	Multiple R	R^2
1. Pseudoword reading	0.81	0.65
2. IQ	0.82	0.67
1. IQ	0.43	0.19
2. Pseudoword reading	0.82	0.67
Gilmore Comprehension n = 412		
Order of entry	Multiple R	R^2
1. Pseudoword reading	0.51	0.26
2. IQ	0.54	0.30
1. IQ	0.40	0.16
2. Pseudoword reading	0.54	0.30
Stanford Comprehension n = 170		
Order of entry	Multiple R	R^2
1. Pseudoword reading	0.59	0.35
2. IQ	0.64	0.41
1. IQ	0.42	0.18
2. Pseudoword reading	0.64	0.41

the relative contributions of IQ scores and phonological processing were examined, IQ did contribute little independent variance to the prediction of word reading and reading comprehension scores (Siegel, in press). These results are shown in Table 2.1. As can be seen from the data presented in Table 2.1, when pseudoword reading is forced into the multiple regression first, IQ contributed relatively little independent variance but when IQ was forced in first, pseudoword reading contributed a great deal of independent variance. These studies have led to the conclusion that phonological processing deficits can exist at all levels of IQ scores and that the problems of the individual with dyslexia are similar whatever the IQ level.

Subtypes of Dyslexia?

Although it is often claimed that there are subtypes within the population of dyslexic individuals, there is no definitive evidence for the existence of subtypes within the population of dyslexic individuals. My colleagues and I have examined the evidence for the existence of these subtypes and have found significant definitional, methodological, and statistical problems with the existing studies of subtypes of reading disabled individuals. These issues are reviewed in Morrison and Siegel (1991b), Siegel and Heaven (1986), Siegel, Levey, and Ferris (1985), and Siegel and Metsala (1991). There are, however, subtypes within the learning disabled population and this heterogeneity within the learning disabled population is mistakenly interpreted as heterogeneity within the reading disabled population. There is a group of children who have difficulties with arithmetic and written work, and often spelling, but not with word recognition or pseudoword reading; these individuals are often labeled as dyslexic when, in fact, they are not (Morrison & Siegel, 1991a; Siegel & Feldman, 1983). In addition, as noted earlier in this chapter, we have found that children with reading comprehension problems are a heterogeneous group and if a deficit in reading comprehension is used to define a reading disability, subtypes will emerge (Siegel & Ryan, 1989a). However, we argue that the finding of subtypes is an artifact of the definition and that if a definition of reading disability is based on poor word recognition or pseudoword reading skills, then the group labeled dyslexic is quite homogeneous in regard to their performance on tasks that tap the basic cognitive processes related to reading.

Basic Cognitive Processes in Reading

The development of a clear and precise definition of dyslexia has resulted in a formulation of the cognitive aspects of this disability. Specifically, there are three processes that are significant in the development of

reading skills in English. These processes are phonological processing, syntactic awareness, and working memory. *Phonological processing* involves a variety of skills but in the context of the development of reading skills, the most significant is the association of sounds with letters; that is, the understanding of grapheme–phoneme conversion rules and the exceptions to these rules. This ability is the basis of decoding print, and although there are other routes to obtain meaning from print, the phonological route is clearly an important one and critical in the early development of reading skills (e.g., Stanovich, 1988a, 1988b). *Syntactic awareness*, also called grammatical sensitivity, refers to the ability to understand the syntax of the language. This ability appears to be critical for fluent and efficient reading of text that requires making predictions about the words that come next in the sequence. *Working memory* refers to the retention of information in short-term storage while processing incoming information and retrieving information from long-term storage. In the context of reading, working memory is relevant because the reader must decode and/or recognize words while remembering what has been read and retrieving information such as grapheme–phoneme conversion rules. During the years in which reading skills are acquired, there is a significant growth in all these skills.

In the following sections, I will provide details of the growth of these skills in children who are normal readers and also in children with dyslexia. I will also examine the similarities and differences in the reading skills of dyslexic and normal readers. It has been a common belief that individuals with dyslexia have perceptual problems but, as outlined by Vellutino (1979), this assumption is an incorrect one. In fact, the difficulties experienced by dyslexics involve a variety of language skills, as Vellutino has argued and as I will illustrate in this chapter.

Phonological Processing

Current theories of the development of reading skills in English stress that phonological processing is the most significant underlying cognitive process. Arguments for this position are outlined in Stanovich (1988a, 1988b). Phonological processing is conceptualized as a modular process that is not under the control of higher level structures. Therefore, a deficit in phonological processing cannot be compensated for by high levels of cognitive functioning (e.g., as indicated by measured intelligence). Other skills cannot be mobilized to accomplish what the phonological processing module does. Phonological processing involves a variety of functions but, in the context of the development of reading skills, the most significant is the association of sounds with letters or combinations of letters, referred to as the understanding of grapheme–phoneme conversion (GPC) rules; because of the irregular nature of

these correspondences in English, the learning of the GPC rules is a very complex process.

For children learning to read English, the learning of these correspondences is a result of systematic instruction and the extraction of the rules is a result of repeated encounters with print. There are no data available to provide evidence as to how much of the development of these skills is a result of specific instruction in the GPC rules and how much is a result of experience with print. In any case, the understanding of the GPC rules develops rapidly in the first years of experience with print under normal conditions, as will be illustrated in this chapter.

Measurement of Phonological Processing Skills

In an alphabetic language such as English, the best measure of phonological processing skills is the reading of pseudowords; that is, pronounceable combinations of letters that can be read by the application of GPC rules, but, of course, are not real words in English. Examples include pseudowords, such as *shum*, *laip*, and *cigbet*. All of these pseudowords can be read by anyone who is familiar with the GPC rules of English even though these are not real words and have not been encountered in print or in spoken language before.

There have been a number of studies of the development of the ability to read pseudowords (e.g., Calfee, Lindamood, & Lindamood, 1973; Hogaboam & Perfetti, 1978; Venezky & Johnson, 1973). There is ample evidence that children with dyslexia have a great deal of difficulty reading pseudowords. Studies such as those of Snowling (1980), Siegel and Ryan (1988), and Waters, Bruck, and Seidenberg (1985) have shown that dyslexics have more difficulty reading pseudowords than normal readers matched in either chronological age or reading level. For example, we have studied the development of the ability to read pseudowords in normal and dyslexic readers, aged 7 to 14 years (Siegel, 1986; Siegel & Ryan, 1988). By the age of 9 years, the normal readers are quite proficient and performing at almost a perfect level for even the most difficult pseudowords, with, in some cases, as many as four syllables. However, the performance of the dyslexic children was quite different. The children with dyslexia acquired these reading skills very slowly, and even at the age of 14 years were performing no better than normal readers at the age of 7 years. These data are shown in Figure 2.1.

The above comparisons are based on chronological age. An alternative way of studying both the development of reading skills and the differences and similarities between normal and dyslexic readers is the use of a match based on reading age, also called reading level. This type of design is used to attempt to equate experience with reading print. The theory of this type of comparison is that children who are poor readers probably read less and, therefore, do not have the same exposure to print so it would be

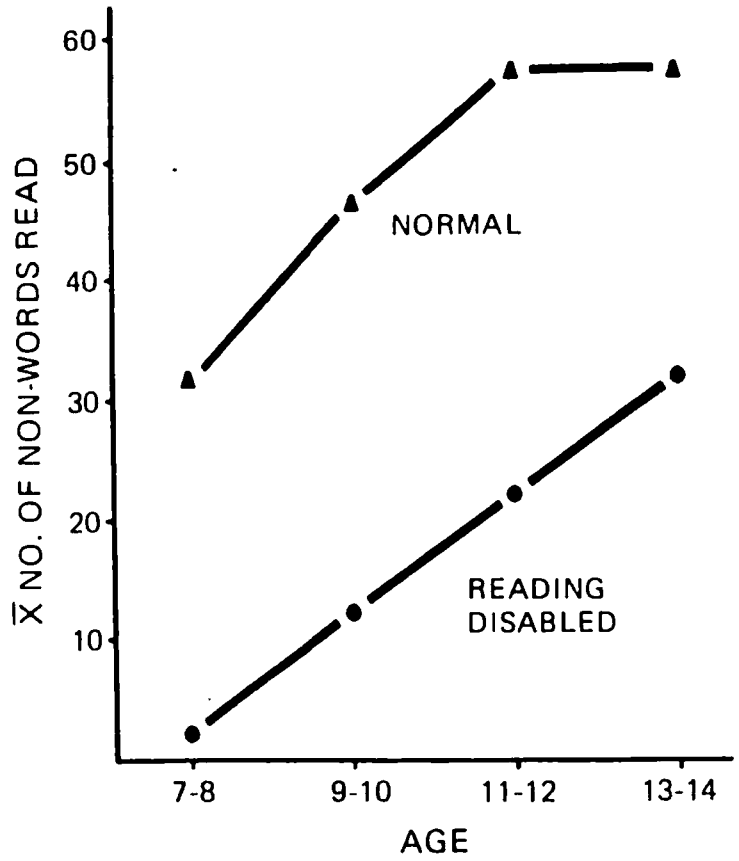

FIGURE 2.1. Accuracy of pseudoword reading as a function of chronological age and group.

expected that a chronological age match would put the disabled readers at a disadvantage. In order to control for experience with print, a comparison of dyslexic and normal readers matched on reading grade level was used. Even when the normal readers and the dyslexics were matched on reading level (hence the dyslexics were considerably older than the normal readers), the performance of the dyslexics on the reading of pseudowords was significantly poorer than the normal readers. That is, even at the same level of proficiency in reading words as normal readers, dyslexics experienced considerable difficulty reading pseudowords. These data are shown in Figure 2.2.

Thus, the acquisition of these phonological processing skills occurs very slowly in children with serious reading problems. This difficulty seems to be the fundamental problem of children with dyslexia and often continues even to adulthood. Many adults with dyslexia become reasonably fluent readers but still have difficulty reading pseudowords or read them very slowly (e.g., Barwick & Siegel, 1990; Bruck, 1990; Shafrir & Siegel, 1991).

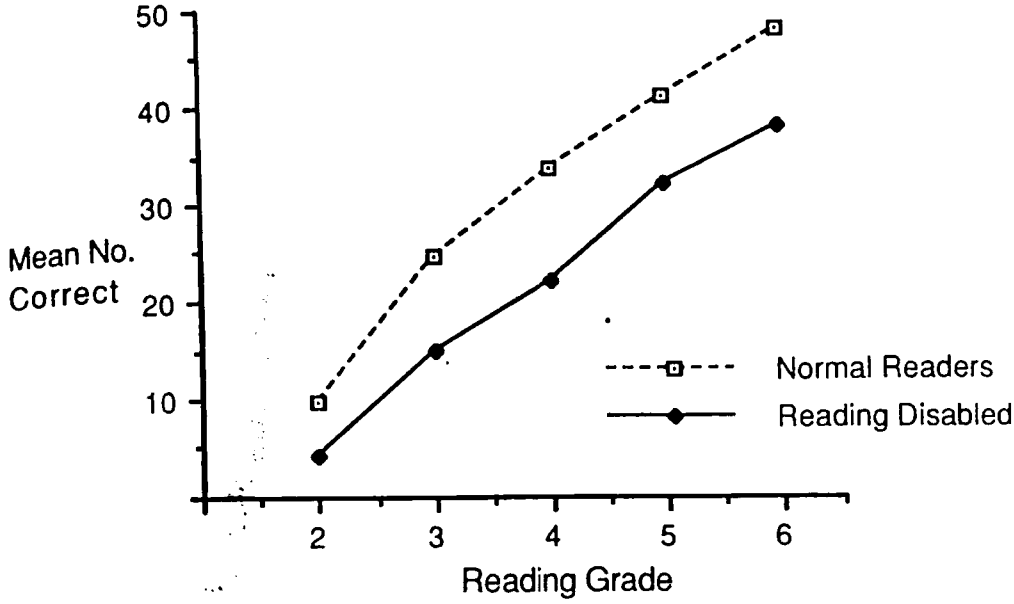

FIGURE 2.2. Accuracy of pseudoword reading as a function of reading grade level and group.

There are other kinds of tasks that have been used to measure the development of the understanding of grapheme–phoneme conversion rules. They provide additional evidence that dyslexics have difficulty with the phonological route and use other processes to read words. In one study, we contrasted the reading of pseudowords that could be read by analogy or by phonics, for example, *puscle*, *fody*, *risten* (Siegel & Geva, 1990). Dyslexics had a great deal of difficulty with these pseudowords. The dyslexics were significantly less likely than normal readers of the same chronological age to read these words correctly. Even when matched with normal readers of the same reading grade level, they had significantly lower scores. Compared to the normal readers of the same chronological or reading ages, dyslexics were significantly less likely to use a rule-based strategy and more likely to use an analogy strategy. This pattern suggests a greater reliance on the visual route.

Although we have evidence about the inadequate phonological skills of dyslexics, little is known about the manner in which the complex set of grapheme–phoneme conversion rules of the English language is acquired. The ascertainment of the order and nature of the acquisition of these rules is an important first step in the understanding and treatment of dyslexia. A number of investigators have begun to work on these issues (e.g., Guthrie & Seifert, 1979; Siegel & Faux, 1989; Snowling, 1980). To study this acquisition process, we presented dyslexics and normal readers with words and pseudowords that involved a variety of grapheme–phoneme conversion rules, such as consonant blends, r-influenced vowels,

inconsistent vowels, etc. (Siegel & Faux, 1989). We found that complexity, as measured by the number of syllables in a pseudoword, was a significant determinant of the difficulty or reading the pseudoword. Pseudowords with two or more syllables were quite difficult for older dyslexics (11–13 years) even though normal readers had become quite proficient by the age of 9 to 10 years. Even simple vowels and consonant blends were not mastered by the oldest dyslexics in the study (ages 11–14 years) when they were required to read pseudowords such as *mog*, *lun*, and *spad*, although most of the 7- and 8-year-old normal readers had no difficulty with these features in words or pseudowords.

In most cases, even when the dyslexic readers appeared to demonstrate mastery of grapheme–phoneme conversion rules when they read a word, they were unable to read a pseudoword with the same rule. Dyslexics experienced unusual difficulty when reading pseudowords. Even when they could read words with particular letter sound correspondences in CVC words, such as *ran*, *wet*, and *sit*, they could not read pseudowords such as *han*, *fet*, and *rit*, and although they could read words involving consonant blends, such as *hunt*, *spot*, and *help*, they could not read pseudowords of a similar structure, such as *lunt*, *grot*, and *melp*.

This superiority of words over pseudowords suggests that the dyslexic children were using some sort of direct lexical access that, of course, they could use when they read words but that was not possible in the reading of pseudowords. It is probable that this direct lexical access involves processing each word as a picture (visual representation) rather than as a series of letters with sounds. This visual representation, rather than GPC rules, is retrieved from long-term memory.

One relatively simple "rule" of English, with few exceptions, is that a final "e" in a one-syllable word makes the vowel long. This rule was not mastered by the oldest dyslexics in this study. That is, the older dyslexics could correctly read the words that contained these rules (e.g., *like*, *cute*, *nose*) but could not read the comparable pseudoword (e.g., *rike*, *fute*, *mose*). This difficulty is quite surprising since this rule is repeatedly stressed in reading instruction and is normally mastered very early in the development of reading skills. When the reading disabled and normal readers were matched on reading grade level, there were many instances in which the scores of the reading disabled were significantly lower than those of normal readers who were the reading grade level controls. For example, the normal readers had significantly higher scores than the disabled readers of the same reading age on the following tasks: reading one syllable pseudowords at grade level 3, two-syllable pseudowords at grades 4 to 5, multisyllable pseudowords at grade 6, and pseudowords with consonant blends at grade levels 2, 3, and 6. There were some cases in which there were no diffierences between dyslexics and reading level matched normal readers; however, these instances were often ones in which there were floor or ceiling effects.

Words can obviously be read by some sort of direct visual access but pseudowords cannot be read without intermediate phonological processing, because, by definition, there is no word in the internal lexicon that matches a pseudoword. Hence, these data indicate that dyslexics have a severe deficit in phonological processing.

Pseudoword reading is not the only task that distinguishes dyslexics from normal readers. Another task is the spelling of pseudowords. Dyslexics make significantly lower scores on a task that involves the spelling of pseudowords, even when the dyslexics are at the same reading grade level as younger normal readers (Siegel & Ryan, 1988).

One type of evidence of phonological processing skills is the use of phonological recoding in short-term memory such that rhyming (confusable) stimuli are more difficult to remember than nonrhyming stimuli. A number of studies have found that younger poor readers are less disrupted by rhyming stimuli (e.g., Bryne & Shea, 1979; Mann, Liberman, & Shankweiler, 1980; Shankweiler, Liberman, Mark, Fowler, & Fischer, 1979; Siegel & Linder, 1984). However, Johnston (1982) and Siegel and Linder (1984) have found that older dyslexic children do show phonetic confusability although their short-term memory for letters was significantly poorer than age-matched controls. This latter finding is not surprising as phonological recoding skills are likely to be involved in any verbal memory task and the poor verbal memory of the dyslexics may be a function of inadequate phonological abilities.

Phonemic awareness, the ability to recognize the basic phonemic segments of the language, is obviously an important component of phonological processing. There is evidence that difficulties with phonemic awareness predict subsequent reading problems (e.g., Bradley & Bryant, 1983; Wallach & Wallach, 1976). Poor readers also have deficits in phonological production tasks; for example, naming of objects represented by multisyllable words, and with repetition of multisyllabic words and difficult phrases with alliteration. Pratt and Brady (1988) found differences between good and poor readers on the ability to segment words into phonemes and delete sounds from words. Good readers were more accurate in judging the length of a word or pseudoword.

Dyslexics also have difficulty recognizing the visual form of sounds (Siegel & Ryan, 1988). In the Gates McKillop test the children hear pseudowords such as *whiskate* and are asked to select the correct version of the word from among four printed choices: *iskate*, *wiskay*, *wiskate*, and *whestit*. Dyslexics had significantly lower scores than normal readers on this task.

Syntactic Awareness

Syntactic awareness is the ability to understand the basic grammatical structure of the language in question. Siegel and Ryan (1988) have investigated the development of these skills in normal and disabled readers using an Oral Cloze task, a Sentence Correction task, and the Grammatical Closure test of the Illinois Test of Psycholinguistic Abilities. In the Oral Cloze task, a sentence is read aloud to the child and the child is required to fill in the missing word in sentence. Examples of sentences that we used are: "Jane __ her sister ran up the hill;" "Betty __ dug a hole with her shovel;" "The girl __ is tall plays basketball." In the Sentence Correction task, a sentence that is syntactically incorrect is read aloud to the child and the child is required to correct the sentence. Examples include: "Animal are kept in zoos," "Can you read them book?," and "It was very cold outside tomorrow." In the ITPA Grammatic Closure subtest, the child is required to supply the missing word in a sentence that is read aloud while the examiner points to pictures illustrating the sentence, for example, "Here the thief is stealing the jewels. Here the jewels have been __." In this example, the child must understand the irregular past tense of the verb *to steal* in order to supply the correct word.

When the dyslexics and the normal readers were compared on these three tasks, the dyslexics performed at a level that was significantly lower than the normal readers up to the age of 12 years, as shown in Figure 2.3

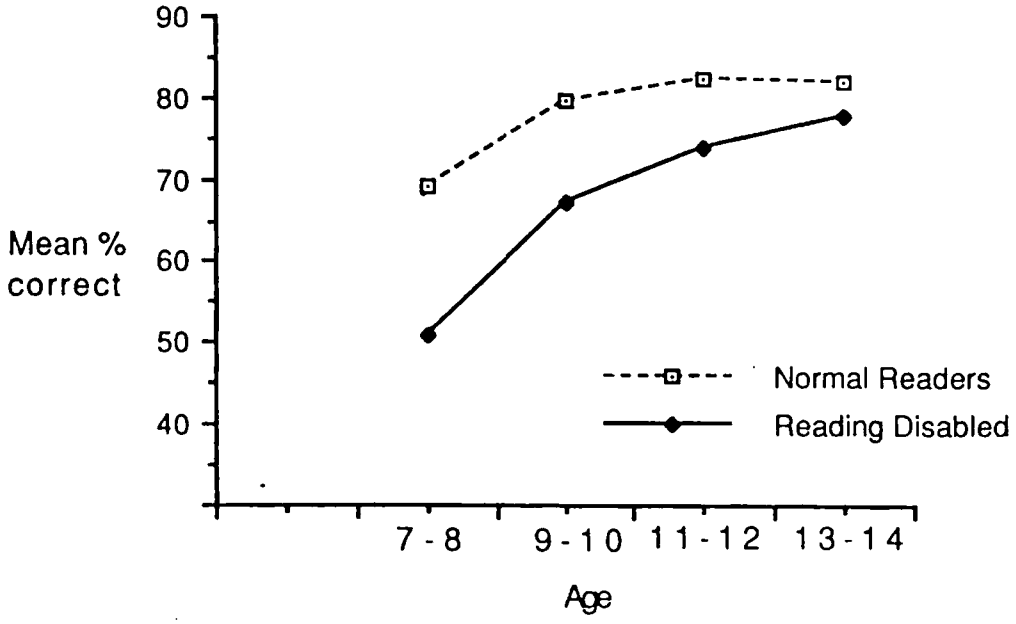

FIGURE 2.3. Mean percentage of correct responses on the Oral Cloze Task as a function of chronological age and group.

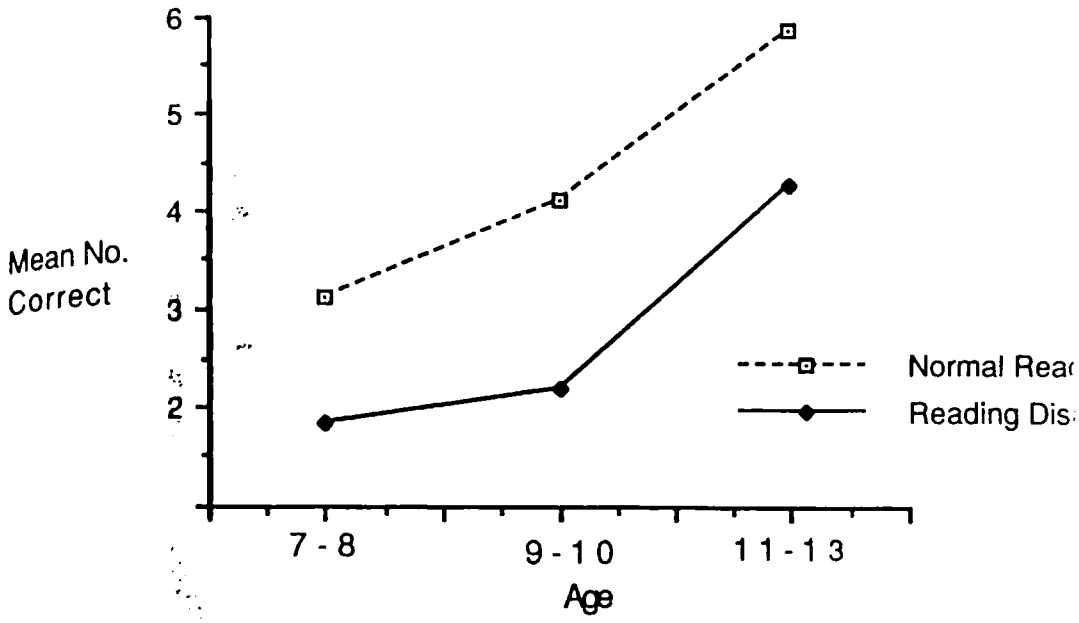

FIGURE 2.4. Performance on the working memory task as a function of chronological age and group.

for the Oral Cloze Task. These results show that after the age of 12 years, the performance of both groups was close to 100, so that this ceiling effect precluded the appearance of group differences. Therefore, it is not possible to determine if the differences between dyslexics and normal readers persists into adulthood. It is possible that with more difficult tasks differences might have appeared between the older normal readers and the dyslexics, but the differences were significant in the elementary school years.

Working Memory

Working memory is the ability to retain information in a short-term store while processing incoming information. In reading, this would mean the decoding or recognizing of words or phrases while remembering what has been read. We have studied working memory in normal readers and dyslexics by developing a task that we feel taps the type of memory processes that occur in reading (Siegel & Ryan, 1989b). In this task, the child is read aloud two, three, four, or five sentences and asked to fill in the missing word at the end of a sentence. The child is then required to remember the missing words. Examples of sentences were: "In the summer it is very __. People go to see monkeys in a __. With dinner we sometimes eat bread and __." In this case, the child was then required to repeat the three words that he or she selected in the same order that the

sentences had been presented. The dyslexics performed significantly more poorly than the normal readers on this task, indicating difficulties with working memory. The data for this task are shown in Figure 2.4. As can be seen in Figure 2.4, the dyslexics had significantly lower scores than the normal readers at each age level.

Other Processes

The three basic cognitive processes just described are important for the development of reading skills and are significantly disrupted in dyslexic readers. There are two other processes that are also relevant to the development of reading: semantics and orthographic processing. *Semantics* refers to the understanding of meaning; *orthographic processing* refers to the understanding of the writing conventions of the language and the correct and incorrect spellings of words. These processes are interesting for a variety of reasons but one of these is dyslexics do not seem to experience the same degree of difficulties in these areas that they do in other areas.

Semantics

There are two types of tasks that indicate that the semantic processing of poor readers is relatively intact. One of these involves is the analysis of errors made in reading single words; the other involves the understanding of the meaning of complex sentences I have shown that there is a small group of dyslexics who make semantic substitutions while reading single isolated words (Siegel, 1985). It is important to note that I am not discussing errors made in reading text but, instead, reading single words. There is no context for the child to use to make guesses in these situations. For example, they make errors such as reading *look* as *see*, *chicken* as *duck*, or *me* as *you* when reading single words that are not in any context. These dyslexics all had very poor, or nonexistent, phonological processing skills and were unable to read a single pseudoword. These types of semantic errors indicate that phonological processing is not used at all because none of the sounds present in the stimulus word are produced in the response. In addition, the response is not visually similar to the target word. However, these types of errors indicate that some semantic processing is occurring and that although the word is not being read correctly, some semantic information is being processed. These kinds of errors are made only in the early stages of reading acquisition and only by poor readers. Some examples of these types of errors are shown in Table 2.2. Normal readers do not appear to make these types of errors. The types of errors that normal readers make typically involve the substitution of a visually and/or phonologically similar word. Examples of

TABLE 2.2 Examples of semantic and normal reader errors.

Target word	Dyslexic semantic error	Normal reader error
Chicken	Duck	Children
Me	You	My
Away	Go	Way
Him	You	How
Around	Because	Round
She	Girl	See
Look	See	Book
Open	Up	Pine

the types of errors that normal readers make when reading these words are also shown in Table 2.2.

Only dyslexic readers make these kind of errors and only a small proportion of dyslexics do so. Normal readers, even at the earliest stages of reading, do not appear to make these semantic errors. These types of errors indicate that grapheme–phoneme conversion rules are not being used at all and that phonological processing is virtually nonexistent.

There is other evidence that the semantic processing skills in dyslexic children are adequate. In the sentence correction task described earlier some of the sentences were syntactically correct but meaningless; that is, they did not make sense. Examples are: "There are flowers flying in the garden"; "In the summer, it snows"; and "The moon is very big and bright in the morning". The dyslexics did not have any trouble correcting these sentences and performed at a level similar to the normal readers (Siegel & Ryan, 1984). This contrasts with their performance on the sentences where the correction of syntax was required. Therefore, the dyslexics have a deficit in the processing of syntactic information but this does not extend to processing of semantic information.

Orthographic Processing

Another aspect of reading is orthographic processing, which will be discussed in the context of dual route theories of reading. One of the popular theories of reading is the dual route theory, which proposes that there are two possible routes involved in gaining access to the meaning of print (e.g., Coltheart, 1978; Forster & Chambers, 1973; Meyer, Schvanevelt, & Ruddy, 1974). One of these routes involves direct lexical access; that is, visually reading a word without any intermediate phonological processing. The orthographic configuration of a word is directly mapped onto an internal visual store in lexical memory. This process is often referred to as *whole word recognition*. The other route involves the use of grapheme–phoneme conversion rules to gain lexical access to a print stimulus. Spelling-sound conversion rules are used to translate a graphemic code into a phonemic one. In this route, the application of the

rules does not rely on word-specific spelling to sound pronunciations. Instead, grapheme-to-phoneme conversion rules are presumed to be stored explicitly and used to determine a word's pronunciation.

Olson, Kliegl, Davidson, and Foltz (1985) have developed two tasks that provide a direct contrast of the visual (orthographic) and phonological processing routes. In the phonological task, the child has to specify which of two pseudowords presented visually, sounds like a real word (e.g., *kake-dake*, *joap-joak*). In the visual task, the child is presented visually with a real word and a pseudoword (e.g., rain-rane, boal-bowl) and has to select the correct spelling. These tasks are designed so that only one process can operate in each task. That is, in the visual task both choices sound exactly the same, so that visual memory for the orthography of a word must by used; phonological processes are not helpful in this case because sounding out the words would produce the identical response to each word. For the phonological task, recall of the visual pattern would not be useful because neither alternative is a correct orthographic pattern in the English language. However, one of the alternatives, when sounded out, does produce an English word, although it is obviously not the correct orthographic form. These tasks were administered to dyslexic and normal readers, aged 7 to 16 years (Siegel, 1986). Not surprisingly, the dyslexics performed more poorly on the phonological task than the normal readers and did not catch up to the normal readers until the age of 13 years.

The dyslexics also had difficulty with the visual task and performed more poorly than the normal readers at ages 7 to 12 years, but the picture is different when a reading grade match was used. When the dyslexic readers are compared to normal readers of the same reading age, resulting in the dyslexics being much older than the normal readers, the dyslexics actually performed at a significantly higher level on the visual task than did the normal readers at reading grade level 2. This finding indicates good visual memory skills in the dyslexics in comparison to their level of word reading. It indicates that the dyslexics were paying attention to the visual aspects of a word rather than the phonological aspects.

To study another aspect of the awareness of orthographic structures, a task was developed (Siegel, Geva, & Share, 1990) in which the ability to recognize legal and illegal orthographic combinations of English letters was assessed. The task was a two-choice one in which the children were presented with 18 pairs of pronounceable pseudowords, one of which contained a bigram that never occurs in an English word in a particular position and the other one of which contained an orthographic string that occurs in English. Examples are *filv-filk*, *moke-moje*, *vism-visn*, and *powl-lowp*. This task was administered to normal and dyslexic readers aged 7 to 16 years.

The performance of the normal readers and dyslexics did not differ except at the youngest ages. At ages 7 to 8 years, the dyslexic children

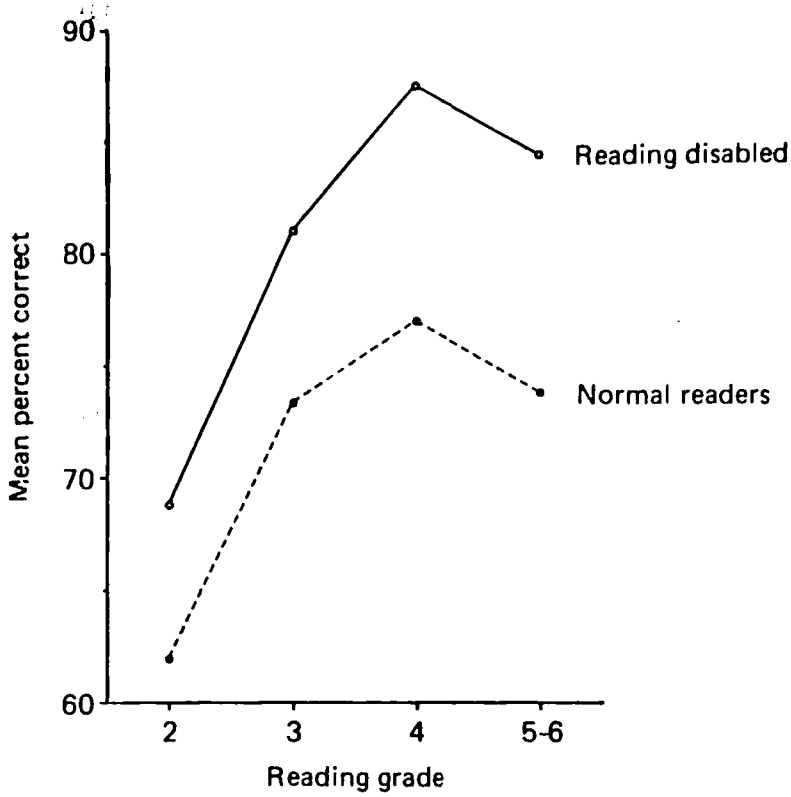

FIGURE 2.5. Performance on the orthographic task as a function of reading grade level and group.

made significantly more errors than did normal readers of the same chronological age. The dyslexic children did not perform more poorly than the normal readers ages 9 to 16 years. However, when the normal and dyslexic readers were matched on reading level, the dyslexics performed at a significantly higher level than the normal readers. These data are shown in Figure 2.5. Therefore, in comparison to the data on phonological processing, the orthographic processing of the dyslexics is quite good. These data indicate that orthographic processing is not as impaired in dyslexics as is phonological processing. Instead, the data show that semantic and orthographic processing occurs in reading but that the use of these processes can disrupt normal reading and cause errors to be made.

Summary

Three processes, syntactic awareness, phonological processing, and working memory are significantly disrupted in children who are dyslexic in English. Semantic and orthographic processes are not disrupted to the same extent. However, the underutilization of phonological processing

and the consequent reliance on semantics and orthographic or visual processing disrupts reading. The deficitsin the three fundamental cognitive processes of phonological processing, syntactic awareness, and working memory constitute the basis of dyslexia.

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References

Barwick, M., & Siegel, L.S. (1990). *The incidence and nature of learning disabilities in runaway, homeless youth*. Unpublished manuscript.

Biemiller, A., & Siegel, L.S. (1991). Developmental changes in relationships between reading comprehension, reading speed, reading accuracy, and working memory. Unpublished manuscript.

Bradley, L., & Bryant, P.E. (1983). Categorizing sounds and learning to read: A causal connection. *Nature*, *301*, 419–421.

Bruck, M. (1990). Word-recognition skills of adults with childhood diagnosis of dyslexia. *Developmental Psychology*, *26*, 439–454.

Byrne, B., & Shea, P. (1979). Semantic and phonemic memory in beginning readers. *Memory and Cognition*, *7*, 333–341.

Calfee, R.C., Lindamood, P., & Lindamood, C. (1973). Acoustic-phonetic skills and reading: Kindergarten through twelfth grade. *Journal of Educational Psychology*, *64*, 293–298.

Coltheart, M. (1978). Lexical access in simple reading tasks. In G. Underwood (Ed.), *Strategies of information processing* (pp. 151–216). London: Academic Press.

Forster, K.I., & Chambers, S. (1973). Lexical access and naming time. *Journal of Verbal Learning and Verbal Behavior*, *12*, 627–635.

Guthrie, J.T., & Seifert, M. (1979). Letter-sound complexity in learning to identify words. *Journal of Educational Psychology*, *69*, 686–696.

Hogaboam, T.W., & Perfetti, C.A. (1978). Reading skill and the role of verbal experience in decoding. *Journal of Educational Psychology*, *70*, 717–729.

Johnston, R. (1982). Phonological coding in dyslexic readers. *British Journal of Psychology*, *73*, 455–460.

Mann, V.A., Liberman, I.Y., & Shankweiler, D. (1980). Children's memory for sentences and word strings in relation to reading ability. *Memory and Cognition*, *8*, 329–335.

Metsala, J., & Siegel, L.S. (in press). Developmental dyslexia and hyperlexia: Attributes and underlying reading processes. In S. Segalowitz & I. Rapin (Eds.), *Developmental neuropsychology*. Amsterdam: Elsevier.

Meyer, D.E., Schvanevelt, R.W., & Ruddy, M.G. (1975). Loci of contextual effects on word recognition. In P.M.A. Rabbitt & S. Dornic (Eds.), *Attention and performance* (Vol. 5, pp. 98–118). New York: Academic Press.

Morrison, S.R., & Siegel, L.S. (1991a). Arithmetic disability: Theoretical considerations and empirical evidence for this subtype. In L.V. Feagans, E.J. Short, & L. Meltzer (Eds.), *Subtypes of learning disabilities: Theoretical perspectives and research*. Hillsdale, NJ: Erlbaum.

Morrison, S.R., & Siegel, L.S. (1991b). Learning disabilities: A critical review of definitional and assessment issues. In J.E. Orzbut & G.W. Hynd. (Eds.), *Advances in the neuropsychology of learning disabilities: A handbook of issues, methods, and practice*. New York: Academic Press.

Olson, R., Kliegl, R., Davidson, B.J., & Foltz, G. (1985). Individual and developmental differences in reading disability. In T.G. Waller (Ed.), *Reading research: Advances in theory and practice* (Vol. 4, pp. 1–64). New York: Academic Press.

Pratt, A.C., & Brady, S. (1988). Relations of phonological awareness to reading disability in children and adults. *Journal of Educational Psychology*, *80*, 319–323.

Shafrir, U., & Siegel, L.S. (1991). Short-term memory and phonological skills in reading and arithmetic disabled adults. Unpublished manuscript.

Shankweiler, D., Liberman, I.Y., Mark, L.S., Fowler, C.A., & Fischer, F.W. (1979). The speech code and learning to read. *Journal of Experimental Psychology: Human Learning and Memory*, *5*, 531–545.

Siegel, L.S. (1985). Psycholinguistic aspects of reading disabilities. In L.S. Siegel & F.J. Morrison (Eds.), *Cognitive development in atypical children*. New York: Springer–Verlag.

Siegel, L.S. (1986). Phonological deficits in children with a reading disability. *Canadian Journal of Special Education*, *2*, 45–54.

Siegel, L.S. (1988a). Evidence that IQ scores are irrelevant to the definition and analysis of reading disability. *Canadian Journal of Psychology*, *42*, 201–215.

Siegel, L.S. (1988b). Definitional and theoretical issues and research on learning disabilities. *Journal of Learning Disabilities*, *21*, 264–266.

Siegel, L.S. (1989a). IQ is irrelevant to the definition of learning disabilities. *Journal of Learning Disabilities*, *22*, 469–478, 486.

Siegel, L.S. (1989b). Why we do not need IQ test scores in the definition and analyses of learning disability. *Journal of Learning Disabilities*, *22*, 514–518.

Siegel, L.S. (1990a). IQ and learning disabilities: R.I.P. In H.L. Swanson & B. Keogh (Eds.), *Learning disabilities: Theoretical and research issues*. Hillsdale, NJ: Erlbaum.

Siegel, L.S. (1990b). Siegel's reply. *Journal of Learning Disabilities*, *23*, 268–269, 319.

Siegel, L.S. (1991). Dyslexics vs. poor readers: Is there a difference? In preparation.

Siegel, L.S. (in press). Phonological processing deficits as the basis of a reading disability. *Developmental Review*.

Siegel, L.S., & Faux, D. (1989). Acquisition of certain grapheme-phoneme correspondences in normally achieving and disabled readers. *Reading and Writing: An Interdisciplinary Journal*, *1*, 37–52.

Siegel, L.S., & Feldman, W. (1983). Non-dyslexic children with combined writing and arithmetic difficulties. *Clinical Pediatrics*, *22*, 241–244.

Siegel, L.S., & Geva, E. (1990). *Reading by analogy or rules: A comparison of poor and normal readers*. Unpublished manuscript.

Siegel, L.S., Geva, E., & Share, D. (1990). *The development of orthographic skills in normal and disabled readers*. Unpublished manuscript.

Siegel, L.S., & Heaven, R.K. (1986). Categorization of learning disabilities. In S.J. Ceci (Ed.), *Handbook of cognitive, social and neuropsychological aspects of learning disabilities* (Vol. 1). Hillsdale, NJ: Erlbaum.

Siegel, L.S., Levey, P., & Ferris, H. (1985). Subtypes of developmental dyslexia: Do they exist? In F.J. Morrison, C. Lord, & D.P. Keating (Eds.), *Applied developmental psychology* (Vol. 2). New York: Academic Press.

Siegel, L.S., & Linder, B.A. (1984). Short-term memory processes in children with reading and arithmetic learning disabilities. *Developmental Psychology, 20*, 200–207.

Siegel, L.S., & Metsala, J. (1991). An alternative to the food processor approach to subtypes of learning disabilities. In N.N. Singh & I. Beale (Eds.). *Current perspectives in learning disabilities: Nature, theory, and treatment*. New York: Springer–Verlag.

Siegel, L.S., & Ryan. E.B. (1984). Reading disability as a language disorder. *Remedial and Special Education, 5*, 28–33.

Siegel, L.S., & Ryan, E.B. (1988). Development of grammatical sensitivity, phonological, and short-term memory skills in normally achieving and learning disabled children. *Developmental Psychology, 24*, 28–37.

Siegel, L.S., & Ryan, E.B. (1989a). Subtypes of developmental dyslexia: The influence of definitional variables. *Reading and Writing: An Interdisciplinary Journal, 1*, 257–287(b).

Siegel, L.S., & Ryan, E.B. (1989b). The development of working memory in normally achieving and subtypes of learning disabled children. *Child Development, 60*, 973–980.

Snowling, M.J. (1980). The development of grapheme-phoneme correspondence in normal and dyslexic readers. *Journal of Experimental Child Psychology, 29*, 294–305.

Stanovich, K.E. (1988a). Explaining the differences between the dyslexic and garden variety poor reader: The phonological-core variance-difference model. *Journal of Learning Disabilities, 21*, 590–604, 612.

Stanovich, K.E. (1988b). The right and wrong places to look for the cognitive locus of reading disability. *Annals of Dyslexia, 38*, 154–177.

Tal, N., & Siegel, L.S. (1990). *The relationship between question-answer type and reading comprehension among good and poor readers*. Unpublished manuscript.

Vellutino, F.R. (1979). *Dyslexia: Theory and research*. Cambridge, MA: MIT Press.

Venezky, R.L., & Johnson, D. (1973). Development of two letter-sound patterns in grades one through three. *Journal of Educational Psychology, 64*, 109–115.

Wallach, M.A., & Wallach, L. (1976). *Teaching all children to read*. Chicago: University of Chicago Press.

Waters, G.S., Bruck, M., & Seidenberg, M. (1985). Do children use similar processes to read and spell words? *Journal of Experimental Child Psychology, 39*, 511–530.