

BEST PRACTICES IN
SCHOOL
NEUROPSYCHOLOGY

**GUIDELINES FOR EFFECTIVE PRACTICE,
ASSESSMENT, AND EVIDENCE-BASED INTERVENTION**

EDITED BY

DANIEL C. MILLER • DENISE E. MARICLE
CHRISTOPHER L. BEDFORD • JULIE A. GETTMAN

SECOND EDITION



WILEY

<p>BEST PRACTICES IN SCHOOL NEUROPSYCHOLOGY</p>		

BEST PRACTICES IN SCHOOL NEUROPSYCHOLOGY

SECOND
EDITION

GUIDELINES FOR EFFECTIVE
PRACTICE, ASSESSMENT, AND
EVIDENCE-BASED INTERVENTION

Edited by

Daniel C. Miller

Denise E. Maricle

Christopher L. Bedford

Julie A. Gettman

WILEY

This edition first published 2022
© 2022 John Wiley & Sons, Inc.

Edition History

John Wiley & Sons, Inc. (1e, 2009)

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, except as permitted by law. Advice on how to obtain permission to reuse material from this title is available at <http://www.wiley.com/go/permissions>.

The right of Daniel C. Miller, Denise E. Maricle, Christopher L. Bedford, and Julie A. Gettman to be identified as the authors of the editorial material in this work has been asserted in accordance with law.

Registered Office

John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, USA

Editorial Office

111 River Street, Hoboken, NJ 07030, USA

For details of our global editorial offices, customer services, and more information about Wiley products visit us at www.wiley.com.

Wiley also publishes its books in a variety of electronic formats and by print-on-demand. Some content that appears in standard print versions of this book may not be available in other formats.

Limit of Liability/Disclaimer of Warranty

The contents of this work are intended to further general scientific research, understanding, and discussion only and are not intended and should not be relied upon as recommending or promoting scientific method, diagnosis, or treatment by physicians for any particular patient. In view of ongoing research, equipment modifications, changes in governmental regulations, and the constant flow of information relating to the use of medicines, equipment, and devices, the reader is urged to review and evaluate the information provided in the package insert or instructions for each medicine, equipment, or device for, among other things, any changes in the instructions or indication of usage and for added warnings and precautions. While the publisher and authors have used their best efforts in preparing this work, they make no representations or warranties with respect to the accuracy or completeness of the contents of this work and specifically disclaim all warranties, including without limitation any implied warranties of merchantability or fitness for a particular purpose. No warranty may be created or extended by sales representatives, written sales materials or promotional statements for this work. The fact that an organization, website, or product is referred to in this work as a citation and/or potential source of further information does not mean that the publisher and authors endorse the information or services the organization, website, or product may provide or recommendations it may make. This work is sold with the understanding that the publisher is not engaged in rendering professional services. The advice and strategies contained herein may not be suitable for your situation. You should consult with a specialist where appropriate. Further, readers should be aware that websites listed in this work may have changed or disappeared between when this work was written and when it is read. Neither the publisher nor authors shall be liable for any loss of profit or any other commercial damages, including but not limited to special, incidental, consequential, or other damages.

Library of Congress Cataloging-in-Publication Data

Name: Miller, Daniel C., editor.

Title: Best practices in school neuropsychology : guidelines for effective practice, assessment, and evidence-based intervention / edited by Daniel C. Miller, Denise E. Maricle, Christopher L. Bedford, Julie A. Gettman.

Description: Second edition. | Hoboken, NJ, USA : Wiley, 2022. | Includes bibliographical references and index.

Identifiers: LCCN 2022007975 (print) | LCCN 2022007976 (ebook) | ISBN 9781119790532 (cloth) | ISBN 9781119790549 (adobe pdf) | ISBN 9781119790556 (epub)

Subjects: LCSH: Pediatric neuropsychology | Clinical neuropsychology | School psychology | School children—Mental health services | Crisis intervention (Mental health services) | Evidence-based psychiatry.

Classification: LCC RJ486.5 .B47 2022 (print) | LCC RJ486.5 (ebook) | DDC 618.92/8—dc23/eng/20220304

LC record available at <https://lcn.loc.gov/2022007975>

LC ebook record available at <https://lcn.loc.gov/2022007976>

Cover Design: Wiley

Cover Image: © PASIEKA/Getty Images

Set in 9.5/12pt and STIXTwoText by Straive, Chennai, India

10 9 8 7 6 5 4 3 2 1

This book is dedicated to all school psychology practitioners who have embraced the belief that “Minds Do Matter: All Children Can Learn!” This book is also dedicated to my colleagues who helped write and edit this second edition – their expertise and dedication to helping children and their families are immensely appreciated and valued. Also thank you to my loving wife,

Michie, my best friend and supporter.

Daniel C. Miller

Family is the tribe we create for ourselves. My family tribe is full of smart, beautiful, strong, diverse women. While I am thankful for all of them, I want to acknowledge two who have been instrumental in my development as a human being. To my blood sister, Laura, and a sister of the heart, Christie, thank you for loving me, being part of my tribe, and showing me what family is all about. Ultimately, though, this book is dedicated to all the children who have ever felt different.

Denise E. Maricle

I'd like to dedicate this book to my son, Ellis, who at 13 years of age continues to provide me with new insights into how learning occurs in and out of the classroom. And also to Julie, whose support and patience I appreciate not just while working on this book but in all of our projects.

Christopher L. Bedford

To the brilliant and kind practitioners who chose the important role of ensuring successful and enriched futures for children, and to the children who inspire them to keep going. To Dr. Miller, who dedicated his life to teaching others how to provide meaningful, brain-based assessment that leads to answers and targeted intervention. To the co-editors and authors for their collective and vast knowledge and contributions. And to my true life partner, Chris, for his endless support and collaboration.

Julie A. Gettman

CONTENTS

ABOUT THE EDITORS	xiii
LIST OF CONTRIBUTORS	xv
FOREWORD	xix

SECTION I PROFESSIONAL ISSUES IN SCHOOL NEUROPSYCHOLOGY

1 SCHOOL NEUROPSYCHOLOGY SPECIALIZATION 3

Daniel C. Miller, Denise E. Maricle, Christopher L. Bedford, and Julie A. Gettman

2 SCHOOL NEUROPSYCHOLOGY TRAINING AND CREDENTIALING 15

Denise E. Maricle and Daniel C. Miller

3 ETHICAL AND LEGAL ISSUES RELATED TO SCHOOL NEUROPSYCHOLOGY 27

Ann Marie Leonard-Zabel

4 NONDISCRIMINATORY, CROSS-CULTURAL SCHOOL NEUROPSYCHOLOGICAL ASSESSMENT 41

Samuel O. Ortiz and Monica Oganés

SECTION II PRACTICE ISSUES IN SCHOOL NEUROPSYCHOLOGY

5 THE INTEGRATED SNP/CHC MODEL 67

Daniel C. Miller and Denise E. Maricle

6 AN INTEGRATIVE THEORETICAL FRAMEWORK FOR COGNITIVE TEST INTERPRETATION IN SCHOOL NEUROPSYCHOLOGICAL EVALUATIONS 87

*Dawn P. Flanagan, Vincent C. Alfonso, Craig J. Zinkiewicz, Samuel O. Ortiz,
and Agnieszka M. Dynda*

7 RECENT ADVANCES IN NEUROSCIENCE RELEVANT TO SCHOOL
NEUROPSYCHOLOGY 121

Daniel C. Miller and Denise E. Maricle

8 SCHOOL NEUROPSYCHOLOGY COLLABORATION WITH HOME,
SCHOOL, AND OUTSIDE PROFESSIONALS 133

Susan B. Hill

9 RETURN TO LEARN: SCHOOL REENTRY FOR CHILDREN
RECOVERING FROM NEUROLOGICAL CONDITIONS 147

Cynthia Pahr

10 STATISTICAL AND CLINICAL INTERPRETATION
GUIDELINES FOR SCHOOL NEUROPSYCHOLOGICAL
ASSESSMENT 163

W. Joel Schneider

11 IMPORTANCE OF ASSESSING EFFORT AND MOTIVATION 185

Julie A. Gettman and Courtney Bindrich

SECTION III CLINICAL APPLICATIONS OF SCHOOL
NEUROPSYCHOLOGY: CLINICAL DISORDERS

12 ASSESSING AND INTERVENING WITH CHILDREN WITH
ADHD 201

Christopher L. Bedford

13 ASSESSING AND INTERVENING WITH CHILDREN WITH AUTISM
SPECTRUM DISORDERS 227

Marilyn J. Monteiro

14 ASSESSING AND INTERVENING WITH CHILDREN
WITH DEVELOPMENTAL DELAYS 243

Julia Cartwright and Mary Dryden

15 ASSESSING AND INTERVENING WITH CHILDREN
WITH EMOTIONAL DISORDERS 271

Richard M. Marshall and Berney J. Wilkinson

16 ASSESSING AND INTERVENING WITH CHILDREN WHO ARE DEAF
AND HARD OF HEARING 285

Gisele Grenon and Robert Whitaker

17 ASSESSING AND INTERVENING WITH CHILDREN WHO ARE
VISUALLY IMPAIRED 301

Arthur W. Joyce, Jack G. Dial, and Catherine L. Dial

18 ASSESSING AND INTERVENING WITH CHILDREN WHO ARE
CHRONICALLY ILL 313

Beth Colaluca

19 ASSESSING AND INTERVENING WITH CHILDREN WITH BRAIN
TUMORS 345

Nadia E. Webb

20 ASSESSING AND INTERVENING WITH CHILDREN WITH SEIZURE
DISORDERS 359

Robb N. Matthews

21 ASSESSING AND INTERVENING WITH CHILDREN WITH TRAUMATIC
BRAIN INJURY 373

Jennifer R. Morrison

22 ASSESSING AND INTERVENING WITH CHILDREN WHO HAVE BEEN
TRAUMATIZED 389

Steven G. Feifer and Wendi L. Johnson

23 ASSESSING AND INTERVENING WITH CHILDREN AND
ADOLESCENTS EXPOSED TO NEUROTOXINS 411

Nadia Webb

SECTION IV CLINICAL APPLICATIONS OF SCHOOL
NEUROPSYCHOLOGY: ACADEMIC DISABILITIES 425

24 ASSESSING AND INTERVENING WITH CHILDREN WITH READING
DISORDERS 427

Marlene Sotelo-Dynega

25 ASSESSING AND INTERVENING WITH CHILDREN WITH WRITTEN
LANGUAGE DISORDERS 451

Steven G. Feifer

26 BEST PRACTICES IN ASSESSING AND INTERVENING
WITH CHILDREN WITH MATH DISORDERS 467

Denise E. Maricle and Katarina Vidovic

27 ASSESSING AND INTERVENING WITH CHILDREN
WITH AUDITORY PROCESSING DISORDERS 487

Donna Geffner and Deborah Swain

28 ASSESSING AND INTERVENING WITH CHILDREN
WITH NONVERBAL LEARNING DISABILITIES 509

Margaret Semrud-Clikeman

SECTION V CLINICAL APPLICATIONS OF
SCHOOL NEUROPSYCHOLOGY: FUNCTIONAL/PROCESSING
DEFICITS

29 ASSESSING AND INTERVENING WITH CHILDREN
WITH SENSORIMOTOR IMPAIRMENT 527

Vidya Pingale and Tina S. Fletcher

30 ASSESSING AND INTERVENING WITH CHILDREN WHO HAVE
DIFFICULTIES WITH LEARNING AND MEMORY 541

Milton J. Dehn

31 ASSESSING AND INTERVENING WITH CHILDREN WITH EXECUTIVE
FUNCTION DISORDERS 561

Wendi L. Johnson and Denise E. Maricle

32 ASSESSING AND INTERVENING WITH CHILDREN WITH PROCESSING
SPEED DEFICITS 589

Daniel C. Miller, Christopher L. Bedford, and Julie A. Gettman

INDEX

609

ABOUT THE EDITORS

Daniel C. Miller, Ph.D., ABPP, ABSNP, NCSP is the president of the School Neuropsychology Institute, and he is the director of the School Neuropsychology Post-Graduate Certification Program. He is also the executive director of the Woodcock Institute for the Advancement of Neurocognitive Research and Applied Practice at Texas Woman's University in Denton, Texas.

Denise E. Maricle, Ph.D., LP-MN, ABSNP, NCSP is a professor in the School of Social Work, Psychology and Philosophy at Texas Woman's University, Denton, TX.

Christopher L. Bedford, Ph.D., LP, ABSNP is the executive director of the American Board of School Neuropsychology and an associate director at the School Neuropsychology Institute. He is also a licensed psychologist and maintains a private practice in St. Paul, Minnesota.

Julie A. Gettman, Ph.D., ABSNP, NCSP is an associate director of the School Neuropsychology Institute. She is a licensed school psychologist and owner of Mindworks Assessment, a private practice specializing in neurocognitive assessment and intervention with children and adolescents. Dr. Gettman's experiences include senior clinical assessment consultant at Psychological Assessment Resources, school-based school psychologist, expert witness, and core faculty adviser for Nova Southeastern University's (Fort Lauderdale, Florida) Specialist in School Psychology graduate program.

LIST OF CONTRIBUTORS

Vincent C. Alfonso

School of Education, Gonzaga University, Spokane, Washington

Christopher L. Bedford

American Board of School Neuropsychology, St. Paul, Minnesota

Cortney Bindrich

Loyola University, Chicago, Illinois

Julia Cartwright

Center for Autism and Developmental Disabilities, The University of Texas Southwestern Medical Center at Dallas, Dallas, Texas

Beth Colaluca

Department of Neuropsychology, Cooks Children's Medical Center, Fort Worth, Texas

Milton J. Dehn

Schoolhouse Educational Services, Inc., Sparta, Wisconsin

Catherine L. Dial

Private practice, Irving, Texas

Jack G. Dial

Private practice, Irving, Texas

Mary Dryden

Center for Autism and Developmental Disabilities, The University of Texas Southwestern Medical Center at Dallas, Dallas, Texas

Agnieszka M. Dynda

Great Neck Public Schools, Great Neck, New York

Steven G. Feifer

Monocacy Neurodevelopmental Center, Frederick, Maryland

Dawn P. Flanagan

Department of Psychology, St. John's University, Queens, New York

Tina S. Fletcher

School of Occupational Therapy, Texas Woman's University, Denton, Texas

Donna Geffner

Donna Geffner and Associates, Long Island, New York

Julie A. Gettman

Mindworks Assessment, St. Paul, Minnesota

Gisele Grenon

Learning Center for the Deaf and Hard of Hearing, Framingham, Massachusetts

Susan B. Hill

Private practice, Dallas, Texas

Wendi L. Johnson

School of Social Work, Psychology, and Philosophy, Texas Woman's University, Denton, Texas

Arthur W. Joyce

Private practice, Irving, Texas

Ann Marie Leonard-Zabel

Curry College, Milton, Massachusetts; NEALAC, Milton, Massachusetts

Denise E. Maricle

School of Social Work, Psychology, and Philosophy, Texas Woman's University, Denton, Texas

Richard M. Marshall

Psychological Associates of Central Florida, Lakeland, Florida

Robb N. Matthews

Baylor Scott & White Health, Round Rock, Texas

Daniel C. Miller

Woodcock Institute for the Advancement of Neurocognitive Research and Applied Practice, Texas Woman's University, Denton, Texas

Marilyn J. Monteiro

Private practice, Addison, Texas

Jennifer R. Morrison

Kids BRAIN, LLC, Dallas, Texas

Monica Oganés

Monica Oganés & Associates, Miami, Florida

Samuel O. Ortiz

Department of Psychology, St. John's University, Jamaica, New York

Cynthia Pahr

EduCLIME, LLC, San Diego, California

Vidya Pingale

Occupational Therapy Department, Hofstra University, Hempstead, New York

W. Joel Schneider

Policy, Organization, and Leadership Studies, College of Education and Human Development, Temple University, Philadelphia, Pennsylvania

Margaret Semrud-Clikeman

Clinical Behavioral Neuroscience, School of Medicine, University of Minnesota, Minneapolis, Minnesota

Marlene Sotelo-Dynega

Department of Psychology, St. John's College of Liberal Arts and Sciences, St. John's University, Queens, New York

Deborah Swain

Swain Center for Listening, Communicating and Learning, Santa Rosa, California

Katarina Vidovic

School Psychology Doctoral Student, Texas Woman's University, Denton, Texas

Nadia E. Webb

Institute for Social and Applied Neuroscience, Santa Fe, New Mexico

Robert Whitaker

Gallaudet University, Washington, D.C.

Berney J. Wilkinson

Psychological Associates of Central Florida, Lakeland, Florida

Craig J. Zinkiewicz

Scottsdale Unified School District, Scottsdale, Arizona

FOREWORD

The first edition of *Best Practices in School Neuropsychology Guidelines for Practice, Assessment, and Evidence-Based Intervention*, edited and authored by Dr. Daniel C. Miller, provided, for the first time, a detailed mapping of how neuropsychology and school psychology could and should be integrated. It contained 32 chapters, written by experts, that gave us a complete picture of the practice of school neuropsychology and the clinical application of school neuropsychology with special populations, academic disabilities, and processing deficits. The breadth and depth of this seminal work were impressive and extremely helpful to practitioners who were just getting used to the idea that knowledge of the brain was essential to the practice of school psychology.

In the foreword to the first edition, I was moved to talk about how lucky we were to be practicing school psychology in a time when neuroscience was bursting with imaging studies, translational studies, and startling advances in the understanding of conditions such as autism. I was also excited to note that this research was about children and not just trying to extend studies about adults downward to pediatric populations. How glorious it was for us to witness this renaissance and renewal in the field of school psychology! We needed Dr. Miller's book alongside us to learn how we school psychologists should go about getting the training to truly integrate neuroscience into our practice. We needed this book to be the signpost that helped us understand the parameters, advantages, and limitations of the state of the research at that time. We needed this book to clearly define what is meant by *school neuropsychology*, and it certainly established that identity!

The responsibility of editors of second edition works is (surprisingly) more labor-intensive than it is for the first edition. The reason is that the editor has to meta-analyze the content and impact of the first edition, research all subsequent advances in the field, and then place them in context in the new work. What chapters do you cull? What chapters will essentially remain unchanged? Where are the most exciting advances in the field happening? What are the limits of translational neuroscience in school neuropsychology? What design will be most helpful to readers in the years to come? In this case, Dr. Miller and his co-editors certainly proved their editorial expertise. This second edition has been designed to balance providing the basic practice parameters of school neuropsychology and illuminating important advances in the field that promote excellence in current practice.

This second edition of *Best Practices* will not disappoint! The authors' expansive understanding of school neuropsychology and their insatiable thirst for keeping up with and advancing school psychology practice is reflected in this work. As usual, chapters that rely on the use of test instruments have been updated as new test editions, improved in their own right, are published. These also lead into chapters about new constructs concerning the measurement of motivation and performance effort that are important to the understanding of scores and the credibility of neuropsychological assessment as a whole.

Perhaps one of the most important updates to the second edition is the remastering of school neuropsychology through a multicultural lens. Inherent in neuropsychological assessment is the specificity and individualization of the clinical picture brought by the clinician. This can only be accomplished if clinicians are aware of the diversity impact on test results and interpretations and also aware of their own implicit and explicit biases. This is a two-way street. This point may well indicate another renaissance for school neuropsychology in that diversity awareness is now acknowledged as essential for good outcomes (finally!). When we conduct school neuropsychological assessments without diversity awareness, we prevent a natural outcome of clinical excellence: social justice. School neuropsychology is an advanced form of practice that must not only improve our ability to help children but also lead the way for us to prevent harm in the first place. Culturally aware school neuropsychological practice puts us on the road to demand the best from test companies, school-based teams, health-care providers, parents, students, and ourselves.

New chapters challenge us to apply research that interfaces with our practice and health care. The advances in imaging and nanotechnology are continuing to evolve and are exciting indeed! Our understanding of the sequelae of early trauma is also illuminated in this volume and is essential to our understanding of brain–body interoception and recovery. At this time, the surgeon general of California, Nadine Burke Harris, has made it possible for all children to be screened and treated for trauma based on the prodigious research on the Adverse Childhood Experiences Questionnaire. Herein lie new initiatives that bring school neuropsychologists into the front of differential diagnosis where the effects of trauma interact with learning and social–emotional functioning. We are greatly needed in this area.

The updates to this second edition make it easy to say that we still live in an exciting time in school neuropsychology. However, prior to its publication, we have been broadsided by a pandemic that has affected all areas of our practice. At the time of this writing, studies on how SARS-2-CoV (Covid-19) affects pediatric populations are few and far between. The American Academy of Pediatrics is imploring the federal government to provide funding for more intensive care beds, thousands of children have been hospitalized, and hundreds of thousands are grieving the loss of primary caregivers. School-based personnel are trying to disentangle the effects of tele-instruction, loss of instruction, loss of school supervision, new disabilities, family stress, exacerbation of existing disabilities, and mental health issues on how children are functioning back in school. Of course, most kids are going to be fine. Regardless of whether they contract Covid-19, they will have the supports and constitution to weather this unprecedented and awfully long event. However, in school neuropsychology, we do not see these students – we see only those who have suffered many setbacks and have encountered extremely stressful issues. Also, at this point, few school systems and organizations are talking about the fact that Covid-19 easily crosses into the central nervous system and the blood–brain barrier. The exact mechanisms are not known at this time, but all point to some students contracting a long-haul version where brain fog and concentration, memory, sleep, and energy issues stay for a chronic period and significantly impact the child’s ability to meet the demands of everyday living. This is where the school neuropsychologist can help the most! We will have to lead the way for school personnel, not just assuming that lack of instruction or depression is the reason for poor school performance. We will have to educate others about what can happen when bacteria and viruses invade the brain, and we will have to help measure and name what is going on so that interventions will work. This post-pandemic era will create gaps in practice that only school neuropsychology can fill, and we can take our knowledge from this book and lead with certainty in an uncertain age.

Some 12 years after the first edition of *Best Practices*, where do we find ourselves? The current volume continues to set the stage for school psychologists who are new to neuroscience to learn what they need to incorporate best practices into their world. This volume also ramps up the clinician’s knowledge with outstanding chapters written by experienced experts who deliver the guidance we need for advanced practice. Readers of this second edition can rest assured that all aspects of the practice of school neuropsychology are included in this one place. The book provides all the skills that we will need to traverse this uncertain pandemic and the aftermath, some of which will be heartbreaking and some of which will be innovative and inspiring. Dr. Miller and his colleagues’ approach to best practices will guide the reader for years to come and, at the same time, manifest the power of school neuropsychology.

ELAINE FLETCHER-JANZEN, ED.D., NCSP, ABPDN
Niles, Michigan
November 2021

PROFESSIONAL ISSUES IN SCHOOL NEUROPSYCHOLOGY

SECTION I

School Neuropsychology Specialization

1

Daniel C. Miller¹, Denise E. Maricle², Christopher L. Bedford³, and
Julie A. Gettman⁴

¹Woodcock Institute for the Advancement of Neurocognitive Research and Applied Practice, Texas Woman's University, Denton, TX, USA

²School of Social Work, Psychology, and Philosophy, Texas Woman's University, Denton, TX, USA

³American Board of School Neuropsychology, LLC, St. Paul, MN, USA

⁴Mindworks Assessment, St. Paul, MN, USA

Although the brain was identified as the source of intelligence as early as the sixth century B.C.E. and neuroscience has been practiced all the way back to ancient civilizations, modern neuroscience has experienced a dramatic resurgence in the last 20 years, with many major discoveries about how the brain works and what role it plays in different neurological diseases and disorders (Ludden, 2017). Though the relevance of neuroscience within psychology and education was acknowledged throughout the twentieth century, it was the 1990s “Decade of the Brain” and the technological advances in brain imaging that gave rise to the specialized fields of school neuropsychology and educational neuroscience.

The early 2000s saw the connections between psychology, education, and neuroscience being explored by researchers across the globe. Resultant discoveries in neuroscience produced major theoretical paradigm shifts and innovations in both research and practice (Yeung et al., 2017). Although scientists have been studying the brain for centuries, it was not until they could watch it in action through technological advances in brain imaging and neuroscience that they began to understand how the brain works (Ludden, 2017). Fueling many of these discoveries was the 2001 Human Genome Project's sequencing and mapping of the human genome and the 2004 National Institutes of Health's (NIH) *Blueprint for Neuroscience Research*, which brought together 14 institutes and centers to support and advance research in neuroscience.

In 2009, the *Human Connectome Project* (Batteray, 2010; Van Essen & Glasser, 2016) was initiated, followed by the 2013–2014 *Brain Research through Advancing Innovative Neurotechnologies* (BRAIN) *Initiative* (Insel et al., 2013) and the *Human Brain Project* (Markram, 2012). The emergence of the *Brain Mapping by Integrated Neurotechnologies for Disease Studies* (Brain/MINDS) in Japan and the *Brain Science and Brain-Like Intelligence Technology* project in China (Grillner et al., 2016) started in 2014. Also in 2014, the Nobel Prize in Physiology or Medicine was awarded to three neuroscientists, John O'Keefe, Edvard Moser, and May-Britt Moser, for their identification of place and grid cells in the brain that form to provide a built-in global positioning system, forever changing our understanding of the brain's spatial representation system (Moser et al., 2008; O'Keefe & Burgess, 2005).

The growth in the applicability of neuroscience has led to the rise of new organizations, such as the *International Mind, Brain and Education Society* (IMBES, founded in 2004; www.imbes.org) and the special interest group *Neuroscience and Education* within the *European Association for Research on Learning and Instruction* (EARLI, founded in 2009). New scholarly journals, such as *Trends in Neuroscience and Education*; *Mind, Brain, and Education*; and *Educational Neuroscience*, have joined the established standards, such as *Neuropsychology*, *Journal of Neuropsychology*, *Developmental Neuropsychology*, *Neuropsychology Review*, *Behavioral and Brain Sciences*, *Brain and Cognition*, and *The Clinical Neuropsychologist*, and are attracting theoretical and empirical work exploring the intersection of neuroscience, psychology, and education (Yeung et al., 2017).

Ironically, most of what we know about brain functioning has been learned in the last 30 years. Information is regularly taught in graduate schools across the world that was unknown just 20 years ago. These tremendous advances in our knowledge of how the brain works have made neuroscience the dominant field within psychology (Ludden, 2017).

In 2018, Davis and Reynolds characterized pediatric neuropsychology as an emergent discipline requiring a diverse array of competencies that draw from a constellation of sources including pediatric neurology, pediatric neuropsychology, school psychology, and pediatric psychiatry. In their perspective, those specializing in pediatric neuropsychology needed to be competent working with a diverse array of professionals (neurologists, neurosurgeons, occupational therapists, speech pathologists, attorneys, and teachers) and have a broad and deep knowledge of psychology, pathology, neurodevelopment, neurodiversity, applicable laws (HIPAA, FERPA, IDEA), and rehabilitation or intervention strategies appropriate for pediatric patients.

Emergence of School Neuropsychology

School neuropsychology merges the field of school psychology with pediatric clinical neuropsychology. The practice of school neuropsychology is the application of the knowledge gleaned from the study of brain-behavior relationships to children and adolescents. Additionally, it incorporates the knowledge of school systems, special education law, and educational neuroscience into the practice of pediatric neuropsychology. School neuropsychology requires a comprehensive skill set to effectively analyze assessment data and behaviors from a brain-based perspective; consider historical, environmental, and academic influences; and provide targeted recommendations for home, community, and academic settings. School neuropsychology focuses on the neuropsychological underpinnings of specific cognitive domains such as sensorimotor skills, attention, learning and memory, visuospatial processing, auditory processing, executive functions, language skills, and speed of processing.

School neuropsychologists play an important role in examining and understanding the functional manifestations, or profiles of strengths and weaknesses, of the students they work with. They typically work in schools, private or group practices, hospitals, clinics, and other types of medical settings. They routinely focus their expertise on higher incidence disabilities in children and youth, such as autism, specific learning disabilities (SLDs), attention-deficit hyperactivity disorder, and complex cognitive processing disorders. They have training in and possess the knowledge necessary to work with low incidence neurological and medical conditions. School neuropsychologists also possess the knowledge, training, and expertise to analyze and integrate significant medical and environmental symptomology present in more impaired pediatric populations. Unlike pediatric clinical neuropsychologists, school psychologists trained in school neuropsychology bring knowledge and understanding of school systems, special education laws and procedures, and school-based intervention techniques designed for children and adolescents. Understanding how neurodiversity and neurological challenges can be addressed in a school environment is critical for those who work with children and adolescents as this is an environment in which they spend a significant amount of time and where most children and adolescents receive therapeutic or rehabilitative services.

The focus of this book is on the practice of school neuropsychology. The first edition of this book was published in 2010, and since that time, the research related to neurodevelopmental and genetic disorders in children has increased exponentially. Countless publications, articles, and professional books are now available, as are many new assessment instruments. The next section of this chapter reviews why the specialization of school neuropsychology is important for school psychologists and

clinical psychologists who work with children and adolescents in private practices or other settings. Following that section, the chapter will provide a brief review of the history of school neuropsychology. The last section of the chapter will discuss challenges for the future of the school neuropsychology specialization.

Reasons for a School Neuropsychology Specialization

Everything we do, think, say, or feel and how we behave in and interact with the world is mediated by our brain. Understanding how brains develop and work is fundamental to understanding what it means to be human. It would be impossible to provide quality education or study learning without incorporating the brain, the only human organ that learns and then produces thoughts, feelings, or actions. There are many unanswered questions about how the brain works, but scientific advances in our knowledge of brain functions occur on a regular basis. Brain science informs educational methods and practices.

Human abilities are complex, and each student has a unique learning and memory profile that helps professionals, parents, and students understand difficulties, strengths, and the importance of interventions. Understanding complexities can assist with promoting progress through developmental milestones, achievement of academic potential, and recovery from or compensation for congenital and acquired disorders. A thorough brain-behavioral assessment can assist with a student's transition to the world of work and/or higher education, which nurtures a student's success in society and life.

School neuropsychology is all-encompassing. It combines the study of the mind (psychology) with the study of the brain (neuropsychology) and its relationship to children (development) and education (learning and schools). It is the belief of the editors of this book that all school psychologists should have comprehensive training in pediatric neuropsychology. Without the "neuro" we are missing a fundamental aspect involved in human existence. How can you understand human development without understanding brain-behavior relationships? How can you understand psychology and psychopathology without understanding brain-behavior relationships? How can you understand learning and learning disabilities without understanding brain-behavior relationships? How can you understand any disability or human difference without understanding the nuances of brain-behavior relationships? What aspect of a child (or any human, for that matter) is not brain-behavior based?

Clinical psychology has embraced neuropsychology and promoted training and best practices for those interested in incorporating neuropsychological expertise into their practices (Hannay et al., 1998). Pediatric neuropsychologists often work in hospital settings and collaborate with other medical professionals such as neurologists to determine the behavioral sequelae of central nervous system dysfunction regardless of the underlying causes (Reynolds et al., 2021). They regularly encounter children who have more severe neurological conditions caused by genetic disorders or congenital or acquired brain injuries. Pediatric neuropsychologists in private practice settings incorporate a brain-based perspective as they encounter a range of low to high incident disorders in children and youth.

Psychologists in the schools are often placed in the position of providing assessments focused on answering referral questions related to whether a child meets the criteria for special education services. With the well-documented shortage of school psychologists (Morrison et al., 2020), most practitioners have large caseloads and feel pressure to complete assessments quickly. The special education gatekeeping role of school psychologists encourages speed of assessment, a focus on criteria for services versus individual needs, and a less thorough assessment. Traditional psychoeducational assessments used for special education placement decisions do not always provide sufficient information to inform targeted, evidence-based interventions or consider important nuances among low and high incidence disabling conditions.

When children are assessed comprehensively to identify core patterns of strengths and weaknesses across all information processing modalities, important treatment and care options are discovered that may be outside special education qualification referral questions. For example, analyzing how children take in sensory information from all sources; how quickly and efficiently they process, learn, and store that information; and how they can retrieve and project that information is

critical to understanding the child. It allows the practitioner to make adjustments that will enhance the learning process, connect them to supportive care, and figure out how to enhance learning and emotional stability.

Psychologists who treat school-aged children outside of school settings are expected to help their clients achieve their main job in childhood: completing school. They also need to be familiar with diagnostic frameworks, expectations, legal mandates, services, and staffing issues that are particular to schools. An understanding of these issues is important to the assessment process and the ability to provide recommendations that bridge both home and school. The focus of school neuropsychology nicely blends neuropsychological principles with issues faced in school settings, allows for the development of realistic options for treatment in school settings, and ultimately guides psychologists to work more collaboratively and meaningfully with school staff.

Psychologists in schools treat all children: diagnosed to not yet diagnosed, high achieving to low achieving, emotionally stable to severely dysregulated, and those with ample private care access to those who will receive most of their intervention services from school personnel. It is the responsibility of psychologists to become familiar with a broad range of symptomology, know the correct questions to ask, and know how to assess appropriately for a variety of difficulties. School neuropsychology provides the foundation for understanding the brain basis of symptoms within the individual and in home, community, and school settings, which leads to a deeper understanding of the reason for symptomology and ways to intervene.

School neuropsychology prepares practitioners to look beyond test scores. While test scores are a necessary gauge in the assessment process, understanding why and how that score was obtained provides important information. What does the pattern of low and high scores across the entire battery have in common? What do they say about how information is received, processed, and generated by the child? How do we influence those inputs and outputs so information is more readily learned?

Over the past several decades, many of the current psychoeducational assessment instruments have slowly integrated neuropsychological constructs into mainstream assessment, such as executive functions, working memory, and processing speed. At a minimum, assessment specialists need to understand the neurological foundations for these constructs to better understand the implications of assessment results. Most traditional psychoeducational assessments include measures of cognitive abilities, academic achievement, and screeners for social-emotional functions, and this level of assessment may be sufficient for potential special education placement considerations. However, school neuropsychological evaluations are more comprehensive and include assessing sensorimotor functions, auditory and visual processing, learning and the various types of memory, executive functions, attention, and processing speed and efficiency. The focus of a school neuropsychological assessment often evaluates *how* a student learns in addition to *what* they have learned and then provides guidance to educators on how to maximize the learning potential of students. School neuropsychological evaluations consider the broad range of ways information is consumed, how it is analyzed and processed, and how the information is relayed to the world. They incorporate historical, medical, social, emotional, and cultural factors to fully understand symptomology. These comprehensive evaluations typically include a deeper analysis of results that helps pinpoint specific difficulties versus a focus only on combined assessment scores, which may overlook important information because the combined scores are balanced by better performance on other subtests in the same domain.

The specialization of school neuropsychology is only a little over 30 years old, yet there have been remarkable advances in theoretical approaches, professional publications, and new assessment resources. In the next section of the chapter, a brief historical review of school neuropsychology will be provided.

A Brief Historical Review

The interest among school psychologists in the field of neuropsychology as it relates to children in the educational environment is not new. The integration of neuropsychology into school psychology can be credited to George Hynd (1981), who helped develop a school neuropsychology specialization within the University of Georgia's Doctoral School Psychology Program in the early 1980s. A major impetus for the interest in school neuropsychology was the passage of Public Law 94-142,

the Education for All Handicapped Children Act of 1975 (EAHCA, 1975), the landmark federal legislation pertaining to the education of children with disabilities. P.L. 94-142 included a disability classification of specific learning disabilities (SLD), which was defined as a disorder in one or more of the basic psychological processes and their impact on academic achievement. The goal of better understanding brain-behavior relationships in children with learning and behavioral problems served as the initial motivation for the development of the school neuropsychology specialization.

Since the early 1980s, there has been an explosion of books and tests published, which has helped advance the school neuropsychology specialization. In the following sections of the chapter, some of the significant publications and advances in assessment products will be mentioned. Undoubtedly, some books and some tests will be left out of this discussion. For a more comprehensive review of the major publications in school neuropsychology, see Miller and Maricle's (2019) *Essentials of School Neuropsychological Assessment Third Edition*.

1980–1989 School Neuropsychology Resources

Starting in the 1980s and continuing each decade thereafter, a steady group of researchers, book authors, and test developers have advanced the specializations of pediatric and school neuropsychology. The first textbook for practitioners interested in school neuropsychology and written by school psychologists was *Neuropsychological Assessment of the School-Aged Child: Issues and Procedures* (Hynd & Obrzut, 1981). Several other pediatric neuropsychology textbooks published in the mid-to-late 1980s were used for a number of years in many graduate neuropsychology classes (listed in order of publication dates): *Child Neuropsychology: An Introduction to Theory, Research, and Clinical Practice* (Rourke et al., 1983), *Neuropsychological Assessment and Intervention with Children and Adolescents* (Hartlage & Telzrow, 1986), *Child Neuropsychology Volume 1 – Theory and Research* and *Child Neuropsychology Volume 2 – Clinical Practice* (Obrzut & Hynd, 1986a, 1986b), *Pediatric Neuropsychology* (Hynd & Willis, 1988), *Fundamentals of Clinical Child Neuropsychology* (Novick & Arnold, 1988), *Assessment Issues in Child Neuropsychology* (Tramontana & Hooper, 1988), and the *Handbook of Clinical Child Neuropsychology* (Reynolds & Fletcher-Janzen, 1989).

The state of the art in pediatric neuropsychological assessment in the 1980s were the *Children's Halstead-Reitan Neuropsychological Test Battery for Older Children ages 9–14* (Reitan & Davison, 1974; Reitan & Wolfson, 1992), the *Reitan-Indiana Test Battery for Children ages 5–8* (Reitan, 1969; Reitan & Davison, 1974), and the *Luria-Nebraska Neuropsychological Battery: Children's Revision* (Golden, 1986). In 1983, the *Kaufman Assessment Battery for Children* (K-ABC; Kaufman & Kaufman) was introduced as a new test of cognitive abilities and was one of the first intelligence tests to be principally based on neuropsychological theory. The current version of the K-ABC is the *K-ABC Second Edition Normative Update* (Kaufman & Kaufman, 2018).

In 1989, the *Woodcock-Johnson Psycho-Educational Battery, Revised* (WJ-R; Woodcock & Johnson) was published. New to this edition was the integration of Gf-Gc theory (Cattell & Horn, 1978; Horn 1968, 1988) as the theoretical foundation for the test. The current version, the *Woodcock-Johnson IV*, consists of three co-normed batteries: the *Woodcock-Johnson IV Tests of Cognitive Abilities* (WJ IV COG; Schrank et al., 2014c), the *Woodcock-Johnson IV Tests of Oral Language* (WJ IV OL; Schrank et al., 2014b), and the *Woodcock-Johnson IV Tests of Achievement* (WJ IV ACH; Schrank et al., 2014a), all based on Cattell-Horn-Carroll (CHC) theory, which is an extension of Gf-Gc theory (McGrew, 2005; Schneider & McGrew, 2012).

By the late 1980s, neuropsychology had gained such a following within the school psychology community that a special interest group was formed within the National Association of School Psychologists (Miller, 2010, 2013; Miller & Maricle, 2019). School neuropsychology was just starting to crystalize as a sub-specialization within school psychology in the 1980s, but the resources that became available to practitioners and researchers in the 1990s solidified the emerging specialization.

1990–1999 School Neuropsychology Resources

In 1990, P.L. 94-142 was reauthorized and given the moniker the Individuals with Disabilities Education Act (IDEA). In this revised version of special education law, traumatic brain injury was a recognized disability for the first time, which enhanced interest in school neuropsychology. The 1990s was the decade during which neuropsychological assessment tools were published that were

specifically designed for school-age children and youth and were not just downward extensions of adult tests. Several first editions of memory and learning tests specifically designed for school-aged children were published (e.g., *Wide Range Assessment of Memory and Learning* (WRAML; Sheslow & Adams, 1990); *Test of Memory and Learning* (TOMAL; Reynolds & Bigler, 1994); and the *Children's Memory Scale* (CMS; Cohen, 1997)). Several first editions of complete tests of cognitive abilities based on neuropsychological theories or neuropsychological test batteries were published, including the *Cognitive Assessment System* (CAS; Nagileri & Das, 1997), the *NEPSY: A Developmental Neuropsychological Assessment* (Korkman et al., 1997), and the *Wechsler Intelligence Scale for Children as a Process Instrument* (Wechsler et al., 1999). Current versions of these tests include the *Cognitive Assessment System - Second Edition* (CAS2; Naglieri & Goldstein, 2014), NEPSY-II (Korkman et al., 2007), and the *Wechsler Intelligence Scale for Children Integrated, Fifth Edition* (Wechsler & Kaplan, 2015), which is a companion test with the current version of the *Wechsler Intelligence Scale for Children, Fifth Edition* (WISC-V; Wechsler, 2014).

In the 1990s, several texts were published by school psychologists on the topic of school and pediatric neuropsychology, including *Neuropsychological Foundations of Learning Disabilities: A Handbook of Issues, Methods, and Practice* (Obrzut & Hynd, 1991), *Child Neuropsychology: Assessment and Interventions for Neurodevelopmental Disorders* (Teeter & Semrud-Clikeman, 1997), and the second edition of the *Handbook of Clinical Child Neuropsychology* (Reynolds & Fletcher-Janzen, 1997). During this decade, several additional books written by pediatric neuropsychologists were published, including *Advances in Child Neuropsychology, Volume 1* (Tramontana & Hooper, 1992) and *Pediatric Neuropsychology: Interfacing Assessment and Treatment for Rehabilitation* (Batchelor and Raymond, 1996).

In 1995, the *Child Neuropsychology* journal published its first issue. This journal has become an important outlet for research related to school neuropsychology and pediatric neuropsychology. In 1999, the American Board of School Neuropsychology (ABSNP) was established. ABSNP issues diplomate certificates in school neuropsychology following demonstration of competence through training, peer-review case study, and written examination.

2000–2009 School Neuropsychology Resources

During the first decade of the twenty-first century, multiple books were published in the emerging school neuropsychology specialization. Two school psychologists published three books that discussed the neuropsychological foundations of academic achievement: *The Neuropsychology of Reading Disorders* (Feifer & De Fina, 2000), *The Neuropsychology of Written Language Disorders* (Feifer & De Fina, 2002), and *The Neuropsychology of Mathematics* (Feifer & De Fina, 2005). In 2007, *The Neuropsychology of Reading Disorders* book was updated and replaced by *Integrating RTI with Cognitive Neuropsychology: A Scientific Approach to Reading* (Feifer & Della Toffalo). In 2001, Dawn Flanagan and Samuel Ortiz wrote the first edition of the *Essentials of Cross-Battery Assessment*, an influential book on the practice of school neuropsychology. Also in 2001, the *Delis-Kaplan Executive Function System* (D-KEFS; Delis et al., 2001) was published and provided school neuropsychologists with new measures of executive functions.

In 2002, Virginia Berninger, a trainer of school psychologists, and Todd Richards, a neuroscientist, wrote a book designed to bridge the gap between brain-behavior research and education called *Brain Literacy for Educators and Psychologists*. In 2003, Sally Shaywitz, a physician, wrote an influential book called *Overcoming Dyslexia*. She was the keynote speaker at the 2004 National Association of School Psychologists (NASP) Convention in Dallas, Texas. In 2004, Ida Sue Baron, a clinical neuropsychologist, wrote *Neuropsychological Evaluation of the Child*. In 2004–2005, two influential school neuropsychology books were published: *School Neuropsychology: A Practitioner's Handbook* (Hale & Fiorello, 2004) and the first edition of the *School Neuropsychology Handbook* (D'Amato et al., 2005). Both of these books were used as textbooks in graduate school neuropsychology classes for several years.

In 2006, the first national School Neuropsychology conference was held in Dallas, Texas, and a national school neuropsychology conference has been held each subsequent year. In 2007, the first edition of the *Essentials of School Neuropsychological Assessment* (Miller, 2007) and the *Essentials of Cross-Battery Assessment, Second Edition* (Flanagan et al., 2007) were published, and the NEPSY-II (Korkman et al., 2007) was released.