Natália Martins Dias
Caroline de Oliveira Cardoso *Editors*

Neuropsychological Interventions for Children - Volume 2

Applications and Interfaces

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Foreword to the Brazilian Edition

In recent decades, we have observed the significant growth of Neuropsychology as a comprehensive science, with many branches that extend to various areas of knowledge, including child development. The neuropsychological approach to a child with neurodevelopmental disorders allows us to understand what is happening in their brain; establish possible anatomic-clinical correlations; detect cognitive, emotional, or behavioral changes; and select quantitative and qualitative tests that can assess their true deficits and preserved abilities. Thus, we obtain their functional profile and can draw up an intervention plan based on their potential and appropriate to the development of the compromised abilities.

According to Vygotsky and his disciple Luria, the maturation of a child's higher mental functions is not only due to its biological substrate but is also influenced by the environment with which it interacts, and it is essential to consider the emotional, family, social, cultural, and economic aspects in the Neuropsychological Intervention.

The advancement of studies and research in the field of Child Neuropsychology, especially with the advent of structural and functional neuroimaging techniques, has allowed the realization of a clinical intervention work increasingly efficient and with results that offer patients better prospects for life. This work increasingly bears the mark of the multidisciplinary character of Neuropsychology.

Publications that can add knowledge to this area are very important for researchers and therapists working in Child Neuropsychology. In this book, the organizers, Dr. Natalia Martins Dias and Dr. Caroline de Oliveira Cardoso, two great neuropsychologists and researchers in the field of Neuropsychology, gathered renowned professionals to discuss interventions in the clinical context and interface areas of Child Neuropsychology.

In the first section of this book dedicated to the presentation of clinical cases related to Neurodevelopmental Disorders, the authors are concerned with presenting an update of research done on the disorders in question and discuss, in the presentation of each clinical case, a systematized stimulation adapted to the individual characteristics of the child or adolescent. Let's talk a little about the seven chapters of this session:

In Chap. 1, "Neuropsychological Intervention in Brain Injuries in Childhood and Adolescence," the authors highlight the advantages of applying a Neuropsychological Rehabilitation program with a holistic or multimodal approach to work on the cognitive-behavioral and social development of these patients, including individual and group care. The case study presents the gains obtained by an adolescent with a model of biopsychosocial clinical care of functionality created to respond to the complaints and deficits raised from the Neuropsychological evaluation of the case. This program is extended to the patient's parents, caregivers, and teachers and aims to extend the gains obtained in the clinic to his daily life, school, and social life.

In Chap. 2, "Neuropsychological Rehabilitation in Patients with Attention Deficit Hyperactivity Disorder," a topic frequently discussed and explored in literature, the authors describe the most common comorbidities that accompany this condition and discuss the neuropsychological deficits that are more prevalent in this disorder, with a focus on the functions of attention, working memory, inhibitory control, procrastination, and emotional regulation. They propose intervention through cognitive training and holistic neuropsychological rehabilitation (HNR) in order to establish individualized goals for the patient and strategies to compensate for the deficits, grounded in their preserved abilities, through the systematization of the areas worked on. They also discuss pharmacological therapy and the application of the neurofeedback technique. The clinical case illustrates the importance of neuropsychological evaluation and qualitative and quantitative results for identifying the patient's deficits and cognitive reserves in order to design an appropriate rehabilitation program. It shows how HNR can have positive effects on the automation of the aspects worked on.

In Chap. 3, the authors address Autism Spectrum Disorder (ASD), proposing a "Practical Model of Neuropsychological Intervention for the ASD." In the neuropsychological intervention, in addition to behavioral-cognitive techniques, coping and emotional regulation strategies are used, aiming to improve the individual's functionality. The clinical case involves a boy with moderate ASD, explaining the main steps of the neuropsychological assessment and intervention, based on an ecological diagnosis, aiming to understand the problems faced by the child and his family, in order to create work steps that can be constantly reassessed and adjusted. Thus, the authors demonstrate that neuropsychological intervention extends far beyond cognitive rehabilitation.

Chapter 4 tackles a very challenging topic, which is "Intervention in Intellectual Developmental Disorder." The patient with intellectual developmental disorder (IDD), in addition to the delay in neuropsychomotor development, exhibits deficits in intellectual functions and limitations in cognitive functioning/development and adaptive behavior. The authors discuss the main intervention programs currently available and emphasize that the best results were achieved through programs that use metacognitive strategies. They highlight early behavioral intervention and neuropsychological interventions with cognitive stimulation programs as positive. The case study presented here demonstrates the importance of neuropsychological assessment, cognitive intervention, school inclusion work, and family guidance in the care of patients with IDD.

In Chap. 5, the authors present the application of the "Historical-Cultural Neuropsychological Approach," developed primarily by Vygotsky and Luria, in the intervention of a case of childhood absence epilepsy. This is a different approach from the cognitive neuropsychological approach and is based on some primary concepts: neuropsychological factors, functional system, systemic and dynamic location of psychological functions, and the concept of activity. From the identification of these factors, the evaluation-intervention process will select the activities that involve the deficits in neuropsychological functioning, will outline the work to overcome the compromised areas, and will provide support during the intervention, mediating and adjusting the activities, aiming to meet the needs of the child's psychological age. The clinical case introduces the concept of "defectology" which is based on a conception of development as an essentially qualitative process, through which the "defect" produces flaws and alterations that lead to the creation of adaptations and compensatory paths, leading the system to a new order.

In Chap. 6, "Rehabilitation of Reading and Writing Learning Disorder," the authors clarify the diagnostic criteria involving learning disabilities described in the literature, highlighting the high incidence of students who suffer from academic failure causing low self-esteem and emotional and social problems. The clinical case presented here draws the reader's attention to the careful diagnosis that a specific learning disorder requires, since the symptoms may change throughout the patient's history, necessitating changes in the therapeutic approach. The described adolescent presented deficits in the phonological pathway in the first years of schooling that were gradually overcome. However, her greatest difficulties were related to lexical-semantic processes and lexical access, impacting reading comprehension and characterizing semantic dyslexia. The intervention was based on metalinguistic and metacognitive strategies, aiming at stimulating lexical-syntactic-semantic processing.

In Chap. 7, "Remediation of Developmental Dyscalculia," the authors define developmental dyscalculia (DD) as a learning disorder characterized by atypical development of mathematical skills and low arithmetic performance, not justified by sensory, intellectual, pedagogical, or socioeconomic disabilities. They posit that a diagnosis should be made by a neuropsychologist, with school screening instruments, specialized psychometric instruments to assess DD, and data on the child's school, emotional, and interpersonal history. Remediation should follow five modalities of intervention: math-centered, psychological and behavioral approaches, noninvasive brain stimulation technologies, pharmacological, and multicomponent. The case study presented demonstrates gains in numerical cognition in children with DD from computerized training, non-instrumental music training and neuropsychological cognitive training.

In the second section of the book, from Chaps. 8, 9, 10, 11, 12, 13, and 14, the authors discuss interface areas of child neuropsychology, proving once again the extensive work of Neuropsychology and how its performance has shown promising results. Let's see what interfaces are discussed here:

In Chap. 8, "School Neuropsychology," the author brings some of the history of the area of school neuropsychology, with its levels of neuropsychological

assessment and intervention, its benefits, and its limits. The author talks about the scope of the interdisciplinary "Education and Neuropsychology" and the important role of the neuropsychologist in educational practices. She also advocates the creation of instruments, with performance standards for children and adolescents in learning situations, which are used and applied appropriately.

In Chap. 9, "Play and Game: Outlining Playful Practices in the Scenarios of Stimulation and Rehabilitation of Executive Functions," the authors defend the application of digital games in the stimulation and remediation of executive functions (EF) in children and adolescents. They propose the creation of preschool programs focused on the stimulation of EF as a prevention of future learning disabilities. They bring research data proving that digital games benefit prefrontal lobe maturation, act in favor of brain neuroplasticity, and are motivational because of their playful and interactive aspect.

In Chap. 10, "Mindfulness as a Strategy in Child Stimulation and Rehabilitation," the authors present several studies showing the benefits of mindfulness-based interventions in different clinical conditions such as ADHD and ASD, with improvement in neurocognitive functions of attention, executive functions, emotional regulation, and improvement in depression and anxiety. Studies conducted with mindfulness intervention in schools have shown positive results in students' academic performance and mental health. Research shows that the practice of mindfulness activates the prefrontal area and strengthens neural connections. The most effective results of mindfulness interventions seem to occur when their practice is associated with neuropsychological techniques.

In Chap. 11, "Motor Skills and Executive Functions: A Close Relationship Throughout Childhood," the authors try to establish the relationships between motor development and cognitive development, focusing mainly on the executive functions. There are neuronal connections between the prefrontal cortex, primarily responsible for executive functions, and the cerebellum, responsible for temporal control and coordination of movements, which may explain these relationships. When studying the neurodevelopment of children, we detect that there seems to occur a synchronicity in the advancement of the development of EF and of broad and fine motor skills. Research with children and adolescents proves that systematic and long-lasting physical activity programs promote positive effects in several domains of cognition and metacognition, especially in executive functions. It is interesting to think about the benefits that interventional physical activity programs applied in schools can bring in the implementation of students' executive functions and how much we still have to research on this subject.

Chapter 12, "Play and Games as Tools for Cognitive Stimulation: Possible Interfaces with Neuropsychological Intervention," brings the importance of the child's play behavior allowing him/her to have experiences and through them create, imagine, interact, and learn. It is through play that the child trains its psychological and psychic functions and develops its cognition. According to the authors, the appropriate interaction of the adult with the child through play, respecting his/her age, time, creativity, and proposals, provides cognitive, socialization, and

language gains. Symbolic and sociodramatic play stimulates the child to think, to be flexible, to take on character roles, and to express feelings. They emphasize that when playing with children with cognitive deficits, it is up to the therapist to create strategies that engage them and enable their learning without taking away their spontaneity. The neuropsychologist can use planned scenarios to contextualize a sociodramatic play, offering material for them to organize, create, and develop their cognitive skills. Every child should have time to play, especially those who have some cognitive deficit.

In Chap. 13, "Music and Neuropsychological Rehabilitation: Multidisciplinary Perspectives" the authors point out that the neurosciences have sought to deepen their knowledge of the functional neuroanatomy of musical cognition, but much still needs to be done. Music activates broad brain areas involved in cognition and emotional processing. It affects the functioning of the brain, causing physiological changes in humans such as variations in heartbeat and respiratory rate, production of neurotransmitters linked to reward and pleasure, and even neuromodulation of pain. Musical training modifies the brain, requires multimodal skills, and integrates cognitive functions such as attention, memory, and sensory and body association areas, involving learning processes. Several studies prove the gains offered by music in the physical and cognitive rehabilitation of different neurodevelopmental disorders such as ASD, ADHD, and language disorder, in cases of Williams syndrome, among others.

In Chap. 14, "Transcranial Direct Current Stimulation: New Perspectives in the Rehabilitation of Children and Adolescents," the authors deal with transcranial direct current stimulation (tDCS), a noninvasive, painless neuromodulation technique that has been used as an alternative treatment, or in conjunction with pharmacological treatment, in patients with neuropsychiatric disorders such as major depression and schizophrenia. In adults, its application has been widely investigated with good results. The main focus of the authors is the studies that have investigated the effects of stimulation with tDCS in children and adolescents with neurodevelopmental disorders such as ASD, ADHD, and dyslexia and in neuromotor disorders. In these cases, tDCS has been used in conjunction with rehabilitation techniques and has shown cognitive gains and induction of neuroplasticity, improving the learning process. The dose parameters should be adjusted in the case of children, taking into account the anatomical and neurophysiological differences of a developing brain. Further research on the application of tDCS in childhood and adolescence needs to be implemented.

As we can see, this is a brilliant work concerned with transmitting knowledge of scientific quality to all students and professionals who are interested in this exciting area of science which is neuropsychology. I greatly appreciated the content of this book and the way it was written. Reading it made me reflect on several aspects of neuropsychological intervention in children and stimulated my constant search for innovative rehabilitation techniques. I congratulate all the authors for their excellent work.

I thank the honor of prefacing this work and recommend it to all who are interested in child neuropsychology and seek to improve their clinical and therapeutic approach.

To the readers, happy reading!

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Acknowledgments

"*An entire book about intervention*!" This was our goal when the idea of setting up this partnership came up. A partnership that combined the scientific interest of two young researchers with experience in developing interventions, authors of PIAFEx and PENcE, and the concern in making available material with practical tips, truly useful.

From this initial idea came not just one, but two works of *Neuropsychological Interventions for Children*:

- Volume 1: *From Early-Preventive Stimulation to Rehabilitation*
- Volume 2: *Applications and Interfaces*

From our experience in the development, application, and evaluation of intervention programs in childhood, we believe that we have assembled in these two volumes a unique team, which will certainly make this book a reference in the area of child neuropsychology. We thank the fellow authors, experts in their respective areas, who readily agreed to collaborate with us, writing chapters rich in research data, professional experience, and rationale for practice for both volumes.

We thank, above all, the organizers of the *Neuropsychology in Clinical Practice Collection*, where this work was initially and originally published, in Brazil, and Springer, which gave us international visibility. This partnership certainly brings a great contribution to the development of neuropsychology in Brazil and worldwide.

Natália M. Dias
Caroline O. Cardoso
Volume Editors

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About the Editors

Natália Martins Dias is a psychologist, graduated from Universidade São Francisco. Natália received Master and PhD, with post-doctorate, in Developmental Disorders from Universidade Presbteriana Mackenzie, São Paulo, Brazil, and is Professor of the Department of Psychology at the Universidade Federal de Santa Catarina—UFSC, Brazil. She is the coordinator of the Cognitive and School Neuropsychology Laboratory—LANCE and member of the board of the Brazilian Society of Neuropsychology—SBNp (2019-2025) and of the "Neuropsychology" Working Group of the National Association of Researchers in Psychology (ANPEPP). Professor Natália is also an Associated Researcher of the National Science for Education Network—CpE and a CNPq Research Productivity Scholar.

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