Second Edition

Assessing Neuromotor Readiness for Learning

The INPP Developmental Screening Test and School Intervention Programme

Sally Goddard Blythe

WILEY Blackwell

Assessing Neuromotor Readiness for Learning

The INPP Developmental Screening Test and School Intervention Programme

Second Edition

Sally Goddard Blythe

WILEY Blackwell

This second edition first published 2025

Edition History
John Wiley & Sons, Inc. (1e, 2012)

Registered Office(s)
John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, USA
John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

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.

Library of Congress Cataloging-in-Publication Data Applied For:
Paperback ISBN: 9781394337736

Cover Design: Wiley
Cover Image: © Ariel Skelley/Getty Images

Set in 12/15pt, JoannaMTStd by Straive, Pondicherry, India

Contents

About the Companion Website

Assessing Neuromotor Readiness for Learning - The INPP Developmental Screening Test and School Intervention Programme, 2nd Edition is accompanied by a companion website

www.wiley.com/go/blythe/neuromotorreadiness2

The website includes:

- Appendix 2
- Appendix 3

1
Introduction

1.1 OVERVIEW[1]

A significant percentage of children in mainstream schools have been found to have immature motor skills and postural instability.[2,3,4] Such neuromotor immaturity is often rooted in the continued presence of a cluster of primitive reflexes (normally present in infants up to 6 months of age, and then replaced over time by postural reactions). Research has shown that there is a direct correlation between immature motor skills and educational achievement. With proper guidance and instruction, teachers and other professionals can be trained to screen for signs of such delay, so that appropriate referrals can be made or physical intervention programmes introduced. This book provides all the tools and guidance needed to identify children with such immaturity, implement a physical programme if appropriate and evaluate outcomes.

There are many motor training and movement programmes available, but the model developed by the Institute for Neuro-Physiological Psychology (INPP) described in this book is unique in having been evaluated in practice and offering a means of assessing neuromotor status in the pre-school and school-aged child both at the beginning and at the end of intervention.

The book is organised in three sections:

1. The first section offers a series of screening tests for children aged 4–7 years to assess the presence of three reflexes, control of static balance, coordination, visual perception and visual-motor integration.
2. The second section provides a similar series of screening tests for children from 7 years of age and above.
3. The third section details a complete developmental movement programme designed to be used with whole classes or smaller groups of children over the course of one academic year.

Assessing Neuromotor Readiness for Learning - The INPP Developmental Screening Test and School Intervention Programme, Second Edition. Sally Goddard Blythe.

Companion website: www.wiley.com/go/blythe/neuromotorreadiness2

This book is supported by additional test materials and observation and score sheets to download available from www.wiley.com/go/blythe/neuromotorreadiness2. and enhanced by INPP video training materials, available for download purchase from https://www.inpp.org.uk/accessnmr.

1.2 RATIONALE FOR SCREENING AND REMEDIATION OF NEUROMOTOR IMMATURITY

The INPP programme for schools is based on a clinical programme developed at the INPP and it has been used since the 1970s. In 1996, key tests were selected from the INPP full diagnostic assessment and clinical programme and adapted by the author for use with larger groups of children in a school setting.

This adapted series of screening tests is intended to be used by teachers, doctors and other trained professionals involved in child development and education *as a screening tool only*. It will not provide sufficient detailed information to justify a diagnosis, nor is it intended to replace standard neurological examinations, psychological or educational assessments usually carried out by trained psychologists, remedial specialists, medical and other non-medical professionals. It will, however, provide tools that enable a teacher to identify children who are under-achieving as a result of immature neuromotor skills and who are likely to benefit from the INPP programmes or other physical remedial programmes.

The INPP developmental movement programme comprises a series of daily exercises, based on movements normally made by the developing child in the first year of life. These movements must be carried out every day under teacher supervision. One of the major differences between the INPP programme and many other programmes designed to improve coordination and balance, is that the INPP exercises take children back to the very *beginning* of balance training and postural development.

1.3 WHAT IS THE INPP?

The Institute for Neuro-Physiological Psychology was established in 1975 by psychologist Peter Blythe PhD with several aims in mind:

1. To carry out research into the effects of immaturity in the functioning of the central nervous system (CNS) in children with specific learning difficulties (and adults suffering from anxiety states, agoraphobia and panic disorder).
2. To develop reliable methods of assessing CNS maturity.
3. To devise effective remedial intervention programmes.

Children seen at the INPP are examined on an individual basis using a series of standard medical tests to assess a range of physical abilities:

- gross muscle coordination and balance;
- patterns of motor development;
- cerebellar involvement;
- dysdiadochokinesia (ability to carry out rapid alternate movements);
- aberrant primitive and postural reflexes;
- oculomotor functioning (control of eye movements);
- visual perception;
- visual motor integration (VMI);
- audiometric examination and dichotic listening.

The diagnostic assessment findings provide the basis for an individual regime of physical exercises which the child carries out every day at home under parental supervision. The exercises take between 5 and 10 minutes a day over a period of approximately 12 months. The child is reviewed at 6 to 8 weekly intervals to assess progress and adjust the exercises accordingly.

One of the problems with the INPP clinical programme has always been that it involves detailed assessment on a one-to-one basis, is costly in terms of professional time and can, therefore, only reach a relatively small number of the children who would benefit from this type of assessment and intervention. It was to overcome this problem that, in 1996, the author selected a reduced number of tests from the INPP diagnostic assessment and compiled the shortened screening tests in this book, which have been designed to be used as a *screening device* by teachers and other professionals involved in education and child development, to enable them to identify children with signs of neuromotor immaturity.[5]

1.4 THE INPP DEVELOPMENTAL MOVEMENT PROGRAMME FOR SCHOOLS

As part of the same package, the author also devised a unique developmental movement programme for use in schools. The concept behind the combined screening tests and developmental programme was that teachers could be trained in a 1-day course how to administer the screening tests, enabling them to identify children with signs of neuromotor immaturity in the classroom and implement effective intervention.

The Developmental Movement Programme is designed to be used with a whole class of children or smaller selected groups for 10 minutes a day, every school day, over the course of one academic year. Teachers do *not* select specific exercises for individual children but use the developmental movements in sequence, progressing according to the abilities of the class with the slowest child setting the pace.

This programme has been widely used in individual schools throughout the UK, in other European countries and as far afield as South Africa and Mexico. Research carried out on the screening tests and developmental movement programme has consistently shown that:

1. Neuromotor immaturity is a factor amongst children in mainstream schools.
2. There is a link between neuromotor immaturity and lower educational performance.
3. The INPP Developmental Movement Programme is effective in reducing markers of neuromotor immaturity.
4. When clear signs of neuromotor immaturity (> 25%) *and* educational under-achievement coexist, children who followed the INPP developmental movement programme showed greater improvements in measures of non-verbal cognitive performance and reading.[6]
5. Small group studies have indicated that children who were under-achieving by more than a year in reading and who had clear signs of neuromotor immaturity (> 50%) made significantly increased gains in reading at the end of the year having followed the INPP Developmental Movement Programme.[7]

1.5 WHAT IS NEUROMOTOR IMMATURITY?

Neuromotor performance describes a complex functional behaviour which results from activation of the central and peripheral nervous systems and involves motor structures which operate through the musculoskeletal system involving multiple inputs from the individual's internal and external environment. The systems and structures responsible for movement within an individual are constantly evolving throughout the developmental process, but at certain stages in development a child is expected to have attained a certain level of neuromotor performance. Motor milestones and motor performance provide outward signs of functional neuromotor maturity.

Neuromotor *immaturity* describes the retention of immature patterns of movement control. These may occur as a result of classical neurological signs (pathology) or be reflective of a functional or developmental delay in the pathways involved. The INPP screening tests are aimed at identifying various 'soft signs'* of neurological dysfunction together with the presence of three primitive reflexes in the school-aged population. These tests do not point to causation, nor do they predict learning outcomes in individuals, but they can help to identify the presence of obstacles to educational achievement. Furthermore, in many cases, these obstacles can be removed with the use of a specific developmental movement programme.

*Soft sign – a mild or slight neurologic abnormality that does not provide specific information about cause or locus of the problem.

1.6 WHAT IS THE SIGNIFICANCE OF PRIMITIVE REFLEXES TO EDUCATION?

Primitive reflexes are included in the INPP screening tests because the presence of primitive reflexes at key stages in development provides acknowledged signposts of maturity in the functioning of the CNS. While doctors, midwives and health visitors are familiar with assessment of the primitive reflexes at birth, and tests for primitive reflexes are repeated at developmental check-ups in the first 6 months of postnatal life, if development appears to be progressing normally in the first year then these tests are not repeated in the pre-school or school-aged child. Capute[8] noted:

> While motor milestones – the neurodevelopmental functional end point of the transitioning of the immature and mature primitive reflexes into volitional activity – have been highlighted in predicting future motor function, the primitive reflexes represent the earliest neurodevelopmental markers available for study. By paediatricians becoming familiar with their quantitative and qualitative aspects, coupled with the time of their appearance and suppression, they will have this neuromotor tool available for the early detection of a significant motor handicap. Primitive reflexes have been highlighted since they are available at birth to be clinically evaluated and followed during sequential office visits during the first six months of life, the time during which infants are more closely followed at office visits. Delay or deviancy (non-sequential appearance) of motor milestones are preceded by an exaggeration or delayed suppression of the primitive reflexes.

Residual primitive reflexes in the school-aged child are not necessarily the primary cause of difficulties observed in the classroom but, rather, signify immaturity in the functioning of the CNS and associated pathways, which support many higher aspects of learning.

1.7 WHAT ARE PRIMITIVE REFLEXES?

Primitive reflexes are a group of reflexes that develop during life in the womb, are fully developed at birth in the full-term baby (40 weeks) and are gradually inhibited and transformed into more mature patterns and postural abilities during the first 6 months of postnatal life. Only one of the primitive reflexes, the Tonic Labyrinthine Reflex (TLR), can remain in a modified form up to 3.5 years of age.

Inhibition and transformation occur primarily as a result of maturation within the developing central nervous system. Primitive reflexes never entirely disappear but become inhibited as 'higher' centres in the brain mature in the first months of life. Primitive reflexes can remain active if there has been damage to higher centres in early life, such as cerebral palsy, or if there is accident or damage to higher brain

centres in later life, for example after a stroke, head injury or in degenerative diseases of the CNS, such as multiple sclerosis or Alzheimer's disease. According to medical theory, primitive reflexes should not remain active in the general population beyond 6 months of age, and, if elicited beyond this age, are usually considered to be indicative of underlying pathology.

However, there is an increasing body of evidence which suggests that *traces* of primitive reflexes (residual reflexes) can remain active in the general population in the absence of identified pathology.[1,2,3,4,6,9,10,11,12] These individuals often do not fit into a particular diagnostic category, but the development of certain motor functions necessary to support higher aspects of learning do not remain commensurate with chronological age. Residual presence of primitive reflexes in children over the age of 6 months can, therefore, provide indications of neuromotor immaturity, which acts as a barrier to learning.

Assessment of primitive reflexes beyond the first 6 months of life provides the clinician or educator with tools with which to:

1. identify signs of neuromotor immaturity (*identification*);
2. assess the type and level of intervention that is appropriate for the child (*intervention/remediation*);
3. measure change in reflex status before and after intervention (*evaluation*).

1.8 WHAT IS THE SIGNIFICANCE OF NEUROMOTOR MATURITY TO EDUCATION?

A longitudinal study tracking the progress of nearly 15 000 children who were born in the UK between 2000 and 2001[13] released findings in February 2010. It showed that children who failed at 9 months to reach four key milestones in gross motor development relating to sitting unaided, crawling, standing and taking their first steps were found to be five points behind on average cognitive ability tests taken at 5 years of age compared with those who passed the milestones. 'Delay in gross and fine motor development in a child's first year, was significantly associated with cognitive development and behavioural adjustment at five'.[14]

Readiness for school requires much more than a child simply reaching the chronological age for school entry. To perform well in an educational environment, a child needs to be able to: sit still; focus attention on one task without being distracted by irrelevant environmental stimuli; hold and manipulate a writing instrument; and control the eye movements necessary to maintain a stable image on the page, follow a line of print without the eyes 'jumping' or losing their place and adjust visual focus between different distances at speed. These are physical abilities, which are linked to the development and maturation of motor skills and postural control. Growth and physical development are as important to education as they are to the field of developmental medicine but have been largely ignored by the educational