ENCOURAGING PHYSICAL DEVELOPMENT through MOVEMENT-PLAY

ENCOURAGING PHYSICAL DEVELOPMENT through MOVEMENT-PLAY

CAROL ARCHER
AND IRAM SIRAJ

SAGE

Los Angeles | London | New Delhi
Singapore | Washington DC

SAGE

Los Angeles | London | New Delhi
Singapore | Washington DC

SAGE Publications Ltd
1 Oliver's Yard
55 City Road
London EC1Y 1SP

SAGE Publications Inc.
2455 Teller Road
Thousand Oaks, California 91320

SAGE Publications India Pvt Ltd
B 1/I 1 Mohan Cooperative Industrial Area
Mathura Road
New Delhi 110 044

SAGE Publications Asia-Pacific Pte Ltd
3 Church Street
#10-04 Samsung Hub
Singapore 049483

First published 2015

Editor: Amy Jarrold
Editorial assistant: George Knowles
Production editor: Tom Bedford
Copyeditor: Michelle Clark
Proofreader: Audrey Scriven
Indexer: Cathy Heath
Marketing manager: Dilhara Attygalle
Cover design: Wendy Scott
Typeset by: C&M Digitals (P) Ltd, Chennai, India
Printed in India at Replika Press Pvt Ltd

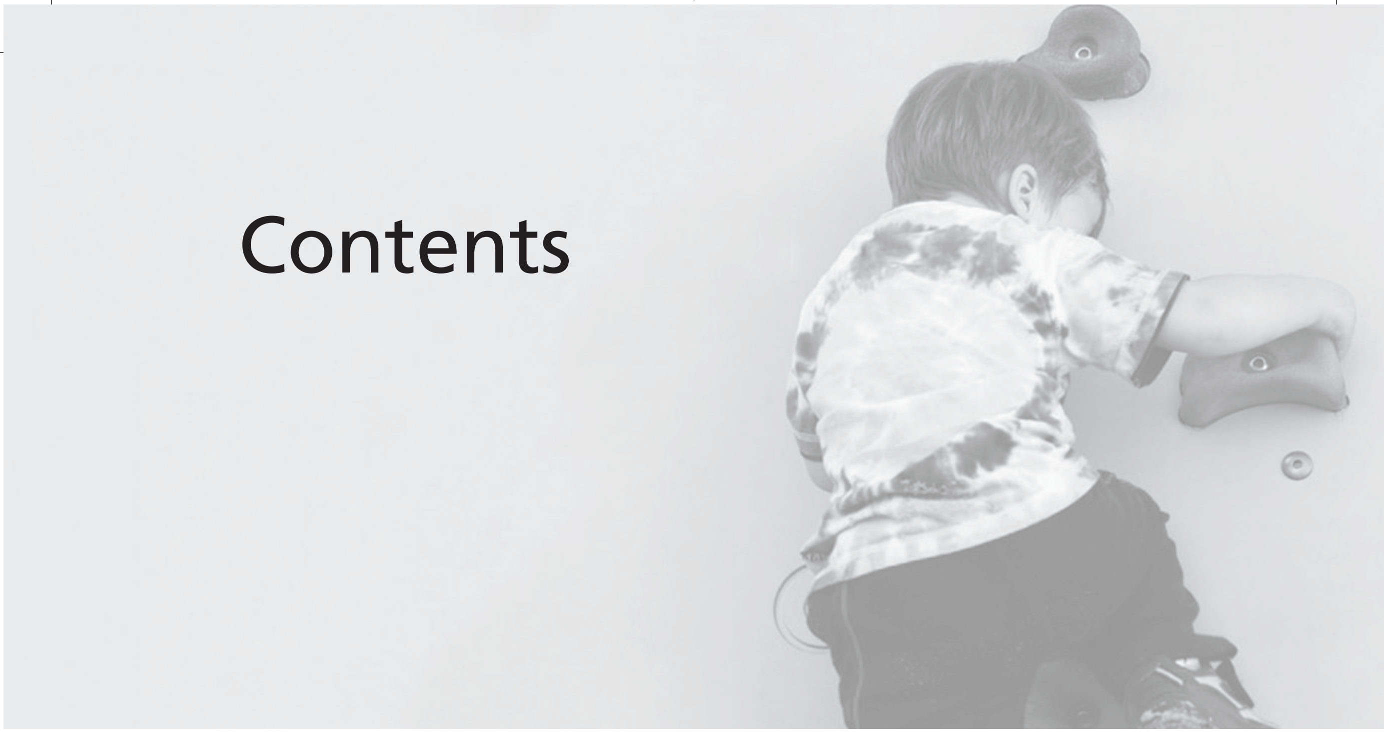
Library of Congress Control Number: 2014953071

British Library Cataloguing in Publication data

A catalogue record for this book is available from the British Library

MIX
Paper from responsible sources
FSC® C016779
FSC www.fsc.org

ISBN 978-1-4462-9711-7
ISBN 978-1-4462-9712-4 (pbk)



Contents

Figures and tables

Figures

Tables

About the authors

Carol Archer has taught in early childhood education and primary schools for over two decades and is currently an advisory teacher for the Integrated Early Years Service in the London borough of Camden. She also works as a movement-play practitioner/consultant for other education authorities. She finished her Master's degree in early years education at the Institute of Education, University of London, in 2011, and recently published a paper with Iram Siraj on 'Measuring the quality of movement-play in early childhood education settings' in the *European Early Childhood Education Research Journal*. She is passionate about promoting physical development through movement-play for all young children from birth to six years of age in this under-researched, under-theorised and under-practised area of learning.

Iram Siraj is Professor of Early Childhood Education at the UCL Institute of Education, University College London, and the University of Wollongong in Australia. Iram's recent research projects have included leading on the Evaluation of the Foundation Phase across Wales and she is a principal investigator for the major Department for Education's 17-year study, the Effective Pre-school, Primary and Secondary Education (EPPSE 3–16, 1997–2014) project, and the influential Researching Effective Pedagogy in the Early Years (REPEY) project. She has led on longitudinal studies/randomised controlled trials as a principal investigator in a number of countries, including the UK, Australia and Ireland. She is currently a specialist adviser to the House of Commons Select Committee on early education and has undertaken reviews of the Foundation Phase for the Welsh Government and the workforce for the Scottish Government. She has also published widely.

Acknowledgements

First and foremost our thanks go to the children and practitioners who have contributed so much to our understanding of young children's movement development, and the many children and parents who gave permission to use photographs to illustrate the movement patterns and physical activities printed in this book.

Special thanks go to all the children and staff at Agar Children's Centre, Collingham Gardens Nursery and 1a Children's Centre for all their time, patience, invaluable help and contributions. In particular, Teresa Barker, Mikelia Fugolin, Katharine Jerrom and Marilyn Sherwood-Clinton for their unceasing support, enthusiasm and sense of humour during the whole process. Thanks also go to Carole Limtouch and Monica Piszczyk for their valuable work with parents and their contributions.

Many thanks to Lynn Linsell, senior manager at Camden Integrated Early Years Service, for her advice and contribution to the template included in Chapter 6 on policy, and to Regents Park Children's Centre for their current Physical Development policy.

Thanks also go to Camilla Saunders and Helen Simpson who read and made constructive and helpful comments on early drafts.

This work on movement-play began with training from Jasmin Pasch, to whom we owe many thanks for her ongoing support, and countless discussions with Carol. Thanks also go to Bette Lamont, who has been a constant inspiration, to Jacqui Cousins for providing direction and support in the early stages of this work, and to Susan Hill who encouraged the development of the assessment scale for movement-play which Camden Early Years Advisors contributed to.

1 Movement-play and its influence on young children's development

What is movement-play?

Movement-play is about children moving in specific ways as they go through a developmental sequence of significant movement patterns that link the body and brain. Early reflexes, senses and movement are the young child's route to learning, which is through the body. Movement and sensory experiences are crucial for the child's social and emotional development, behaviour and learning. Movement stimulates the neurological system that fires and wires the brain, forming a multitude of connections that lay important foundations for the young child's future learning and development. In this way, movement-play is more than physical activity but does not preclude it.

This chapter explores neuroscience and neurological dysfunction in relation to children's movement and physical development. This will be important to the reader as background information in relation to the more practical chapters coming later in the book.

Physical activity and health

Research has exposed the link between exercise and health benefits since the 1950s (Tremarche et al., 2007), but it was only near the end of the last century that it began to be taken seriously (van Praag, 2009). Today, it is common knowledge that physical activity can mitigate the risk of heart disease, type 2 diabetes, osteoporosis, hypertension, cardiovascular disease (DH, 2011) and depression (van Praag, 2009) and improve cognition

(Cotman et al., 2007; van Praag, 2009). Evidence now shows that promoting physical activity across the lifespan can reverse trends in obesity and disease (DH, 2011) and improve brain health, resilience, learning and memory (Cotman and Berchtold, 2007; van Praag, 2009).

Recent lifestyle changes have, however, resulted in increasing amounts of inactivity among even the youngest children and young adults. The use of computers, Internet surfing, video game playing and television have led to ever-increasing numbers becoming overweight or obese (DH, 2011). As a consequence, the last ten years have seen a rising number of young people with health problems that are more usually associated with adults. Mounting concern about the state of health of the youngest children has meant the need for more movement activity has never been greater.

Linking movement with five areas of early childhood development

How does movement and physical development fit in with all the areas of early childhood development? The five broad areas of children's learning and development are:

- physical
- communication and language
- self-regulation
- cognitive
- social and emotional development.

These cover every aspect of a young child's life. Although each area is addressed separately, children's development is interconnected and therefore occurs across all areas.

Physical development

Physical development includes the child's ability to gradually control movement, coordination, balance, fine and gross motor skills. By repeating specific movement patterns, infants eventually learn to balance away from the floor and crawl on all fours. When infants learn to crawl, they put pressure on their hands and fingers through their arms and shoulders. This is how they begin to develop the fine motor skills essential for writing, drawing, throwing and catching a ball, building with blocks and using scissors.

Over time, infants pull themselves up onto their feet, walking and balancing with skill. Later, more challenging and vigorous movement activities are learned and refined, such as climbing high on a climbing frame or wall, hanging upside down, or swinging high on a swing or accomplishing somersaults.

Core concepts of maths are embedded in the body through a sense of rhythm, patterns, sequencing and space. To understand spatial relationships, children must first learn about their own body position and size, which can be done effectively through movement. Movement is at the heart of young children's physical development and is inextricably linked to other areas of learning.

Communication and language

Body language is a fundamental part of communication for very young children and will come before the development of spoken language. When children have developed their movement vocabulary, they will be able to understand the body language of others. Early forms of communication, suggests Maude (2010), are non-verbal as babies successfully use gestures and body language as a means of conveying messages between themselves and their carers and vice versa. Movement conversations can be sustained as the infant and adult make eye contact, touch, smile, change facial gestures and move their bodies in response to each other.

Some people feel more comfortable communicating through body language. Speaking on BBC Radio 4, Akram Khan, a famous contemporary dancer, said he was so shy when he was young that he didn't talk much to other children, especially girls. Then he won a disco competition in his teens and discovered that his body was his language. 'Once I discovered dance,' he said, 'I knew that this is my language. My dance has never failed me. It is my companion.' Akram Khan developed verbal means of communication more easily once he developed his movement vocabulary. Similarly, adults can provide babies and young children with the language and companionship of movement and dance. It is possible to develop a deep bonding experience through moving together with another person.

Maude (2010: 1) reminds us that, 'language acquisition through moving cannot be underestimated'. The acquisition of body language associated with movement includes nouns, such as the names for body parts; verbs, as children lie down, sit on a chair, stand or point; adverbs, such as slowly, quickly; and prepositions, such as up, down, behind, over, under.

Physical literacy can be developed by translating movements into spoken language in a variety of contexts by using descriptive, directional and action words that young children can experience and then use themselves.

Self-regulation

Young children accused of fidgeting are not likely to respond to an adult's demands to sit still. Instead, these children just need to move! Young children learn by actively engaging with and participating in the learning process and, therefore, the classroom environment needs to support the child's body in order that the mind can develop and learn. Many benefits flow from the child actively moving because they learn through their body first and foremost.

Children learn to translate what they physically experience into information they can use to regulate their thoughts, emotions and behaviour (Blair and Diamond, 2008). Infants begin to translate soothing touch and the sound of soft voices into signals that help them to develop self-calming skills. Young children begin to freely move their bodies and gradually begin to learn to inhibit urges to grab things for themselves, then how to wait for their turn, which helps them regulate emotional tension.

When young children learn through their bodies, they are also developing their minds as the two work in partnership together. Children in classrooms that honour their innate need to move learn to regulate their emotions and intellectual development by being provided with numerous and varied opportunities for their bodies to do what they need to.

Cognitive development

Cognitive development occurs rapidly during the preschool years. Neuroscientists have found in their experiments that learning in terms of cognition, memory and behaviour occurs through physical activity. Goddard Blythe (2005a) suggests that physical skills, including balance, posture and coordination, need to be secured in the early years in order for children to enter the school system better equipped to cope with the demands of the classroom. When specific movement activities, such as tummy time, crawling, rolling, swinging, hanging upside down and somersaults, are repeated, areas of the brain are stimulated. It is through repeating specific movement patterns that young children develop their ability to sit still, concentrate, coordinate their hands and eyes when writing and control their eye movements for reading, thus influencing their later academic achievement.

Social and emotional development

Understanding how to communicate, share, make friends and get along with others in the first six years is carried out with more ease through physical activity. Through movement activities or games, children learn rules of behaviour, they learn to read the facial expressions of others and express their own emotions, such as fear, sadness, anger and happiness. As a baby is raised high in the air by a trusted adult she squeals with delight. The first time a young child attempts to hang upside down on a climbing frame he may feel fearful until an observant adult comes to his side or holds him in a gentle, reassuring way. Healthy play experiences such as everyday rough and tumble activities promote social bonds, and nourish social learning and the development of emotionally healthy minds (Panksepp, 2010). When children and parents rough and tumble together, it is a chance to strengthen the bond between them. Sharing stillness and silence with a peer or adult can impact on the children's well-being and feelings of connectedness.

All these areas of child development are not separate entities: physical development, communication, social and emotional and cognitive development and self-regulation do not mature separately from one another. There is an overlap and interconnectedness between them. When children learn something related to one area, it impacts on the others. Children do not differentiate between thinking, feeling and moving because the mind and body are inextricably linked.

Neuroscience research, the brain, exercise and learning and their application to education

We will now turn to neuroscience and how advances in research have informed us about how the brain functions. These findings have considerable implications for early education in terms of teaching and learning, and none more so than those concerning children's earliest years.

The child's body is inextricably linked to the brain, which develops and restructures itself based on experiences. The brain receives information from the senses and integrates it, and the body takes action quickly and efficiently precisely because of the insulation called myelin that forms around the axons. This speeds up communication between neurons.

Myelination begins when the foetus is in the womb, continues throughout childhood and adolescence (Rutter et al., 2010) and relates closely to developmental milestones (Goddard Blythe, 2005a). The child's experiences help to fine-tune the brain's responses to the stimulation it receives. This beneficial process does, however, also highlight the vulnerability of young children's brains, as they can, as a result, be susceptible to developmental problems if their environment is impoverished and experience of movement patterns is limited.

Such knowledge about the brain is relatively new – much is still being discovered and not all is yet fully understood. The use of functional magnetic resonance imaging (fMRI) over the last twenty-five years or so has allowed scientists to see images inside the human brain. These show areas where, as a result of neural activity, oxygen-rich blood is flowing to those active regions of the brain. Blood flowing in specific areas of the brain suggests that particular functions have been activated. For example, a language task will activate several different regions of the brain as there is not just one area that is responsible for that function: several areas can contribute (Greenfield, 2001).

Functional magnetic resonance imaging (fMRI) is a non-invasive procedure widely used in brain science and neuroscientists are presently seeking to explore if they can more accurately map the human brain's 'wiring system' through directly measuring neural activity. Despite its relative newness fMRI has certainly begun to open up our understanding of how the brain works and further research is progressing and developing relatively quickly, 'but the adventure is only really just beginning' (Greenfield, 2001: 192).

The brain is an extremely complex, fascinating, constantly active, living organ. Everyone has a unique brain, developing in response to a person's genetic make-up and the influence of the environment, both of which affect learning ability (The Royal Society (TRS), 2011). Environmental and genetic influences begin while in the womb. After birth, genetic make-up interacts with environmental factors, such as diet, toxins and social interactions (TRS, 2011: 3). Children's experiences, particularly those that stimulate the brain in their earliest years, have a profound effect on structuring their brains (Goddard Blythe, 2005b; Hannaford, 1995; Lamont, 2007b; Macintyre and McVitty, 2004). Further considerations are the effects of early deprivation and poverty, as these interact with a genetic predisposition, affecting future mental health problems and, as a consequence, influence learning (TRS, 2011). This is important information for those interested in children and learning as it is education that can affect young children's well-being and has future economic benefits for the individual and society (TRS, 2011).

Neuroscience research continues to help us understand how the brain functions and is revealing approaches to teaching and learning. Neuroresearch in education, however, is still relatively new and we are advised to be cautious in its application (Bruer, 2002; Jensen, 2005; TRS, 2011). Nonetheless, the findings from brain-based learning influence many aspects of education, such as teaching strategies, special education, learning environments and assessments, to name just a few (Jensen, 2005). Schoolchildren in England typically spend 190 days each year at school for 12 years, accumulating over 12,000 hours of time during their school lives with teachers.

Increasing numbers of infants and young children are attending early education settings, including early childhood settings and school settings (DfE, 2012). As children's brains are susceptible to environmental influences, changes in the brain will undoubtedly take place as a result of their experiences at preschool/school. It would appear, therefore, that preschool/school is the optimum place to influence learning (TRS, 2011).

For some time now, neuroscientists experimenting on animals (Cotman et al., 2007; Hillman et al., 2008; O'Callaghan et al., 2007; O'Callaghan et al., 2009; van Praag, 2009) have shed light on the developing brain and learning, with insights that help us to understand teaching and learning in new ways (TRS, 2011). For example, neuroscientists have demonstrated the benefits of exercise on brain function. Research on animals has revealed that exercise increases the number of new neurons in the hippocampus, an area of the brain that is important for learning, memory and cognition (O'Callaghan et al., 2007; van Praag, 2009). Indeed, research has shown that physical activity has a profound effect on memory (van Praag, 2009). The more aerobic the activity, the more chemicals are released in the brain, which is associated with synaptic plasticity and results in changes in the neural architecture of the brain (Hillman et al., 2008; Jensen, 2005; van Praag, 2009). Therefore, the more enriched the environment, the greater the number of neural connections.

The brain is made up of billions of brain cells called neurons, with its development beginning in the womb (TRS, 2011). By the time babies are due to be born, they will have most of their neurones (Greenfield, 2001). Each neuron makes about 10,000 connections with other neurons. Some of the brain cells are genetically determined, though many are shaped by experiences after birth, with environmental influences also determining how the brain begins to be organised. Thus, the brain processes stimuli from the body and from the outside world (Greenfield, 2001). Connections between the brain cells are known as synapses, enabling information to travel from one neuron to another. Neurons connect to each other and are strengthened when they are activated so that 'neurons that fire together wire together' (TRS, 2011: 5).

After birth, babies' heads continue to grow to accommodate an ever-increasing brain so, by the time children are four years old, their brains are four times the size they were when they were born (Greenfield, 2001). Every time we move, think, interact, talk, walk, learn and feel or remember something, our neurons are making connections. Young children stimulate these connections as they encounter new experiences by repeating them over and over again in an attempt to make sense of the world around them. In this way, they design their own nervous systems as they encounter choices and challenges.

The brain can learn, change and develop in response to experiences, but those pathways that are not used will be pruned away. Activity and growth in the brain run concurrently and we are advised to use it as much as we can (Greenfield, 2001: 147). Our brains are amazingly adaptable, creating more neuronal connections in response to the demands of the environment, known as experience-dependent plasticity (TRS, 2011: 5).

The child develops as a unique individual as synapses build into complex networks through ongoing childhood experiences. Thus, the brain of a child in their early years is capable of being moulded by experience because of the processes of myelination, synaptogenesis and neural plasticity (Rutter, 2006a). During this period of life, the brain is much more sensitive to experiences than it is in later years.

Myelin is the fatty cells that insulate the axons of neurons. The process of myelination helps faster communication to take place between axons. Sensory and motor areas of the brain are myelinated around the pre-school period (Tierney and Nelson, 2009), whereas connections in other areas of the brain are strengthened later, with the vestibular system, for example, at between six-and-a-half and eight years of age (Goddard Blythe, 2005a). So, the times at which different regions of the brain are myelinated differ, with the process in some regions not having been completed until adolescence or early adulthood (Tierney and Nelson, 2009: 3). The early years, however, are particularly important for the development of the brain. This is when the foundations vital for language, social and emotional development are formed and these are strongly influenced by experiences during this time (Tierney and Nelson, 2009: 3). In this way, experiences in a child's earliest years will influence the development of the brain's architecture. While the brain is constantly changing and developing throughout our lifetimes, it is the early years that lay the foundations for the development of the higher-level functions of the brain.

There are times during childhood and young adulthood when changes in the brain involve more exuberant activity than usual, often called 'sensitive periods' (TRS, 2011: 5). A sensitive period is likely to occur at times of high synaptic density during childhood and extending into young adulthood. These periods have been linked with critical times for learning. Sensitive periods have been identified for certain sensory stimuli, such as vision, speech sounds and emotion, as well as motor and cognitive experiences, such as language. The capacity to learn something specific can be lost or diminished because of limited or no experience of it during a critical period (TRS, 2011). For example, infants' brains are tuned in to the sounds of nearly all languages, but a child will learn the language sounds that they are exposed to most and experience with people close to them (Tierney and Nelson, 2009: 3). Learning a second language later in life is more difficult than it is in early childhood. Indeed, the prime time for learning to read, write and speak a second language is in the child's earliest years and up to about the age of 12, when ears and brains are able to adapt to hear differences in sounds so the child can then articulate them (TRS, 2011). After this time, another language becomes increasingly difficult to learn for most people, if not impossible for some, though not all. Pruning of the synapses is mostly related to experience, so neural pathways that are not used will be eliminated, while those that are activated are strengthened (Tierney and Nelson, 2009). The young child's brain is more sensitive to experiences than later in life and is remarkably adaptable and responsive due to its plasticity.

When it comes to applying this knowledge about sensitive periods for learning to the field of education, there is some contention among neuroscientists (Blakemore and Frith, 2005; Bruer, 2002; Goswami, 2006; Howard-Jones, 2007).

Bruer (2002), linking neuroscience, psychology and education in the study of human cognition, questions claims made about the connection between peak synaptic densities and critical times for learning. He (2002: 1032) is sceptical that neuroscience research has much to offer teachers right now as there is more we need to know about changes in synaptic density and how this process influences mental development and cognition before it should be applied to education. He suggests that, as research progresses, which may take many years, it will undoubtedly contribute to the application of science to education. Until then, Bruer argues, its application to education has 'little practical value' and he advocates that more years of research are carried out for this 'approach to bear fruit'.

Bruer made these claims over a decade ago, although concern among neuroscientists more recently is focused on the 'inappropriate exploitation of neuroscience' (TRS, 2011: 17), as the enthusiasm for neuroscience in education has led to some confusion. For example, neuromyths (Goswami, 2006; Howard-Jones, 2007; TRS, 2011) appear to be dominating ideas about teaching and learning, which, Goswami emphatically argues, need to be eliminated. Neuromyths such as identifying children as either left-brained or right-brained learners are regarded as an 'over literal interpretation of hemispheric specialisation' by Goswami (2006: 2), who also questions labelling children as either visual, auditory or kinaesthetic learners, as well as being sceptical about claims made regarding whole brain learning through a commercial Brain Gym® package. These neuromyths are being adopted as facts when, some argue, they should be regarded as a 'misapplication of science to education' (Goswami, 2006: 2).

It is difficult for educationalists to sift through the volume of information, games, and ideas claiming to be based on neuroscientific evidence in order to identify what is 'independent, accurate and authoritative' (TRS, 2011: 18). If educational neuroscience is to be effective and impact on the quality of learning positively, then a long-term dialogue (TRS, 2011) and interdisciplinary cooperation between educators, policymakers and neuroscientists need to take place to ensure 'scientific validity and educational relevance' (Howard-Jones, 2007: 8).

From this we can see that there appears to be a lack of consensus about the application of brain science in education. Neuroscience, however, has certainly entered into the arena of education and, consequently, it is important that it develops into an effective discipline (TRS, 2011).

Blakemore and Frith (2005: 459) stress the importance of anchoring education in neuroscientific evidence-based research, highlighting that, 'now is the time to explore the implications of brain science for education'. Research on the brain and learning 'could influence the way we think about teaching', which may 'transform educational strategies and enable us to design educational programmes that optimise learning' (Blakemore and Frith, 2005: 460). Indeed, The Royal Society (2011: 19) of scientists suggests that neuroscience be considered as a tool for 'science-based education policy' to 'help assess the performance and impact' of a variety of educational approaches. The Society also recommends that neuroscience be included in initial teacher education courses and as part of continued professional development to ensure that 'research is critically discussed, evaluated and effectively applied' (TRS, 2011: 21). Clearly, more communication is needed between neuroscientists, cognitive psychologists and educationalists in order that necessary steps can be taken to implement the most credible research into learning environments for children from birth to 6 years of age.

Movement patterns, development and learning

A significant contribution has been made to our knowledge about the influence of movement on a child's neurological system, learning and development by a number of practitioners and researchers (Goddard Blythe, 2005a; Hannaford, 1995; Jensen, 2005; Lamont, 2007a; Macintyre and McVitty, 2004; McPhillips and Sheehy, 2004). Working in the field of neurological reorganisation and dysfunction, they have first-hand experience of investigating the relationship between movement activity, development and learning with regard to children from birth through primary school and beyond. Persuaded by the influence that early movement patterns have on the neurological system and learning, they are convinced of the importance of its application in early movement-play education.

For example, in her work as a developmental movement therapist, Lamont (2007b) has found that when infants repeat specific movement patterns, such as tummy crawling and crawling on all fours, important developments take place and particular areas of the brain are stimulated. Conversely, when babies miss out on significant movements, then critical functions are compromised, affecting later development and, thus, their ability to reach their full potential at school (Lamont, 2007c). Goddard Blythe (2005a) has developed a programme of physical exercises based on reflexes and movements that infants normally make in the first year of life and has evidence to show the enhanced literacy skills of children who have participated in these exercises at school.

Several weeks after conception, the growing foetus will move in the womb, increasing activity at a later stage by twisting, stretching and kicking. The first year after birth is also a critically important time for the young infant, as this is the time that basic movement patterns are developing. This is indeed the best time for infants to develop these early movements. They do not have to be taught as infants, given the space, time and encouragement, will strive to do all that is required of them to move.

Infants need to be free to explore these significant movement patterns and, in this way, they will design and redesign their complex nervous system (Hannaford, 1995: 22). Movement is the basis of everything we do, from walking, getting dressed and brushing our teeth to talking.

Every infant goes through a series of developmental movement stages before the brain and body can operate at their full potential (Lamont, 2007a: 2). These stages can be revisited at any time and introduced to children who missed out on any of these movement patterns in their earliest years. Learning for the infant and young child is grounded in the body and is inseparably linked to reflexes, the senses and movement (Goddard Blythe, 2005a; Hannaford, 1995; Lamont, 2007b; Macintyre and McVitty, 2004; McPhillips et al., 2000).

Reflexes

Work on foetal movements at the Royal Maternity Hospital in Belfast by McPhillips et al. (2000) revealed that primary reflexes assist and enable development of the architecture of the central nervous system. Primary reflexes are therefore playing a critical role during foetal development that helps the foetus kick, move its arms and legs and suck its thumb. Reflexes that begin during life in the womb are critical for the survival of the baby after birth, such as rooting and sucking, which are triggered in the search for food when the baby is hungry (McPhillips et al., 2000). The newborn is full of primary (sometimes called primitive) reflexes, which all play a part in continuing to organise the brain and body during the first year of life.

After birth, the new baby wriggles its legs and arms around in search of a movement pattern. The baby begins to reach and grasp objects in an attempt to bring them to its midline and then to the mouth. These reflexes are actions that direct the baby's movements in early stages of development.

Some reflexes may be familiar to those who have had contact with a baby, such as the Moro reflex, sometimes called the startle reflex, activating the fight or flight response, or the neck reflexes, such as the symmetrical (STNR) and asymmetrical tonic neck reflex (ATNR) or the Palmar reflex. Goddard Blythe (2005a, 2005b) has written extensively about primary reflexes, how they influence the child's development and how, if reflexes persist, this can interfere with the child's future learning. For example, the ATNR normally disappears when a baby is around six months old (Goddard Blythe, 2005a, 2005b; McPhillips et al., 2000), but, if it persists, can indicate developmental delays.

Given the space to lie flat, an infant's face will turn to one side and the arm and leg will extend on the side to which the head is turned, while the arm and leg on the opposite side flex. This is the ATNR and it should be activated when a baby is placed on his or her tummy and the face turns automatically to one side to enable breathing to take place. As the head moves to one side, so the baby's eyes follow the hand in the same direction, with the head, eyes, and hand moving in unison. Eventually, the baby's eye and hand movements begin to happen independent of the head movement, which is an early sign of hand–eye coordination (Goddard Blythe, 2005a; McPhillips et al., 2000) and this is very important for later literacy development and other aspects of coordination.

Constant rehearsal and repetition of reflex movements is vital for their integration and the infant's development (McPhillips et al., 2000). However McPhillips et al. (2000) and Goddard Blythe (2005a) have also found that when the ATNR persists in primary age children, then it not only hinders the development of balance and coordination but can also affect later reading and writing skills.

The Palmar reflex is particularly noticeable when a baby's grasp on an adult's finger is strong enough to enable the baby to be pulled into an upright position. This reflex is connected to feeding, as the infant might grasp the finger of an adult when sucking milk or else an adult can stroke a newborn baby's palm to encourage it to suck when it is reluctant to. The fingers and thumb work together until this reflex becomes more refined so the infant can move each finger independently and is eventually able to manipulate objects. Interestingly the fingers, though smaller in size than other body parts, take up a large number of the neurons in the motor cortex because of the precision of the movement that the fingers need to make (Greenfield, 2001: 132). The mouth too takes up a considerable share of this part of the brain in order to undertake the complex task of speech development. Goddard Blythe (2005a: 59) has assessed children with speech difficulties who also have 'difficulty with thumb and finger opposition as well as with hypersensitivity to gentle stimulation to the palm of the hand'.

The numerous early primary reflexes drive the baby to move, stimulating lower functions of the brain so that, after much practice, the infant is able to 'sit, roll over, tummy crawl, crawl on all fours, develop a pincer grip and eventually stand and walk' (Goddard Blythe, 2005a: 63-64). As the infant grows and matures, early reflexes are gradually controlled to allow more mature postural reflexes to develop. During the first three-and-a-half years, postural reflexes enable the child to move more fluidly by gaining control of the body, posture and body movements. This is an important stage of development for a child whose brain is functioning efficiently.

The positive interplay of genes, the environment, and interactions can enable children to reach significant movement milestones in their development. If, however, a child encounters interruptions in development for whatever reason, then it is likely to indicate that learning difficulties will appear later.

The seven senses

The senses in the body drive young infants to explore the world around them. Newborn babies immediately respond to their new environment through their senses. So, for instance, they will sense leaving the warmth of the womb and feel the air on their skin, then the water when being washed and the loving arms of their parents when held, and attempt to gain eye contact with their mothers while breastfeeding and hear soothing noises being made by their parents.

The five senses of taste, smell, touch, vision and hearing are generally well known and acknowledged to be important aspects of young children's development. The vestibular and proprioception are two less well-known senses, though they are connected to the five senses.

The vestibular system is primarily responsible for balance, while proprioception tells us where our bodies are in space and helps us to know where parts of our body are in relation to each other.

The vestibular system

It is constant motion that activates the vestibular system. This sense is stimulated in the womb, as the mother moves around, and later, after birth, as the infant is gently rocked to and fro. This type of motion provides input for the vestibular system, which, eventually, enables the body to learn how to control movement and balance. This system enables young children to maintain body postures, which is vital for everything they will do in their daily lives (Hannaford, 1995).

As the balance system develops it supports infants in maintaining stable postures. Infants learn to sit up when their back muscles are strong enough and when the balance function of the inner ear is more fully developed. This is important as, when children are older, they need to have a stable posture in order to sit upright to write, copy from the board, type or listen to the teacher.

Children whose vestibular sense is functioning well will feel confident with their internal balance system and respond to vigorous vestibular activity with enjoyment. They will want to be up and active throughout the day, looking to take part in spinning, swinging, rocking, falling and tumbling activities, and will be able to perform 'remarkable feats of balance' (Hannaford, 1995: 36).

Coordination, balance and movement rely on a vestibular system that is functioning well. Indications that children are experiencing problems with balance may be seen if they have difficulty standing, walking, running, or climbing the stairs without falling or bumping into things, stumbling or tripping. A child may find walking on uneven surfaces awkward, appearing to be uncoordinated and clumsy, but may be experiencing difficulties with balance. Resolving balance problems can bring about a significant improvement to the overall quality of a child's life and his or her ability to play and learn (Macintyre and McVitty, 2004).

There is a strong link between the vestibular system and vision, which controls eye movements so that objects are in focus as the body moves. Any problems with this may affect a child's ability to follow an object with the eyes when the body is moving (Hannaford, 1995).

By activating the vestibular system, children will stimulate their brains so that they are open to learning. The brain and body are connected and cannot be regarded separately. The vestibular system is also closely associated with touch and proprioception.

Proprioception – the sixth sense

Proprioceptors can be found in the muscles and joints and are activated by bodily movement, letting us know where each part of our body is in relation to the rest, how it is moving, and where our bodies are in space (Hannaford, 1995). If the proprioceptive system is in good working order, then children will thrive when engaged in physical activity and be willing participants in movement-play. In infants, proprioception works together with vision, touch and the vestibular system to support them in their drive to reach developmental milestones, such as rolling over, crawling and walking.

If this system is not working well, then the body can be floppy or children may have difficulties sensing the position of their own limbs. They may seek out active movements, such as pushing, pulling, rough and tumble, strong bear hugs or being sandwiched between two cushions, anything that gives them the vigorous proprioceptive input they need (Kranowitz, 2005: 142).

Sacks (2007: 58), a neurologist and psychiatrist, writes about his patients' neurological disorders, referring to the proprioceptive system as the 'vital sixth sense', without which a human being is 'disembodied'. He refers to his patient Christina, who is unable to 'feel' her body parts or that her body belongs to her. She lost her sense of proprioception and became like a floppy doll. Christina's condition is very rare, however – the more commonly seen indications of an under-responsive system include having a fairly floppy or weak posture or not being aware of where different body parts are.

A child whose posture may be described as floppy, whose legs are not strong enough to stand and whose spine is not able to hold the upper body up for sitting independently must be encouraged to continue tummy time and crawling until the body is aligned and the muscles have strengthened sufficiently that they are ready to hold the body in an upright posture (Lamont, 2014). Difficulties related to this system are some of the hardest and most frustrating for a child to live with, and further help from medical professionals may be needed.

A vast amount of sensory input is received by each young child, which the brain then processes and coordinates and, ultimately, the body expresses as movement (Greenfield, 2001). All sensory systems, in order to be able to function well, work in collaboration with each other, which means that if a problem occurs in one system, a multitude of difficulties can arise (Macintyre and McVitty, 2004).

Movement patterns

Those living or working with young children will have noticed that they love to move and they move instinctively, as their bodies just tell them to. As we have seen so far, infants' early reflex movements and senses are driving forth the growth of their brains to their full potential; later, children will seek out specific developmental movement activities. Yet, the natural tendency for young children to move tends to be taken for granted rather than fully appreciated for the impact it has on their development.

Tummy time

As babies move on their tummies, with their arms and legs working together to propel them forwards, this movement pattern helps to develop their stability and mobility (Lamont, 2007b). Many other skills are emerging as babies push up the upper body, showing incredible strength as their arms hold them away from the floor. This is the groundwork for developing the upright posture as this movement aligns the cervical and lumbar spine. At the same time, as infants move their heads from left to right and right to left, the eyes track horizontally – a skill needed in later years to read (Lamont, 2007b). Tummy crawling 'creates a range of motions in the hip sockets and shoulders' that eventually improve the organisation of these joints (Lamont, 2007b: 2). Lamont found that children who had lots of tummy time, which stimulates the pelvic area, were more likely to be ready for toilet training 'on time', whereas many of those preschool and older children who missed out on tummy time experienced difficulty with toilet training still at those later ages. Also, as infants hold themselves up, their hands and arms rotate in this position, enabling fine motor skills to begin to emerge. This stage of development gives infants time to develop an awareness and organisation of their lower body through much practice and hard work (Lamont, 2007b).

This is a vital developmental stage for young infants, yet many have had little or no time on their tummies (Lamont, 2007b; Mcintyre and McVitty, 2004). This is the position all infants between ten weeks and seven months should be in unless they are sleeping or being held by an adult (Lamont, 2007b). Given the space, time and opportunities to repeat and practise a number of intricate movements at this stage, infants will eventually reach the stage of the crawling pattern.

Crawling

Crawling is a milestone in infants' development; it is the first time they are up off the floor, conquering gravity and laying the foundations for balance that will be with them for the rest of their lives (Lamont, 2007b: 2).

When crawling on hands and knees, both hemispheres of the brain communicate and interchange information with each other through the corpus collosum (Lamont, 2007b). Thus, crawling creates neurological connections between the two hemispheres, so the more a baby crawls, the faster these connections will transmit information. This movement also helps the spine to align and the shoulders and hips further rotate in preparation for walking (Lamont, 2007b).

Crawling on hands and knees combines balance, vision, touch and proprioception. Visual convergence is stimulated as infants look up and down, focusing on things at varying distances while crawling. As they crawl, their hands open out on the floor, strengthening fine motor movements that eventually can become, in time and with practice, 'the skilled and dexterous movements of a pianist' (Greenfield, 2001: 44). 'Fine motor movements are controlled by the motor cortex which communicates with other parts of the brain in order to activate the finger muscles' (Greenfield, 2001: 44). Indeed, the neurological development that is taking place here is laying the foundations for later tasks, such as passing an object from one hand to another, and, later still in their development, taking notes in class.

The first year of an infant's life is truly very busy indeed! Each movement pattern provides the foundations for the next phase, stimulating innumerable functions. Without the experience of early movement patterns, it is likely that there will be some degree of developmental delay. Interestingly, Lamont (2007b: 3) found that when these early movement patterns were undertaken by older children in a therapy programme, they led to 'improvements in visual motor skills, tracking, balance, impulse control, anger management, reading and attention'.

Further movement activities

During children's first six to eight years, the growth of their brains and neurological system is dependent on them working hard at stimulating the nervous system through movement activities, such as tummy crawling, crawling on all fours, running, tumbling, spinning, swinging, pushing, pulling and hanging upside down (Lamont, 2007d).

These movements involve the complex coordination of muscle groups linked to the brain stem (Greenfield, 2001). Young children's future achievements are dependent on their movement experiences from the time they are born as these cause the brain to 'constantly transform itself in unimaginably plastic ways' (Hannaford, 1995: 14). The brain's structure is connected to young children's inner body mechanisms, driving movements that ultimately restructure the architecture of the brain. Throughout children's early years, their engagement in specific movement patterns stimulates the neurological system so that 'the body becomes the instrument of learning' (Hannaford, 1995: 18).

Examples of children engaged in significant movement patterns can be seen in Chapter 3.

CASE STUDY

Amir was three years and six months old and had attended 1a Children's Centre full-time since he was three years old. His parents and staff were becoming increasingly concerned about his habit of biting children, which was happening more and more. This increase in biting was of such concern to his parents, especially his father who travelled a lot on business and was often away from home for long periods of time, that they began to hint they might withdraw Amir from the Centre. The Centre's Head, Marilyn Sherwood-Chilton, met with Amir's parents and, with their permission, discussed their concerns with Bette Lamont, a developmental movement consultant from Seattle, who was working with the local authority at that time.

Amir was a delightful boy who eagerly joined in with activities presented in the nursery for all the children. As time progressed, however, what became his habitual biting of other children prevented them from playing with him. His lower face was limp and his tongue tended to hang out of his mouth and he often dribbled. Concern was also rising about his language development as communication was extremely limited with both peers and staff.

Assessment

An informal assessment from a neurological perspective by Bette Lamont revealed that Amir was in a state of under-responsiveness, with low muscle tone and poor sensation in his face. Bette also observed that he had an 'overall awkwardness, poor body awareness and lowered sensations generally, which were leading him to some of his unsociable behaviours'.

From a neurological viewpoint, Bette Lamont's analysis revealed that nerves in Amir's face were under-responsive through a lack of stimulation and his awkward, uncoordinated gait indicated he had missed out on the usual crawling pattern, which was later confirmed by his parents.

As Amir held on to the scooter during his assessment, his hands were shaped in a 'grasp' that looked like the Palmar reflex. This reflex is normally inhibited gradually in the first six to seven months of life, beginning with the ability to let go of an object, such as a favourite toy. Interestingly, the Palmar reflex has a connection to the mouth and feeding – as gentle pressure is applied to the palm of the hands, an infant can be encouraged to start sucking (Goddard Blythe, 2005).

Lack of control of his mouth and saliva escaping, together with using his hands in a fist, indicated that the Palmar reflex was possibly still present for Amir. While the Palmar reflex remains, with the thumb and four fingers continuing to operate together, a child is unable to acquire good fine motor skills, which will enable him or her to develop a pincer grip and manipulate objects, for instance. Lack of articulation of the hands and mouth was of particular interest in Amir's case as this is crucial for speech development.

Intervention

Interventions for Amir included massaging his face with different textures. His Key Person at the Children's Centre, Sharon Sparkes, set up a box together with Amir, who chose a variety of scratchy, soft, cool and smooth implements with which to massage his face, such as a sponge, an emery board, a smooth pebble, a feather and Velcro, which he kept inside this box. He would willingly undertake this task himself or invite an adult to choose an item to use on his face while he continued to play with the sand, for example.

The nervous system can be stimulated by activities related to the proprioception system, such as pressing firmly on to the body with cushions below and on top of the child's body. The Centre Head introduced this activity to the children, which resulted in a queue of children waiting for their turn as it seemed such fun. It was called the 'sandwich'!

Crawling activities were also introduced, among other things, to align Amir's gait, as well as encourage the opening of his hands and fingers, which assists with the inhibition of this reflex so that he would be able to develop good manual dexterity before he transitioned from nursery to school.

Outcome

The number of times a day Amir was biting dramatically decreased and he stopped biting altogether within the first two weeks of the

(Continued)

(Continued)

start of the intervention. As mentioned previously, Amir's parents had thought about withdrawing him from the Centre, but they changed their minds when they saw how much happier he was and how much his social interactions with peers had improved.

Amir also stopped dribbling and his language improved, as did his communication with others and his behaviour. Consequently, he was able to make friends as his behaviour matured through the work carried out on his sensory system.

When Bette was given this feedback about Amir's progress since her intervention, she said, 'It is amazing to hear about Amir's success, and with such a short intervention on my part and such a simple intervention on the part of the nursery. I bet his parents are very proud of him and grateful to the nursery. I guess it was just all in him and we just had to do a few things to unlock it.'

Conclusion

Goddard Blythe (2005b) questions whether or not every child is ready for school in terms of their neuro-motor development, which describes a range of physical skills, including balance, posture and coordination. If these physical foundations for learning are secured in the preschool years, then children enter the school system better equipped to cope with the demands of the classroom, such as the ability to sit and concentrate, coordinate their hand and eyes when writing and control the eye movements needed for reading. Goddard Blythe has found that some children appear to be readier than others when they start school.

One way to address this situation would be to ensure that all infants and young children are provided with opportunities for movement-play activities. Early education settings need to 'create the best possible environment to support the child's unfolding mind and complex brain' for all children in preschools and in early primary school from birth to six or seven years of age (Lamont, 2007b).

Further reading

Bette Lamont's website, for various resources, at: http://neurologicalreorganization.org/resources/

Goddard Blythe, S. (2005a) *The Well Balanced Child: Movement and early learning* (Second Edition). Stroud: Hawthorne Press.

Goddard Blythe, S. (2005b) *Reflexes, Learning and Behaviour: A window into the child's mind: A non-invasive approach to solving learning & behavior problems*. Eugene, OR: Fern Ridge Press.

Greenfield, S. (2001) *The Human Brain: A guided tour* (Reissue). London: Phoenix.

Hannaford, C. (1995) *Smart Moves: Why learning is not all in your head*. Weaverville: Great Ocean Publishers.

Kranowitz, C. (2005) *The Out-of-Sync Child: Recognizing and coping with sensory processing disorder* (Revised). New York: Skylight Press, Perigee Books.

Maude, P. (2010) 'Physical literacy and the young child'. AIESEP Conference Paper.

McPhillips, M., Hepper, P.G. and Mulhern, G. (2000) 'Effects of replicating primary-reflex movements on specific reading difficulties in children: A randomised, double-blind, controlled trial'. *The Lancet*, 355: 537–41.

Rutter, M. (2006a) *Genes and Behavior: Nature–nurture interplay explained*. Malden, MA: Blackwell.

Sacks, O. (2007) *The Man Who Mistook His Wife for a Hat*. London: Picador.

The Royal Society (TRS) (2011) 'Brain Waves Module 2: Neuroscience: implications for education and lifelong learning'. RS Policy document 02/11, DES2105. London: The Royal Society.