# Early learning in the balance: priming the first ABC

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**In this article, Sally Goddard Blythe makes a spirited case for an approach to early years learning which takes full account of children's 'readiness' for the demands of formal schooling in terms of their neurological and physical development. Cogent arguments are presented for much more attention to be given to the development of motor skills than is currently the case and for opportunities for movement and physical education to be provided on a par with those provided for literacy and numeracy.**

The psychosocial aspects of learning are central to education, but at times they have tended to dominate educational policy to the detriment of biological factors which are fundamental to learning and which remain largely unchanged from one generation to the next.

When a child enters formal school (in the UK in the school year in which they become five), it is often assumed that he/she will be able to sit still, pay attention, hold a writing implement and get his/her eyes to make the movements necessary to follow along a line of print. In fact, primary school inspection reports often comment, fairly briefly, about the under-fives and many include the statement 'Most of the children can hold a pencil correctly' (David and Nurse, 1999), indicating this expectation. Many children acquire these skills without difficulty; others do take longer and enter the school system at a definite disadvantage in terms of their physical and neurological development. These children run the risk of later specific learning difficulties, not because they lack intelligence, but because the basic systems fundamental to learning are not fully in place at the time they start school. **A**ttention, **b**alance and **c**oordination are the primary **ABC** upon which all later learning depends.

The concept of neurological readiness for particular learning is not new. Back in 1947 it was noted that reading readiness seemed to coincide with the shedding of the first milk teeth, and that individual variation in the onset of the eruption of secondary dentition might be indicative of other aspects of neurological maturity related to reading readiness (Gesell, 1947; Ames, 1967; Frances and Ames, 1972). Bax and Whitmore (1999) investigated whether it would be of value to include a short battery of neurodevelopmental tests in school entrant medical examinations. They found significant links between neurological maturity and performance on cognitive psychological tests. Despite an increasing body of evidence to support this view, chronological age remains the criterion on which time of school entry is based.

### A = Attention

Attention describes the focusing of conscious awareness upon a specific task, particularly when that task is being learned, and it requires a high level of arousal. Focused attention depends on the ability to reject irrelevant sensory stimuli such as background noise, movement within the visual field and sensations from the muscles and skin. Poor attention results from a number of factors such as under-arousal, boredom, fatigue, anxiety or inability to occlude irrelevant sensory stimuli.

At certain stages in early life it is developmentally normal to be stimulus-bound. Capacity for sustained, self-directed attention starts to increase at the same time as basic perceptual-motor functions mature. In any task, a balance must be struck between sensory-motor and cognitive information processing. If the demands of body management are great, then less information processing can take place at a cognitive level (Rowe, 1996).

Although learning takes place in the brain, it is the body which acts as both a receptor for information and the medium through which knowledge is expressed. Speech is dependent upon the motor system for control of the lips and the tongue; writing is a motor task which involves coordination of the eyes and the hand with the support of the postural system. Even reading is an oculo-*motor* skill. Motor skills provide outward signs of maturity in the relationship between the brain and the body, or more accurately maturity of the central nervous system. They are expressed through movement, balance and posture. Thus a child's motor abilities at key stages in development can provide insight into his/her developmental level of operation.

### B = Balance

Control of the body begins with balance. The most advanced level of movement is the ability to stay totally still. Imagine a bicycle or bowling a hoop along the ground. Neither can remain upright without support unless set in motion. Initially, balance is only maintained by moving fast and wobble sets in as movement slows down, stops or starts. As control over balance improves, the amount of movement required to remain upright can be reduced, for it is movement which enables matter to bear weight over a narrow base of support. Motor development of the child in the first two to three years of life follows the same principle.

When babies are born they cannot hold their heads up and they require a supporting surface for the whole body. By circa 12 - 14 months of age most babies have learned to support their weight over an increasingly small area of support, progressing from lying prone or supine, to four point kneeling (creeping on hands and knees), semi-upright (sitting), to standing and walking. Initially toddlers 'stagger' at speed with a wide gait and arms held in a primary balance position. As balance improves, the amount of movement and involvement of other body parts can be reduced, but in the learning stage of each new skill it is through movement that a child gains mastery over the next developmental skill. The younger the child, the more basic and uncontrolled the movement.

### C = Coordination

At birth, a neonate responds to the outside world with a set of primitive reflexes. Primitive reflexes are automatic stereotyped responses to specific stimuli which are carried out without conscious awareness. They allow no leeway for variation, choice of action or *voluntary* control of movement. As the infant matures, the developing brain should gradually inhibit the primitive reflexes as more mature postural reflexes develop. Postural reflexes lay the foundations for automatic control of balance, posture and the development of an increasing repertoire of voluntary movements. Research has shown that older children who have immature primitive and postural reflexes have a higher incidence of specific learning difficulties compared with children with mature reflexes (Gustafsson, 1970; Rider, 1972; Bender, 1976; Wilkinson, 1994; O'Dell and Cook, 1996). Recent research has shown that reflex abnormalities can be corrected by using a specific movement programme to stimulate the appropriate reflexes at a later age, and that reflex maturation is accompanied by concomitant improvements in reading and writing (McPhillips, *et al*., 2000). Such exercise programmes, based upon the replication of early reflexes and infant movement patterns, were based upon movements originally devised by The Institute for the Neuro-Physiological Psychology (INPP), Chester, UK.

It is developmentally normal for a child to reverse letters and numbers occasionally up to eight years of age. The difference between b and d, p and q, m and w, 3 and 5 are differences of direction and phonics. (After all a cup, for example, is still a cup whatever the orientation from which it is viewed). A child's sense of direction begins with his/her body in space. Studies have shown that when trainee astronauts are put into a gravity-free environment, they start to write from right to left and to reverse numbers and letters. The phenomenon is called 'transient space dyslexia'. This is one example of the functional relationship between balance and visual perception (Levinson, H. L., 1984). Between six and a half and eight years of age, a major period of myelination is completed which strengthens neurological connections between the balance mechanism, the cerebellum (coordinator of fine motor movements) and the corpus callosum (which connects the two cerebral hemispheres). Only when these systems are operating together in synchrony does a child's sense of direction become stable.

### Movement - a functional link between Attention and Coordination

In order to sit or stand still, entire muscle groups must work together in cooperation with the balance and postural systems. Children who have poorly developed postural control often have difficulty sitting still and focusing attention because they still function at a level of *postural field dependence* (Kohen-Raz, 1986). The conscious brain must struggle to maintain control over balance, posture and involuntary movement - all functions which should have come under the automatic control of subcortical centres such as the thalamus, cerebellum, midbrain and brainstem by five years of age. Delay in the development of motor skills can compromise other areas of functioning.

Eye movements and visual perception are also linked to balance. Stimulation of the balance mechanism (such as spinning or rolling) temporarily tricks the visual system into thinking the environment is also moving (the sensation of being dizzy). Equally, specific visual stimuli can fool the balance mechanism into thinking the individual is moving (subjective vertigo). This is because the balance mechanism in the inner ear and the muscles which control eye movements operate from the same circuit in the brain - the vestibular (balance), ocular (visual), reflex arc. Problems with automatic balance will affect eye movements and vice versa.

In normal development the visual abilities to fixate and to follow are enhanced as head stability is obtained. Automatic head control is acquired as head righting reflexes develop in the first six months of life and are integrated at each new level of postural control in the course of the first three and a half years. The ability to maintain the head at the midline perpendicular to the supporting base gives the child the sense of 'centre' in space. A sense of centre is necessary to maintain balance without constant compensation from the visual and proprioceptive (signals from the body to the brain) systems. These skills are acquired through a combination of maturity and *physical* interaction with the environment. Through motion we train our brains.

Children who constantly fidget, move around in their chairs and cannot stay on task are unable to inhibit enough motor skills to pay attention. Hyperactivity consists of motor acts. Hyperactive children need continuous motor feedback to maintain a state of arousal and to keep the brain in gear. Whereas most of us when we become tired need to reduce our physical activity, these children simply change down a gear, increase the revs (motor activity) and keep going. The price they pay for arousal is inability to focus and sustain attention on one task. This may be *one* reason why children with true hyperkinetic syndrome respond to a regimen of mild amphetamine, a molecule that is similar to norepinephrine. The boost increases the firing rate of the beta brainwaves (necessary to remain in an alert waking state), thus enabling them to inhibit distracting motor movements and allowing them to concentrate better (Hobson, 1999). Scaramella-Nowinski (2000) at The Neuro-Psychology Diagnostic Centre, Illinois found that 60% of a group of children diagnosed with Attention Deficit Disorder (ADD) showed abnormalities on an EEG.

**D = Developmental indicators**

In the former Czechoslovakia two simple tests were carried out to assess school readiness (personal communication to the author, Westlake, M. 1997). Could the child draw a circle in both a clockwise and anticlockwise direction? Could the child touch the left ear with the right hand and the right foot with the left hand? These simple motor abilities are essential if a child is to be able to form its letters and to cross the midline from the left to the right side of the page when writing.

As recently as three years ago in one region of Malawi (personal communication to the author, McDonnell, D., 1998), the local chief used to assess children before they started school by asking them to stand on one leg and touch one ear with the opposite hand. If they were unable to do this, they were not ready for school. This simple test mirrors a number of tests which are available to assess standing balance (Fawcett, A. J., Nicolson, R. I. and Dean, P., 1996; Schrager, 2000). Standing balance indicates whether control of balance is sufficiently well established to free the motor system to concentrate on higher, more complex skills.

A study carried out at The Institute for Neuro-Physiological Psychology in Chester (Goddard Blythe and Hyland, 1998) found that there were clear differences in the early development of a group of children aged seven to eight years who had reading, writing and copying difficulties when compared to a group of children who had no difficulties. Children who had reading, writing and copying problems had a *cluster* of factors in early development related to balance, motor skills and auditory processing. They were later at learning to walk (over 16 months) and many had not passed through the developmental stages of crawling like a commando on their tummies or creeping on hands and knees; they were later at learning to talk, to ride a bicycle, catch a ball and carry out fine motor tasks such as doing up buttons and tying shoelaces. They had difficulty sitting still and had a higher incidence of bedwetting above the age of five years. Furthermore, these children did not ‘grow out’ of their problems; rather the discrepancy between the two groups increased with time as delays in early motor development continued to have an impact upon the cognitive skills that depend upon the motor system for their expression such as reading, writing and copying.

Factors related to the development of phonological skills were also significant in this group: they were later at learning to talk, had a history of more frequent ear, nose and throat infections in the first three years of life and were hypersensitive or over-reactive to certain sounds at seven years of age (Goddard Blythe and Hyland, 1998).

Delay in motor development can also affect visual functioning. As early as 1977 Pavlidis (personal communication, 1977) found that a group of children with reading problems also demonstrated aberrant eye movements (lack of visual pursuit) which could be detected from three and half years of age. A common factor amongst the group was that none had passed through the developmental stages of crawling on their tummies or creeping on hands and knees. Bein-Wierzbinski (2000) has demonstrated significant changes in eye movements in a child with specific learning difficulties after he had carried out a daily exercise programme which replicated the reflex movements of infancy.

Failure to crawl and creep are not necessarily *by themselves* a predictor of later specific learning difficulties. Rather, crawling and creeping represent the successful completion of several stages of motor development which assume that head control and independent use of upper and lower, left and right sections of the body have been established. It is in the *process* of crawling and creeping that a child starts to synchronise balance, vision and proprioception, and to train hand-eye coordination at the same visual distance he/she will use to read and write some years later (Goddard, 1995).

A child who has immature sensory-motor skills also risks experiencing difficulty with later aspects of social interaction. Motor impaired children often find it hard to integrate their personalities into the environment. Because *they* have a limited physical vocabulary they find it difficult to read other people’s body language and tailor an appropriate response. For example, they may fail to pick up on cues of irritation or aggression and tend to respond to difficult situations by either over-reacting or avoidance (fight or flight). Movement is a child’s first language - it is the first medium of expression of the physical and emotional conditions of an individual. Self-control begins with the control of movement (Kiphard, and Schilling, 1974).

**E = Environment**

Delay in neurological development can occur as a result of intrinsic and/or environmental influences. Environmental factors associated with changes in the way we live mean that children spend less time engaged in physical activities than they did 40 years ago. The development of modern baby equipment has reduced the time young babies spend playing on the floor. From the floor, an infant learns to hold the head upright, to sit and develop the movements necessary for crawling. Tactile stimulation is provided by contact with the floor and this plays a part in developing a child's sense of body map, a precursor to spatial awareness. Hours which might have been spent in physical play are too often replaced sitting in a car seat ferrying siblings to school or sitting in front of a television or a computer screen where there is a surfeit of stimulation but no physical interaction - arousal without integration.

Increased emphasis on reading, writing and arithmetic *alone* will not accelerate the developmentally delayed child's academic achievements in the long term. For some, a six month delay before entering school, with increased opportunity for developing gross and fine motor skills, may be sufficient and can benefit children who were born prematurely or children whose birthdays fall in the late summer or early autumn (i.e. children who would be the youngest in a Reception class where all are expected to begin school at the start of the academic year in which they become five). Further, ensuring at least ten to fifteen minutes a day within the primary curriculum for daily physical activities aimed at the child's current developmental level can help to bring physical skills into line with academic expectations.

Professionals involved with preschool children are in an ideal position to develop motor skills. The guiding principle in any such programme is to meet the individual children at their appropriate level of development. For example a child of four years of age who has poor standing balance (cannot stand on one leg for eight seconds without falling over, shifts from foot to foot when standing, or stands with a wide base) needs activities which start at the *preceding* stage of developmental competence - four point kneeling. The child who has never crawled or crept needs activities on the floor which involve vestibular stimulation, that is, activities which involve spinning, swinging and rolling, before proceeding to games which involve crawling and creeping (pretending to be a caterpillar, a crocodile, a panther and a monkey).

Motor development in the first year of life seems to mirror human evolution both in the movement patterns that the infant passes through and the changes in brain development that those movements signify: starting from the aquatic environment of the womb the infant begins life like an amphibian and progresses through a reptilian stage of crawling on the belly using homolateral movements; a mammalian phase, creeping on hands and knees using a cross pattern movement to a simian stage when creeping and walking are combined. Finally, the infant outstrips other animals by being ready to develop the skills unique to humans: bipedal walking, talking, fine motor skills and the use of symbolic language.

Motor skills provide one outward sign of neurological maturity. A well-organised balance system indicates a well-organised brain. Balance is trained through movement. It is time that we recognised that the brain does not learn by itself - the body learns too (Goddard, 1996). The child who develops physically at a younger age and is better coordinated has fewer learning problems than does the child who develops later. The child who is in control of his/her body is better equipped to deal with the outside world. Attention, balance and coordination are fundamental for learning. In view of these facts, opportunities for movement and physical education are as important as the teaching of literacy and maths, especially in the early learning years.

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