

Early brain development: why education is not a race

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Children must master the language of things before they master the language of words.

- Friedrich Froebel 1895

In 1837 Friedrich Froebel founded his own school and called it "kindergarten," or the children's garden. Froebel described his educational philosophy as "self-activity" which was premised on the notion that children were to be led by their own interests and be free to explore them. In this educational context, the teacher's role was to be a guide rather than lecturer or trainer. In the end, Froebel's most important gift to children was a philosophical position where the classroom was viewed as a lovely, thriving garden needing a teacher who took on the role of loving and supportive parent. In the fast-paced world of the 21st century, one can realistically wonder if some educational gardens can be more readily described as superhighways to socially demarcated destinations of success underpinned by a belief that the quicker a child's formal education takes place the better.

Almost two decades ago, American scholar Professor David Elkind noted that 'education is not a race' (Elkind 1987). Indeed, Elkind has

become synonymous with the term "hurried child" and has spent much of his life documenting the inherent problems with trying to get children to do too much too soon. Much of Elkind's work focuses on the psychological pitfalls that accompany children who engage in activities long before they are mature enough to do so. Based primarily on his research in cognitive science and psychology, Elkind was and still remains very concerned with ensuring that childhood activities and childhood learning remain developmentally appropriate and are not consumed by a culture of standardised testing, academic competition and parental or educational agendas aimed primarily at improving or hurrying opportunities for academic, sporting or social prowess. For Elkind, generations of children were missing out on free time, unstructured play, opportunities to daydream, being bored and discovering themselves and their world through the environment around them; growing up had become a competition, a race to success.

Elkind's views stem primarily from the context of education in America that arguably operates

on a collective over-focused on gaining a competitive edge and such matters cannot be as great a concern here in Australia. Surely we don't have pockets of suburbia where groups of children spend every day of the week and much of the weekend rushing from one activity to the next. Furthermore, we can't possibly have preparatory programs, early childhood centres and schools who compete with each other to the point that forms of assessment are used as a measure of accountability and tool for marketing. And finally, parents here are not overly concerned about being seen to do all they can for their children to the point of having dance lessons one night, tennis the next, swimming the next, tuition the next, etc. We don't push our children too much and too soon, do we? Growing research across various disciplines actually suggests otherwise; Australians may indeed be hurrying children along so it is timely to examine why this is perhaps not in the best interests of children and childhood.

For most people, trying to gain some measure of success for their children may not appear as such a bad thing. After all, most would agree that parents and educators are only trying to do their best to enhance the options and futures of the children around them. However, if education is indeed becoming a race, it is important to remember that most types of racing include some form of pit stop, chances to refuel, clear navigational pathways, opportunities to change course and most importantly a driver who knows where and how fast he or she might want to go. Therein lies a fundamental problem with moving childhood along, who or what is driving the educational race and where exactly does a pathway to the future lead? Moreover, what inherent dangers accompany a race when the participants are not ready? These are questions that should be continually revisited by parents, early childhood educators, administrators and policy makers due to the fact that recent neurological findings lend

support to the romanticism of Froebel and the concerns of Elkind; too much, too soon and too fast may do more harm than good.

The Developing Brain – More Marathon than Sprint!

One of the most fascinating neurological findings in recent years is the important influence of experience on brain development and learning. In some sense, educators and parents alike have always known that we learn from experience. John Dewey, widely regarded as one of education's greatest thinkers, spent his life writing and philosophising on the nature and importance of experience (Dewey, 1938). In the 21st century however, what is truly amazing is how experience actually shapes the architecture of the brain. At the risk of being overallly simplistic, it works kind of like this ...

Not long after conception the architecture of the brain begins to take shape. *In utero*, the foetus is actually beginning its learning journey based on the environment and experiences of the mother. Upon birth, learning really begins to take off with the growth of connections (synapses) between some 100 billion neurons. These connections are influenced by individual experience and the more repetitive an experience, the greater the opportunity to permanently hardwire these connections. This in turn becomes the essence of learning and is repeated throughout one's lifetime. However, when it comes to formal education, many other factors play a part in this process. It is clear from both social scientists and neurologists that children, at all ages, need appropriate environmental stimuli to facilitate their learning and neurological functioning. It is also important to note that over-stimulation and activities that are introduced too early can actually hinder learning. In other words, appropriate does not necessarily mean more and much of this is dependent on windows of neurological opportunity facilitated by 'myelination'.

As noted above, neurons provide the raw material for learning by building connections in the brain. Throughout life they become differentiated to assume specialised roles and form connections with other neurons enabling them to communicate and store information. Stimulating experiences activate certain connections, repetition consolidates these connections and the brain learns. However, there is also a neurological timetable that extends from birth through childhood and into adulthood and is mediated by various processes. Through early childhood and into adolescence this timetable is significantly influenced by myelin, a fatty material that insulates an important part of the neuron known as the "axon". Myelin actually appears as white fatty material and thus is often referred to as the white matter of the brain. Current research identifies that the escalation of myelin occurs in various stages and there is actually a 100% increase in white matter during adolescence. In other words, the build-up and acquisition of myelin towards full brain maturation is more marathon than sprint.

Why is myelin so significant? As an insulator, myelin aids in the transmission of information from one neuron to another and the more "myelinated" axons in the brain, the greater opportunity for neural information to be passed quickly. The end result of all of this is that certain activities may be easier to learn when regions of the brain are sufficiently myelinated or when brains become "fatter". Incidentally, myelin is the material that gradually breaks down when individuals are stricken with multiple sclerosis.

Myelination is very important for children due to the fact that when we are born we have very few myelinated axons. This is one reason why visual acuity and motor coordination are so limited at birth, the neural networks responsible for facilitating vision and movement aren't working fast enough and will become much more efficient when myelin increases. Furthermore, as we grow older

different regions of the brain myelinate at different ages. For example, when Broca's area, the region of the brain responsible for language production, myelinates children are then able to develop speech and grammar. These times of myelination have become referred to by neuroscientists as "learning windows" and amazingly, a healthy brain knows which areas need to be myelinated first and that myelination cannot happen all at once; again, it takes time to become a 'fathead' (Diamond and Hopson, 1999; see also Herschkowitz and Herschkowitz, 2004; Kotulak, 1996).

There are, of course, a number of other determining factors influencing neural proliferation and as Dr John Ratey from Harvard Medical School states, 'the exact web of connections among neurons at a particular moment is determined by a combination of genetic makeup, environment, the sum of experiences we have imposed on our brains and the activity we are bombarding it with now and each second into the future' (Ratey, 2001). In other words, along with time, stimulation from an individual's environment and social context are other significant factors related to myelination; experience facilitates stimulation, which in turn facilitates neural connectivity.

Some might suggest that if experience and activity are indeed significant factors in neural development then surely the earlier the stimulation (read "enrichment") the greater the propensity for learning and early success. However, while we know that input from the environment helps shape the brain, we must also remember that 'the brain is not primarily an experience-storing device that constantly changes its structure to accommodate new experience ... it is a dynamic computing device that is largely rule driven' (Gazzinga, 1998). Experience is important, but so too is each individual child and a one size fits all race to excellence in formal education settings may do more harm than good. In an earlier issue

of this journal, I noted an example of how doing something too soon or too fast becomes problematic (Nagel, 2005). Specifically, I described how disadvantageous it could be for children to be engaged in writing before the fine motor skills required to hold a pencil are neurologically established. Often, a child who is introduced to penmanship too early has "incorrect" pencil grip neurologically hardwired to the extent that when a teacher or parent aims to correct this it becomes very difficult if not impossible. In a sense a child's brain in this situation is being asked to "unlearn" something already programmed because the "learning window" was forced open too early. If something like pencil grip can be hampered by racing too fast, what might happen to children, who in the early years of their educational lives, engage in cognitive endeavours beyond the developmental timetable of their brain? Perhaps the number of boys identified and labelled as having learning problems in literacy are merely behind the neurologically developmental stages that allow them to process and produce the required information for language related activities.

Equally important, because it is not possible to accelerate emotional maturation since the emotive areas of the brain (limbic system) have their own time clock, how do we ensure that racing towards academic excellence does not result in engulfing children in undue stress beyond their coping abilities? For some children, too much too soon can lead to stress related anxieties that actually turn off thinking processes. It is these types of considerations that must be part of the craft of each and every educator; ensuring that timing is everything and experiences are developmentally appropriate. This cannot be overstated enough especially in an era of educational agendas often founded on enhancing a nation's economic prowess rather than enhancing each child's developmental trajectory. As they engage in facilitating

opportunities and activities for learning, parents and teachers alike would do well to remember how influential they are and how important timing is in regards to stages of neurological development.

At the risk of stating the obvious, parents play a significant role in the development of a child's neural hardware. For example, to stimulate greater language comprehension, you need to talk a lot with children early in life or to help a child be more coordinated or active as they grow, they should be encouraged to run and play games when they are young. In other words, if a child is doing music, sports, engaged in language activities or using their innate curiosity to find meaning in the world around them, then those are the connections that will be hard wired. A double-edged sword thus exists for parents and children who are either deprived of developmentally appropriate stimuli or who are hurried into activities too soon. That being the case, how and where does one begin to ensure that a child's serendipitous and planned learning experiences are timely and sufficient? The first and arguably most significant avenue to garnish such information is by considering the needs of the child.

For all children, parents and other caregivers contribute to healthy brain development by providing routine, proper nutrition, talking, singing, playing and reading to a child. One must also recognise that above all else, relationships are the most important component of healthy early brain development. Indeed, the irreducible core of any child's environment during early development is people. Just as appropriate stimuli will enhance neural connectivity, children's developing minds also require that adults, especially those personally significant in a child's life, will talk to them in special ways, nurture them as they grow and guide them in a loving fashion. Normal neural and human development draws upon these types of everyday experiences far more than those

offered by educational toys, flashcards and a weekly timetable filled with activity. Future success for a child begins with a healthy parent-child relationship. Children who experience warm and responsive caregiving are more empathetic with peers later in life and learn to connect with other people. Fostering this type of emotional hardwiring is perhaps more important than hurrying children through a plethora of activities and academic curricula.

In an educational context and for their neurological benefit, children must be allowed opportunities to explore their environments freely, self-regulate their behaviour and encouraged to ask questions. Howard Gardner, renowned educator and Professor of Cognition and Education at the Harvard Graduate School of Education advises that teachers carefully observe students and that in the early stages of a child's school life they forget about any formal testing or assessment (Gardner, 1995). Observing also means allowing young children to experience learning through the random appropriation of bits and pieces of information. During the early years the brain is not always receptive to carefully organised or sterilised, sequenced material. That is why 'play' is such an important component of formal and informal learning; individual experience fosters new brain growth and refines existing brain structures and there is nothing more naturally individual for children than opportunities to learn via playing. Contemporary research has shown that children who do better academically and socially throughout their school lives, come from home and early learning environments that provided a greater opportunity to explore and play (Eliot, 1999). Play is an incredibly important part of early childhood education and complements the rationale behind why institutionalised learning prior to Year One has traditionally been referred to as preschool. It's only after their fifth birthday that a child's brain is emotionally

and cognitively ready for formal learning; following adult reasoning, using memory in a deliberate fashion, beginning to grasp abstract concepts and having enough self control to sit for long periods of time and attend to what is being taught "starts" around the age of six. It can not be overstated that being ready for the type of learning usually associated with stereotypical classroom structures and agendas "starts" around age six and continues throughout one's life in school. In this sense, the educational mantra of 'lifelong learning' that often surfaces in arenas focusing on adult learning should be the catchcry for all those concerned with hurrying children along. Education is not a race and the brain is uniquely programmed to ensure that too much too fast may actually result in vehicular breakdown.

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