Parenting with the Brain in Mind

FACT SHEET 3

MODULE THREE

THE PRIMARY SCHOOL YEARS PART 1

by John Joseph

How the brain learns – the primary school years

What's this about?

Welcome to Part 1 of 3 articles that examine how brains and minds grow during the primary school years. In this article, we explore how the subtle, prolonged changes in the brain prepare children for growing independence from home. We examine the development of each child's numerous talents and special interests and consider the implications for school-based learning.

"Great parents develop the knowledge, the courage and the capacity to serve their children, rather than the other way around."

What are some key aspects of brain growth during the primary school?

In many ways, the primary years, from about ages seven to about eleven, are less intense than the early years and the growth of the brain, and subsequently learning, slows down quite dramatically by comparison. For many children the onset of adolescence has yet to occur so these years see slower more subtle changes and the move away from total dependence on parents to more interdependence.

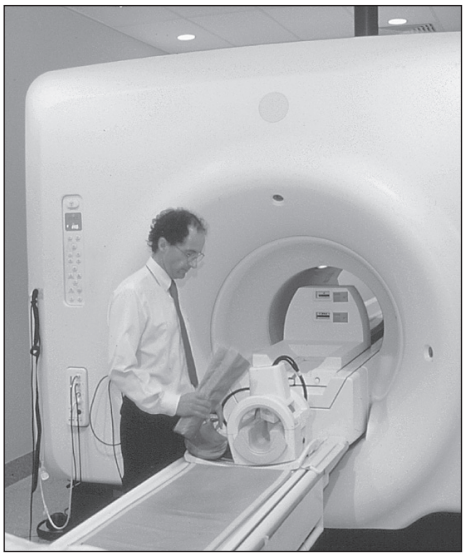
The brain grows about 15% during these years, eventually reaching about 90% of its adult weight. Girls will reach about 90% of their adult height and boys about 80% (Diamond and Hopson). Yet these years also see dramatic variations in levels of physical and emotional maturity between children of similar ages. Accordingly, friendship groups can change quickly and friends can appear to become more important than family.

Primary school aged brains are characterised by the capacity to engage in more logical thinking, reasoning and problem solving. Children even learn how to lie to each other and to parents, a crucial milestone in developing thinking, relationships and a sense of morality. Their motor skills also develop dramatically with many, many children becoming highly proficient in sports.

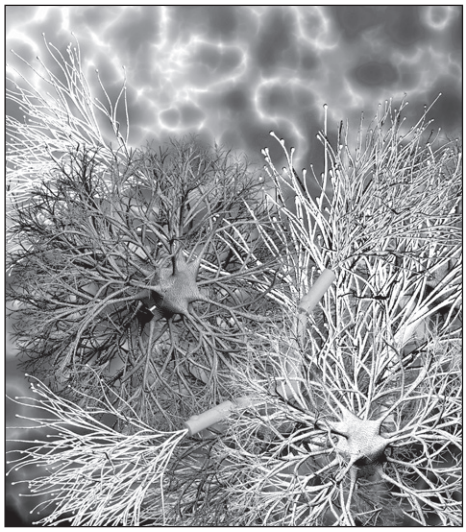
Synapse proliferation, then pruning

In Part 1 of the Early Years article, I wrote about the prodigious growth of neurons in the fetal brain, and their migratory journeys to particular layers of the brain. Once located, neurons put down their roots and pretty well stay put for the life of the brain. But, that does not mean they cease changing, in fact, far from it. Each of the 100 billion or so neurons, which began their fetal migration as tiny, rounded cell bodies, may grow up to 100, 000 dendrites (the main places where neurons receive information). Each neuron grows an axon (the main way neurons send information to other neurons). The dendrites and axons appear to grow in a haphazard, jungle -like manner, constructing trillions of interconnections (synapses). Axons and dendrites communicate with each other in their synapses by sending chemical messengers – neurotransmitters back and forth across the tiny gap. Until recently, many neuroscientists thought that this process of 'wiring' up the brain was a function of early childhood and by the primary school years the brain was already 'hard wired.' On that basis, intelligence and capability were measurable.

Today's neuroscientists, taking advantage of sophisticated brain imaging tools, have amended those ideas. Dendrites, axons and synapses maintain the capability to grow and change throughout life. The term used to describe the process is *plasticity*.



The fetal brain overproduces neurons, dendrites and synapses. Chemical signals called trophic factors direct the construction of the interconnections and nourish the synapses. Each synapse must compete for the trophic factors. Survival depends on the degree of electrical and chemical stimulation and thus, the amount of trophic factor available to the neuron. In other words, 'use it or lose it!'



Seething neurons of a human brain.

Overproduction inevitably means death of some neurons and synapses. It's a process of tuning or modification rather than a cause for consternation. Entire neurons may be lost or the dendrites may prune back to lessen the space for synapses. Its big scale too! Clinical professor of psychiatry at Harvard, John Ratey, says the fetal brain drops from about 200 billion neurons to about 100 billion in the last trimester of pregnancy. And the progressive drop continues in waves throughout childhood.

So, what has all this to do with the primary school years?

The primary year's brain prunes back its dendrites and synapses to manage energy consumption, efficiency in processing, and its capability to adapt to new environments. Exactly how the brain 'decides' what to keep and what to prune is not clearly understood but probably relates to the degree of use (repeated exercise) each synapse receives.

How the brain learns – the primary school years

By the time a child reaches the primary school years, many of his or her concepts about learning are well developed. Whilst primary school kids are highly capable of learning (at home and at school) the concepts they hold strongly influences their degree of attention to new information. Unhealthy concepts about classroom learning may see a child struggle while the same child may excel in learning outside the classroom. Of course, there's more to learning than just attending to information. The brain is not a static, storage site for incoming stimuli. It perceives its world against the duel lenses of experience and imagination, or put another way, **can we learn this and why would we want to learn this?**

In addition, there's more to growing dendrites than repeated exercises. In a study reported in Jensen (1998 and 2002) UCLA neuroscientist, Bob Jacob found that complex, novel environments lead to a greater number of synapses and dendrites. Jacob found that in autopsy studies on graduate participants, there were up to 40% more interconnections than with high school dropouts. Misinterpretation of Jacobs, and others, research created a plethora of claims about enrichment of environments and massive brain growth by following certain types of stimulation. From this, a nonsensical brain myth developed; that listening to certain music, or hanging mobiles over your child's cot could grow better brains.

Key Points

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Jacob, and others (reported in Ratey, 2002) showed that activities that challenge the brain lead to the growth and strengthening of synapses devoted to that learning. But, and here's the crunch, once those activities become routine they automate, requiring less mental strain. Jacob found that those participants who were coasting through school actually had less interconnections than those who were challenged. Subsequently, they reported being bored, even though they were doing okay.

When interest levels are high, so too is enthusiasm. Conversely, when interest levels fall so too does enthusiasm for learning. Your child will show talents and weaknesses particularly in sports, music, riding vehicles or animals, playing computer games, collecting and classifying things, manipulating ideas and symbols mentally, cooking, constructing things and self-expression (just to name a few!).

Key Points

Special interests are a dominating characteristic of the primary school years. Some kids will develop a passion for learning at school, some will develop a passion for avoiding learning at school. Some will grow increasingly apathetic.

During the primary school years, the novelty of learning new things dominates over the mundane repetition of practising old things. When we add the impact of the concepts children hold about learning and their futures to this picture, its easy to understand why such large achievement gaps grow between similarly aged kids. My child may become an expert on her BMX, yours a talented gymnast while another may excel in mathematics.

What does this mean for learning at school?

The curriculum of the primary school years increases in rigour and intensity. Kids are expected to develop greater independence as learners, and also further develop group learning skills (interdependency). Learning through listening and through print mediums such as books, writing, computer screens, posters and film also increases in intensity. The primary year's curriculum reflects children's capacity to engage in higher-order thinking. These years are the realm of **experience dependent learning** (learning which is not constrained by age or time but does require relatively high degrees of motivation and effort to master). Healthy concepts about learning and about the future are critical to experience dependent learning. So too, is novelty, appropriate challenge and the opportunity to practice in order to construct long-term memory. Kids who struggle to make sense of the primary years curriculum usually struggle big time in secondary schools, leading to frustration, further avoidance of learning and ultimately, withdrawal from school-based learning tasks. This has a debilitating effect on their brains.

How do I share this with my kids?

In the primary school years, there are elements of the curriculum that kids **have to learn**. There are also things that kids **want to learn.** Motivation – the internal desire to satisfy appetite – is usually stronger for the **want to do** elements of learning than the **have to do** elements.

For some primary school age kids, what they **want to learn** matches well with what they **have to learn**. For others, there is little or no match. Guess which group has the toughest time at school? Speak with your child about the importance of learning at school as well as the importance of learning what he or she **wants to learn** at home and in other learning environments (sports, clubs etc).

We live in a world where the future so often depends on the achievements of the past. This is why kids who hold concepts that they cannot learn well get themselves into such deep despair. They cannot visualise a future that is any better than the present because they cannot visualise themselves as learners within the context of schools.

This is the issue of our times for children in the primary years and one which education systems globally are attempting to address. A balance between have to do and want to do appears to be gaining momentum.

Summary

The least I need to know

Young brains learns best through novelty, frequent challenges, opportunities to consolidate memory and feedback that promotes further learning. Healthy concepts about what has to be learnt at school are essential, otherwise the child disengages from the school curriculum to pursue other interests. Build healthy concepts (return to earlier articles for how to do this) and create opportunities for your kids to learn in a range of beyond school settings. Promote their talents and build on their weaknesses.

References

(Items marked * are available from Mind Webs).
Log on to **www.mindwebs.com.au** or call Cathy Joseph for a catalogue (08) 8358 6993.

Magic Trees of the Mind, Marian Diamond and Janet Hopson*.

A User's Guide to the Brain, John Ratey.

Teaching with the Brain in Mind,

Next Issue – part two: Thinking and the primary school years – The 4 Ps of good thinking.