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Welcome to **ATTACK!** a two-page occasional publication. Most of **ATTACK!** will be concerned with the holistic curriculum which, if acted on, is a fundamental way to undermine the present undemocratic education system. Don't be discouraged if opportunities to teach holistically are limited, do your best, be a guardian, and act as a witness to this culturally significant and inspiring way of teaching and learning. **ATTACK!** is a partner to https://networkonnet.wordpress.com

Attack! 62 A talismatic, fundamental posting for the Attack! series using Attack 55! (Part 1): neuroplasticity

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Attack! 62 is about the ability of the brain to modify its connections and because of this the importance for infants and children of an environment that is rich in sensory (visual, auditory, tactile, smell) and motor stimuli. Suggestions that primary school teachers are operating on a two-tier curriculum where literacy and numeracy are exalted and the rest of the culture cast in a lowly light, defies the current best understanding of how the brain works cognitively.

Neuroscience has changed from a restricted science of the brain, based mainly on post-mortem examinations and studies of damaged brains, to a science where normal working brains are observable, supported by sophisticated equipment such as MRI scanners and fast computers.

Insights from neuroscience now provide a dynamic view of learning, embedded deeply in biology, and providing insights useful for teachers.

Neo-natal knowledge

Unlike other animals, human babies are born virtually helpless. In contrast, baby horses can run as soon as 40 minutes after their birth. The neuroscientist says, 'The foal's brain is hard-wired.' Which is the same as saying it is restricted by its inherited knowledge. In contrast, the human baby's brain at birth is unfinished. This brain is partly programmed, that is, it comes with inborn instincts or values located in the limbic, the oldest part of the brain, to do with such things as, 'It is better to be warm than to be cold'; 'Better to be fed than to be hungry'. These values are thought to be sufficient for the infant to evolve its own view of reality, mediated by its culture. Thus the human brain is able to adapt to its environment. In doing so, it demonstrates humans' evolutionary advantage: humans survive because they can change when pressed to do so.

So the human baby, apparently disadvantaged by not being hard-wired at birth, is in fact able to let its continuing life experiences 'wire up' the rest of its brain. This 'learning on the job,' confers flexibility which is an extraordinary advantage and even more so if that wiring is based on the widest experiences and there are no serious cultural omissions.

In the infant brain from birth to about two years, trillions of neurons (cells which communicate electrically) link up at a phenomenal rate; as many as two million connections each second. By the end of two years each neuron is connected to about 15,000 other neurons.

At the same time, human infants teach themselves to crawl and then to walk – often by year one – and a year later they can talk, again having taught themselves to do so. Movement is necessary to widening their world and speech, and is a pre-requisite to developing the reality that will locate them somewhere in their culture. These developments indicate that infants have a strong capability to learn: yet, there is no curriculum and there is no instruction. It's as if the youngster is saying to her or his elders, 'Help me to find out, as quickly as possible, what I need to know to survive in this world you have landed me in. Then let me drive my learning myself.'

So the infant's brain is devoted to the task of devising a view of reality which is on the one hand unique, unlike any others' and, on the other hand, developed from the best information available within the milieu of her or his culture. But if young learners' access to the ideas and values of their culture is restricted, an impoverished reality will arise. That situation is compounded by learners solitarily taking it upon themselves to make sense of the phenomena that are present in their culture, putting that powerful learning machine

to work, overtly by observation, demonstration, argument in a way that deepens that the impoverishment of that reality.

Of great interest is the knowledge that brains often make sense of phenomena without the learner being conscious of that learning. This is called implicit or tacit knowledge; we do not know we have it until we need to use it. Then unconsciously held knowledge becomes conscious knowledge.

We all know that the brain works quietly in the background. This activity helps the learner move from knowledge state one to knowledge state two, again subconsciously. Here is an example of this process:

In a science education research programme a group of academics found that learners had as many as four different theories for the way a battery-driven torch worked. The researchers set out to change those theories in a y. 7 class, with a carefully planned intervention. A critical experiment was used to promote one view, the scientists' theory, and to show there was little evidence for three of the students' own theories. Convinced that they had been successful, the researchers tested the new theories immediately. To their dismay the students had not adopted the evidence-supported view at all, and worse, the number of theories had grown to six. However, when the researchers returned to test the learning some four weeks later, all students recognized the evidence-supported theory. Covert processing indeed.

This evidence for continuing but sub-conscious processing of new information was compelling. Both overt and covert forms of meaning, once they become part of the brain's circuitry, are hard to change. And attempts to modify long cherished ideas may lead to further meanings and not necessarily the ones the teacher advocates.

Another form of background learning occurred recently when a colleague experienced this event:

'I was watching the News about a bomb attack on Brussels Airport. While the terrorism was extremely violent I recalled that Belgium had once had an airline of its own, and I knew that it had amalgamated with Air France some years earlier. I tried to recall the name of the Belgian airline but was not successful. Yet about five hours later, the correct name, "Sabina Airline", flashed up.'

No doubt we all have experiences of these Eureka moments when the brain works away by itself and then provides the desired information. People who do crossword puzzles often notice that answers they could not find one day appeared readily the next.

The effect the brain had in the battery torch activity provides an introduction to a long-held concept about learning which was first described in psychology many years ago and is now better understood in neuroscience. This concept is **plasticity.** Its importance is in understanding continuing learning. Neuroplasticity – or brain plasticity – is the ability of the brain to modify its connections or re-wire itself. Without this ability, any brain, not just the human brain, would be unable to develop from infancy through to adulthood or recover from brain injury. The foal, mentioned above, is not completely hard wired otherwise is could not perform in, for example, show-jumping. Nevertheless, learning to be a show-jumper requires much and constant practice.

In the developing infant, the key to developing new connections is environmental enrichment that relies on sensory (visual, auditory, tactile, smell) and motor stimuli. The more sensory and motor stimulation a person receives; the more likely they will be to develop strong views of reality. The brain must process something. If the brain does not hear classical music from an early age then it unlikely to become part of the individual's reality in later years unless strenuous efforts are made to achieve the plasticity needed to let this late new knowledge in to the reality.

Reinforcement or repetitive activities will eventually lead the adult brain to remember the new activity. Learning to swim at an early age is a case in point. As is riding a bicycle. Once learned, one never forgets how to do these activities (provided the brain does not suffer trauma, such as a stroke where the stored knowledge is no longer available).

The benefits of early learning have long been recognised and in some cases have actually influenced when starts are made. Well known is Dr Suzuki's immersion program for music; a blend of well-chosen tunes, scaled-down instruments, much repetition and strong parental involvement. However, children who miss out were not seen to have been seriously disadvantaged. The neuroscientific view, however, is that these children **are** disadvantaged. There is strong support from sociology. In 1972 a University of Otago Medical School in a large-scale, longitudinal study followed the lives of every child born in Dunedin in that year (some 1000 children). Now, after 40 years, the principal finding is, 'The foundation for life is set early.' One researcher studying antisocial behaviour in boys noted, 'It starts out with something as small as delayed speech and gathers force over the life course,' That is to say, this behaviour evolved. Early learning stacks up. (Source – *New Zealand Herald* 25/05/2016, p.32. Also, *Why Am I*? TVNZ On Demand.)