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Into the Mystery of the Adolescent Mind

By Andrew Fuller

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Adolescents are a mystery to many adults — especially their parents.

It is a time when three of the great changes of human life occur: the ability to reproduce, the establishment of an identity and the formal commencement of logical, rational, reasoned thought, though the attainment of logical thinking is fairly patchy from where I sit.

Just how do their minds work anyway?

THERE IS A LONG HISTORY of successful people having fairly dodgy adolescent years and this has been reflected in their school reports. For example, the headmaster of English comedian Stephen Fry wrote on his report in the early seventies, 'He has glaring faults and they have certainly glared at us this term'.

Norman Wisdom, an actor, received a report that said, 'The boy is every inch a fool but luckily for him he's not very tall'.

His teacher who commented, 'all glib cleverness and humbug' similarly dismissed Carl Jung.

So let's take a walk through the brain and mind of your average adolescent. Now this is dangerous territory indeed. It's not just the likelihood of tripping over the odd torrid sexual fantasy, encountering an obsession with privacy that would baffle the most secretive hermit or the risk of being crushed by the wild pendulum of mood swings.

No, even more dangerous than that is the knowledge that this is an area of research that is expanding so rapidly that in a few short years much of what I am about to say may well seem laughable in its simplicity. Oh well, fools step where angels fear to tread and as I'm certainly no angel, here goes...

It is an exciting time to be involved in education. For the first time we can link the research that emotionally supports young people and protects them against suicide, drug abuse and violence with our growing knowledge of how they think, develop and learn.

At the same time, there is a great risk. Some of you will clearly remember the Professor in *Gilligan's Island*. A brilliant man, able to invent coconut compasses, a wind-powered generator of electricity not to mention a thousand other quirky creations but somehow never found time to either work out a way to patch the hole in the ship or build a new ship entirely.

Too often the discussion about education risks becoming a debate about which side of the ship we should patch first. But what would happen if we built an entirely new ship?

Cycles of development

We have probably learned more in the past few years about the way people learn than we have in the past 50 years. Much of this upsurge has been due to the proliferation of PET scans (Positron Emission Tomography) and FMRI (functional magnetic resonance imaging) studies.

The three-pound blob of grey matter that sits on the top of your neck is the most complex, adaptable, regenerating object we know of. And it's busiest when we are children.

The way the mind develops is not a neat sequence of events. Recent research is confirming what two of the great thinkers of child development (Jean Piaget and Maria Montessori) postulated — that children's minds develop in fits and starts followed by periods of consolidation. These processes were labelled as assimilation

increases rapidly so that by two to three years of age, there are 15,000 synapses per neuron. In many ways you could argue that you will never be cleverer, more flexible or more adaptable than you were when you were three.

Up until the age of three, children are like sponges. Given sufficient time and attachment with a caring adult and a reasonably interesting environment, they just learn. They absorb their surroundings and are especially interested in differences. In fact they learn by being attuned to differences. This is true of babies and remains true for all of us throughout our lives. Babies are particularly interested in faces and stripes.

This means from birth we are intensely interested in our social environment: we notice difference, we focus our learning towards emotions, we try to draw causal connections between events and we want to create meaning

Primary schools often find that bullying increases around this age as children jostle for position with peers. For this reason, it makes sense for schools to create peer relationship programs that include bullying prevention, emotional intelligence and resilience.

It's at this point that we start to see the brain gearing up for adolescence.

Many of the neurological changes that occur in the brain during the teenage years commence well before they get to high school. A fact any primary school teacher will confirm with a sad nod of the head.

While adults often view the earlier onset of puberty with dismay, it may actually benefit some young people. Early maturers score slightly higher on IQ tests than their later maturing counterparts and this small advantage appears to persist into adulthood.

During these years, the brain starts to slow down. An eight- or nine-year old's brain runs at about twice the speed that yours does and between 8 and 18 it slows down to its adult running rate. Interestingly, this appears to be followed by a split pathway with some students languishing and loitering their way in to the senior years. With others, often around the middle of Year Ten, the shutters come off, they come out of the fogs and mists of adolescence, the light goes back on and they suddenly get it in a way they haven't for years. The lucky parents of this group heave a sigh of relief and if they are clever, take credit for it all.

Use it or lose it — synaptic pruning

Between ten years of age and puberty, the brain ruthlessly destroys its weakest connections, preserving only those that experience has shown to be useful. The adage here is *use it or lose it* — and this applies at any age. This *synaptic pruning* continues throughout life but occurs mostly during the late childhood and teenage years so that the synapses that carry the most messages get stronger and the weaker ones get cut out. This helps in refinement and specialisation.

This is why the experiences we give children and young people between their 9th and 18th years are so important.

As many as 30,000 synapses may be lost per second over the entire cortex in the early adolescent brain leading to an ultimate loss of almost one half of the synapses that were present in the pre-adolescent period.

The brain at this time is restructuring

Don't Waste Your Breath!

■ Realise that adolescents are not just a smaller version of adults. The adolescent brain is in transition. It differs neuro-chemically and anatomically from an adult brain.

■ Remember that adolescents' frontal lobes are 'closed for construction'. Expecting teenagers to show a lot of forethought, planning, consideration and impulse control is like expecting a goldfish to recite Shakespeare.

■ The brain is re-structuring to become more efficient. Therefore we need to capitalise on this re-structuring. Help them to develop the habits and routines that allow them to work smarter not harder.

■ Parents need to be their teenage children's frontal lobes. Asking an adolescent to do a lot of forward planning is like asking a dog to study physics. This is also the reason why too much freedom too soon does not seem to help too many young people.

■ Last but not least, never underestimate your power. Adolescents need someone around them — an adult who has more options than they do. Someone who they may battle with, but someone who ultimately they imitate and emulate, and believe it or not, that someone is you.

to become more clever and efficient. It is important to capitalise on this by helping young people to create patterns of thinking and habits of learning that are productive. By doing this we put into place trajectories of thinking and learning that lead to success.

Frontal lobes — closed for construction

The second thing that happens in adolescents' brains is that the frontal

lobes — the bit that helps us to plan, consider, control impulses, make wise judgements; in short to be kind, caring, considerate people — are the last bit to mature. In fact someone probably should put a sign on the frontal lobes of most early adolescents saying 'closed for construction'. The frontal lobes are being restructured at this time in a way that prepares them for adult life.

If you are wondering what's the big deal with the frontal lobes, it's really the frontal lobes that allow us to be civilised and human. Susan Greenfield estimates that over the course of history the size of frontal lobes in humans has increased by 29% compared with chimpanzees

.. the frontal lobes — the bit that helps us to plan, consider, control impulses, make wise judgements, in short to be kind, caring, considerate people — is the last bit to mature.

and accommodation by Piaget and were described as cycles of learning by Montessori.

In terms of brain development, there appear to be times of overproduction or exuberance during which we may be highly receptive to new information and able to gain specific skills more easily. During childhood and adolescence, this seems to be the way the brain develops, overdoing it in terms of production and then cutting back on what is not needed later. It's a pretty nifty system because it's precisely that overproduction that allows us to choose to hone and specialise our skills.

If we saw a diagram of key social competencies at different ages, we would get a map of approximately three-year cycles. Of course there is individual variability as well as gender differences but nevertheless a map such as this can be used to help target specific behaviours and learning processes at different times.

Children's brains are much busier and quite a bit cleverer than adults. From birth, the brain is busy setting up connections. At birth each neuron has 2,500 synapses and the number

and to try out our knowledge in new settings.

We are born to learn about new places and people and to adjust to what we find there. This means children already know a whole lot more about learning than adults do.

Then at about three or four years of age, something happens and it all stops. It is almost as if four-year-olds stop in their tracks, look around in bewilderment and express this puzzlement by asking the question *why*?

It is estimated that a four-year-old asks a *why* question every two and a half minutes!

These are the wilful years in which children learn impulse control. Children who do not learn this at this time can learn how to control their impulses later, but it is harder.

Around the age of six, there is a second surge as the brain starts to use language in increasingly complex ways. Aggression management is an important social competency at this time.

Up to the age of nine or ten the brain continues to be twice as active as an adult's. Around the age of nine years peer relationships seem to predominate.



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Handy Hints for Improving Learning in Teens

- **Most learning doesn't happen at school!**
Children spend only 15% of their time at school. They spend more time asleep (33%) than they do at school. Most of their time (52%) is at home, awake, mucking around, playing, and learning about life and it's what they do with that time that is important.
- **Most of their future learning also won't occur in school.**
An estimated 70% of the jobs that will exist in the year 2020 do not exist now. Knowledge is doubling every three years. Fifty years ago a high school graduate left school knowing about 75% of what they would need to know in their working life — today's high school graduate will leave knowing about 2%!
- **Limit TV watching, video and computer games.**
Bad news for those of you with older children! At 17 years of age the optimal amount of TV viewing is half an hour per day. And while some exposure to computer games is good, too much can be toxic.
- **More than nine hours of sleep.**
Teenagers need as much sleep as children, partly

because their brains are doing so much development. Always remember there is no such thing as a sleep bank. So just because you slept 10 hours one night doesn't mean you can get away with only sleeping six hours the next night. Students who don't get enough sleep have to work much harder to do well at school.

- **Eat a good breakfast and drink water.**
If your Mum ever said have fish or eggs for breakfast because it's brain food, she was right! As long as it's medically safe to do so, a breakfast that is high in protein (think cheese, milk, bacon, eggs) and lower in carbohydrates (think cereal, orange juice and toast) promotes concentration and learning. Also encourage your child to drink lots of water; the brain runs on it!

- **Use aromas**
The aromas most often associated with improvements in concentration and memory are lemon, basil and rosemary.

- **Limit the amount of part-time work.**
Senior secondary students should not work more than ten hours a week at a part-time job. If they do so, there is clear evidence that their marks will suffer.

From *Help Your Child Succeed At School* by Andrew Fuller

whose have increased by 17% and cats whose frontal lobes have only grown by 3%.

So if the early adolescents' frontal lobes have essentially gone missing in action for a time, this means that teenagers' brains are all tuned up for emotions, fighting, running away and romance, but not so well tuned up for planning, controlling impulses and forward thinking.

This means that when a frustrated parent says to their teenager, 'Why didn't you think of the consequences?', the kid invariably replies, 'As if'. By the way you know that 'whatever' means yes and 'as if' means no, don't you?

Some parents kind of forget this. They wouldn't dream of giving their teenager free access to their life savings but they will reasonably frequently leave them in charge of a \$200,000 house full of fine furniture and still be stunned by the results!

Parents need to be their teenage children's frontal lobes. Asking

Emotions are in the driver's seat

A couple of other interesting things are happening in the adolescent brain. The first is that hormones become more powerful and adolescents' brains show more activity in the emotional parts of the brain (known as the limbic system) than they do in the planning and impulse control parts of the brain (known as the frontal lobes and the pre-frontal cortex).

This means that adolescents learn best when there is emotion involved! Adolescents remember stuff about themselves and stuff that is relevant to their life situations. As Homer Simpson would say, 'doh!'.

Adolescents like intensity, excitement, and arousal. They are drawn to music, intensity and horror films. Around this time adolescents give off exaggerated secondary signals (rolling of eyes, long deep sighs, etc). Unwise parents and teachers respond to these.

So if the early adolescents' frontal lobes have essentially gone missing in action for a time, this means that teenagers' brains are all tuned up for emotions, fighting, running away and romance, but not so well tuned up for planning, controlling impulses and forward thinking.

an adolescent to do a lot of forward planning is like asking a dog to study physics. This is also the reason why too much freedom too soon does not seem to help too many young people.

Early teenagers are not yet to grown into themselves. The average teenager gains 20 kilograms and grows almost half a metre in the space of four or five years. I'm sure many of you know the sensation of being in a room with a group of young people who seem to be a clumsy jumble of elbows, knees, pimples and groins. Just as they haven't grown into their bodies, they haven't quite grown into their brains either.

It's almost as if teenagers at this stage have a very powerful, juiced up sports car with great acceleration, terrific lines, great sex appeal, but very poor brakes, oh, and a driver with the road sense of an earwig.

This is why it is absolutely pointless arguing with teenagers. I like to think that arguing with a teenager is like mud wrestling with a pig — you both end up dirty but only the pig is happy!

Not only are they emotionally charged, they are lousy at reading other people's emotions. This is particularly true of fear in others.


The puzzling thing to me is that if the brain at this time is so tuned into the emotions, why don't we capitalise on this? Instead it seems that we are yet to grasp in any meaningful way that there is a great deal of crucial learning that simply cannot be accomplished while dressed up in uniforms that promote sedentary learning or timetabled in the itty-bitty episodes we call lessons.

Is the teaching of 'subjects' that obliges each secondary teacher to try to cope with success in learning for 150 to

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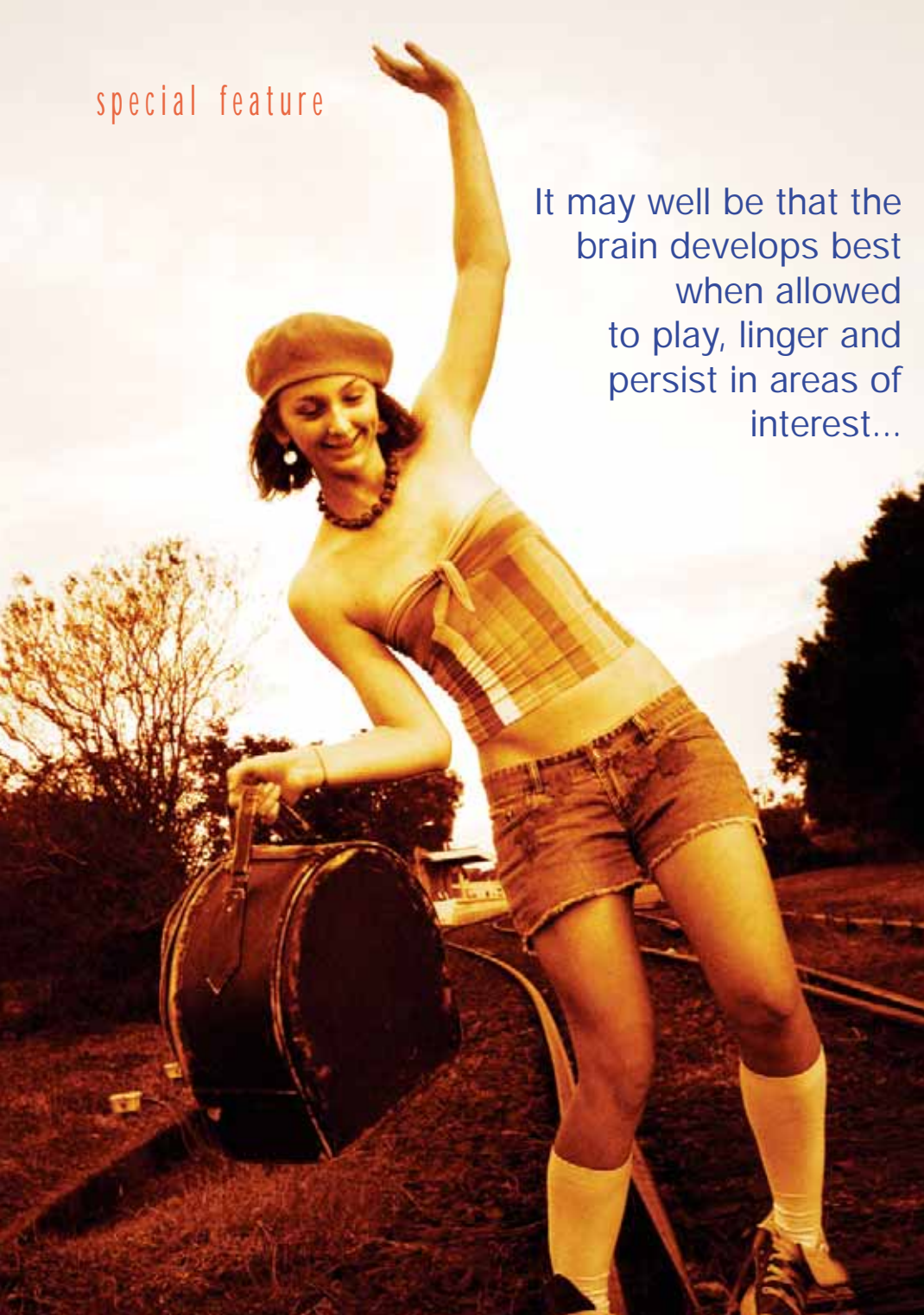
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It may well be that the brain develops best when allowed to play, linger and persist in areas of interest...



240 individual students really the best model we can come up with? Is a system that divides learning into multiple areas suitable for a group of young people who essentially don't have functioning frontal lobes and therefore can't transfer information from one setting to another?

It may well be that the brain develops best when allowed to play, linger and persist in areas of interest and that this may especially be so when the early adolescent is in the company of someone whose opinion he or she cares about.

Friends and more friends

It's not going to come as news to anyone

here that the adolescent brain is not only tumultuously emotional, it is also incredibly social. As Linda Spear points out, most species show an alteration in social behaviour around the time of adolescence. Play fighting and play behaviour increase before declining as sexual maturity is reached.

The intensity of peer relationships may serve two purposes here: an evolutionary advantage as well as a learning purpose. The interest in peers may have traditionally helped the dispersal of adolescents away from the family group thereby avoiding inbreeding. An age related emigration is common among mammalian species and may be evolutionarily adaptive.

Peer affiliation may also promote learning. To learn, humans are hard-wired to do two things:

- Experience differences; and
- To imitate (watch what other people do and copy them).

Imitations are tried out and if successful become patterns or habits.

Teenagers are nothing if they are not great imitators. Fashion, music, lip-gloss, Lynx deodorant — it's all around you!

As well as being great imitators, they are wary in case they lose peer approval. So they are, to quote Con the Fruiterer, 'Looking, looking, looking!'

Needing a lift

Adolescents are harder to motivate and are motivated by different things than adults. They seek out new stimuli, novelty and risk.

Synaptic pruning may be associated with a major decline in the amount of excitatory stimulation reaching the cortex. Glucose metabolism, a measure of brain activity, declines during the adolescent years. This may account for the search for greater amounts of excitement.

Between late childhood and early adolescence there is a 'fall from grace' with the number of reports of feeling 'very happy' dropping by 50%.

Even when engaged in the same activities, adolescents find them less pleasurable than do adults. They experience an increase in negative feelings, depressed mood and mood

ranges than younger or older people.

Therefore they may attain less positive impact from stimuli with low or moderate incentive value. Part of the answer is to bombard them with positive experiences.

As children get older their attitude to school deteriorates and adolescents' academic motivation declines over time. Considering how to increase motivation in students is a major issue for schools.

Getting the zzzz's

Adolescents eat more and they sleep less. They have a preference for sleeping and waking later than they did when

they were children. Adolescents need more sleep than they did as children — around 9 and a quarter hours. Most teenagers' brains aren't ready to wake up until 8 or 9 in the morning.

Teenagers who are sleep deprived do less well at school and are more prone to feelings of sadness and hopelessness. In short, they feel fairly crappy.

Feelin' stressed

The decision-making ability of adolescents may be more vulnerable to disruptions and the stresses and strains of everyday living than that of adults.

They may also respond more strongly to stressful events physiologically with greater blood pressure and cardiac output response than children.

Adolescents are often sleep deprived which may in turn increase vulnerability to stress. They may have more negative life experiences (friendship changes, alterations in romantic liaisons, school work) that they tend to view more negatively and have less control over. This may well increase their sense of helplessness.

The more negative life events an adolescent has the more likely they are to engage in problem behaviours and the less likely they are to engage in a wide range of positive activities.

When you're mad, you're really mad

Aggressive behaviour peaks during adolescence in a number of primate species. Aggression has its origins in the limbic areas and particularly the amygdala, which relates to the emotions, and shapes fight or flight responses.

When emotional, adolescents have lower activity in their frontal lobes and more activity in the amygdala than

adults. The amygdala may also be more easily activated in adolescents. In one experiment, young people were reported to exhibit greater activity in the amygdala than in the frontal lobes when engaged in a task requiring subjects to identify emotional states from facial expressions — adults showed greater frontal activity.

One interesting but curious research finding reveals that young people with low resting heart rates are more likely to be aggressive and engage in high risk behaviours. This raises the possibility that adolescents who have been exposed to high stress during childhood may habituate to that level of stress and become harder to excite or motivate and use more extreme ways of behaving and relating to others to relieve boredom.

The adolescent brain is in transition, and therefore teens should not be treated just like smaller versions of adults. When we grasp the basics behind their development, it makes it easier to understand how they tick, and what they need from their parents and teachers. Rethinking their education and how we support them as parents so that it reflects what we understand from the research is key to their wellbeing. ☺

Andrew Fuller is a clinical psychologist who lectures in child, adolescent and family psychology and consults to communities and schools about the promotion of resilience. He is the author and a fellow of the University of Melbourne's Department of Learning and Educational Development as well as the Department of Psychiatry. See www.andrewfuller.com.au or visit www.inyahead.com.au for book sales.

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