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Professional Development
Workshop Goals:

- Increase understanding of how the brain functions.
- Examine recent discoveries related to brain development.
- Understand the processes of learning and memory.
- Examine the influence of emotions and learning.
- Apply this knowledge to instructional strategies.

Your Personal Learning Goal for Today:

What would you like to learn today?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Goal Setting in the Classroom:

What was the objective of a recent lesson you taught? Did you share this objective with the students?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

How do you ensure that students have clear goals for their learning?

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________________________________________________________________________

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________________________________________________________________________

If a learning objective is lacking authenticity and relevance, the human brain is more likely to reject it. The brain is designed for survival, not boredom.

Bennett and Rolheiser, 2008.
Reflection Page

Use this page to record important ideas and strategies you will use after the workshop.

<table>
<thead>
<tr>
<th>Important ideas:</th>
<th>How I will apply them:</th>
</tr>
</thead>
<tbody>
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Brain Fact:

The brain needs a reason to pay attention to new information. Do you share the goals of each lesson in your classroom with your students?
# Brain Myths or Facts?

Check to indicate whether you believe the statement is a Myth or a Fact:

<table>
<thead>
<tr>
<th></th>
<th>Myth</th>
<th>Fact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>We only use about 10% of our brain.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>A person’s personality displays a right or left brain dominance.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Brain damage is irreversible.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Boys and girls have different brains.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Stress affects the ability of the brain to learn and retain information.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>The brain feeds on glucose, so eating candy during a test is a good idea.</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Physical exercise improves brain function.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Play in mammals affects frontal lobe development. Abnormal play behaviour is often an indication of brain disorder.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>The brain is a “blank slate” at birth.</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Babies are born with cells that allow them to hear and pronounce the sounds of every language in the world.</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>After the age of 12, it is more difficult to learn a new language fluently.</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Smell is the strongest memory trigger.</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>The brain never forgets; we just lose the ability to recall the stored information.</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>You can’t tickle yourself.</td>
<td></td>
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</tbody>
</table>
Emotion and the Brain

Stress and Learning

- Anxious students act out or shut down.
- They have a shortened attention span.
- They filter out all “unnecessary stimuli” not connected to survival.

How can teachers reduce stress in students?

- Choice.
- Physical Activity.
- Predictability.
- Sense of Control.
- Social Interaction.

Based on the 5 factors (in above slide), what specific actions could you take in your classroom to reduce stress in students?

Brain Fact:
The brain is programmed to attend to information with a strong emotional content.
Small Group Participation

1. Choose a topic that interests you.

2. Use any sources, including the Internet, print material and personal knowledge.

3. Spend up to 20 minutes collecting information.

4. Create a Visual Diagram or Graphic Organizer to summarize your learning on large chart paper.

Notes:
Reflection—Bringing it Home

What will you do differently in your classroom based on what you’ve learned today?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

What did you learn today that validates and reinforces what you already do?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

What will you have your students learn about their brains?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

What should parents know about their child’s brain and learning?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

*Education is discovering the brain and that’s about the best news there could be … Anyone who does not have a thorough, holistic grasp of the brain’s architecture, purposes, and main ways of operating is as far behind the times as an automobile designer without a full understanding of engines.*

Leslie Hart, “Human Brain, Human Learning”
Answers for the Brain Terminology Card Sort

1. **Acetylcholine**—a neurotransmitter. It is necessary to form long-term memories; it is in short supply in Alzheimer’s patients. It increases when we sleep and is released through movement.

2. **Amygdala**—the part of the brain that is the source of emotions and emotional memory. It matures BEFORE the frontal lobe. The amygdala is programmed for immediate emotional response.

3. **Caffeine**—acts as a stimulant; puts the brain into a high state of arousal, so concentration and focus may become difficult. Increases heart rate and anxiety.

4. **Consolidation**—the process of stabilizing a memory over time, moving it from working memory to long-term memory.

5. **Cortisol**—the hormone released when the body is under stress. It interferes with the brain’s supply of glucose and causes an influx of calcium into brain cells. Calcium creates free-radical molecules, which can actually damage brain cells. When the brain is damaged by cortisol, the patient has difficulty paying attention which prevents adequate storage of memory; therefore, interferes with general intelligence. In other words, a stressed brain is less able to learn.

6. **Dopamine**—the “feel good” neurotransmitter. It allows us to focus and make decisions. It’s linked with addiction and pleasure. Exercise releases dopamine. Students with ADHD have lower levels of dopamine in their frontal lobes.

7. **Glucose**—the fuel for the brain. It cannot be stored. The frontal lobe requires glucose in order to function. However, too much glucose (from eg, soft drinks) can cause the body to kick out more insulin to deal with the overload of glucose. Ultimately, the brain becomes “glucose-starved”.

8. **Hippocampus**—the part of the brain that is most responsible for storage and retrieval of memory.

9. **Myelination**—the process of strengthening neural pathways to consolidate learning. There is some evidence that alcohol use in a young person’s life can disrupt the myelination and pruning process of the brain.

10. **Nicotine**—interrupts the flow of oxygen to the brain—decreases learning and memory and reduces the production of glucose. Teenage smokers grow twice as many neural receptors for nicotine than people who begin smoking in their 20’s—hence, it is easier to get hooked on nicotine as a teenager.

11. **Plasticity**—refers to the ability of the brain to change as the result of experiences; experiences include ANY sensory input. The use of drugs at an early age can actually affect later plasticity, that is, the ability of the brain to learn and memorize later in life.

12. **Pruning**—the natural process by which the brain eliminates neural pathways that are no longer used. Occurs at least twice: between the ages of 2 and 3 and again at ages 14 through 18. Pruning is based on environment—the brain chooses to keep what it has discovered is important to the individual.

13. **Marijuana**—results in low activity in the frontal lobe (reasoning) and temporal lobes (memory) due to a decrease in blood flow. It interferes with the ability to long-range plan (there’s a reason it’s called “dope”)

The Alberta Teachers’ Association
Information for “Examining the Net-Gen Brain”

- The RAS (Reticular Activating System) is the part of the brain that filters information. There is evidence that the RAS in young people scans more quickly and expects more information than our generation. This is a result of their involvement with more information at a fast pace.

- The average person spends about two seconds per website when doing a search. Our students are programmed to scan more quickly and are less likely to focus attention for a significant length of time.

- The increase in immediate connectivity is related to increased stress in students. Students know immediately if negative information is being said or shared about them.

- Net-Geners are keyed into visuals when they “read” or scan for information. They do not “read” sequentially. Don Tapscott (Grown Up Digital) says they develop hypertext minds.

- Net-Geners are more likely to explore first and then look for instructions.

- Playing video games does NOT activate the frontal lobe—Researchers found (2008) that video games stimulate the visual and motor function, but not the frontal lobe.

- Adolescents who are completely immersed in technology may suffer from stunted frontal lobe development—particularly in the areas of social ability and the ability to empathize and relate to others.
Brain Compatible Teaching Strategy

Think, Pair, Share (An Instructional Tactic)

What is it?
It is a process for students to communicate and share answers in a safe manner that encourages accountability and participation.

What is its purpose?
Think, Pair, Share results in increased student participation and improved retention of information. Using the procedure, students learn from one another and get to try out their ideas in a non-threatening context before venturing to make their ideas more public. Learner confidence improves and all students are given a way to participate in class, rather than the few who usually volunteer. The benefits for the teacher include increased time on task in the classroom and improved quality of student contributions to class discussions. Students and teachers alike gain much clearer understandings of the expectations for attention and participation in classroom discussions.

Process
- **Students are given a limited amount of time to think of their own answer to the posed question.** Students should understand that while there may be no one right answer, it is important that everyone comes up with some reasonable answer to the question.
- **Each student discusses his or her answer with a fellow student.** They begin working together to reach consensus on an answer to the question. Together, each pair of students can reformulate a common answer based on their collective insights to possible solutions to the posed question.
- **Students now share their answers with the whole class.** Students see and hear the same concepts expressed in several different ways as individual students find unique expressions for answers to the posed question. The concepts embedded in the answers are in the language of the learners, rather than the language of the teacher or a textbook.

How can I use this in my classroom?
Virtually any time—to review, encourage discussion, brainstorm, check for understanding, or start a discussion.

More information:
Brain Compatible Teaching Strategy, cont’d

Placemat (An Instructional Tactic)

What is it?
Placemat is a collaborative learning tactic that combines writing and dialogue. It involves groups of students working both alone and together around a single piece of paper to simultaneously involve all members.

What is its purpose?
Placemat ensures accountability and participation of all students. It provides a safe environment as students have time to reflect and can rely on the group for success.

Materials Required
Chart paper is preferable, but not necessary
Pens and pencils

Process
- Students are in small groups (4–6 works best).
- Students divide a piece of chart paper into the number of students in the group.
- A centre square or circle may be used to consolidate information.
- Students are provided with a question to answer.
- Students work individually and silently first to write answers on their portion of the chart paper.
- Students share their thinking with their group. The Round Robin tactic works well for ensuring equal opportunity. Students may be given the option to Pass.
- Students may then share with the large group through reporting, Walk About, or any other techniques appropriate to the assignment.

When could I use this approach?
- Achieving consensus
- Before doing a Mind Map—to identify key ideas
- Brainstorming
- Finding out what students already know
- Focusing on key ideas
- Practice responses (Math)
- Review

For more information:

Brain Compatible Teaching Strategy, cont’d

Mind Mapping (An Instructional Strategy)

What is it?
Mind mapping is a strategy that helps the learner to connect existing knowledge with new knowledge; this makes knowledge dynamic, rather than passive. As a framework tool, it assists in the formation of connections and in organizing concepts and the relationships between facts, concepts and ideas.

What is its purpose?
It is an analytical process that can be used to take notes, to study for an exam, to brainstorm, or to make connections between ideas. It enhances memory. It also allows students to work in groups to practice social skills.

Essentials of Mind Mapping
- The central image represents the subject being mapped
- The main themes radiate like branches from that central image
- Those branches have a key image or key word printed on an associated line
- The branches have a connected structure
- The use of colours and images helps link the ideas to memory in the brain.

Materials
A sheet of paper for each student or group
Coloured pens or crayons, even scissors and glue, if pictures will be used

Process
- Select a topic. It helps to think of a visual that captures the essence of that topic and use it in the centre.
- Brainstorm the key ideas related to that topic.
- Record all ideas.
- Group into common categories.
- Draw a picture or symbol that represents each of the key ideas brainstormed.
- Position those visuals around the outside of the visual in the centre of the map.
- Put in the key word, then connect the key words to the centre.
- Flow with ideas radiating out from each of the key ideas and continue the above process.
- Reflect alone, with a partner, with a small group or with the class. Talk through the journey you took to conceptualize the key ideas related to the topic. Explore the relationships between different aspects of the map.

Note: Complex Mind Maps, when completed, may seem difficult to read or to decode. However, the effectiveness of the activity is the process students work through as they complete it.

More Information:
Sample Graphic Organizers

A. Ranking Ladders

- Ideas are placed on the steps or rungs of the ladder.
- To make a ranking ladder a truly evaluative organizer, ideas should be placed on the steps in order of importance.
- Next to the idea on the rung, students may write their rationale for placing the idea at that point, or provide an explanation of the idea.

B. Fish-Bone Diagram

Fish Bone Organizer

Note: This sample of Fish Bone is for Teacher reference only and is only a framework for understanding. Students should create their own headings and supporting evidence.

Fish Bone is used to organize information. It is often used in problem solving or to identify and organize factors. The diagram below illustrates the structure of the Fishbone Organizer. Notice how the head of the Fish Bone provides the idea that acts as the focus for the thinking. In a way, Fish Bone is a more sophisticated form of Brainstorming. The students do more than simply identify or recall ideas; they also organize them according to some type of classification of the main ideas and the sub ideas (this is the analysis and evaluation level of Bloom’s Taxonomy).

Appendix D

The Adolescent Brain: A Work in Progress—June, 2009
By Pat Wolfe

One day a child is cheerful, loving and obedient, comes to a parent or teacher for advice, dresses in appropriate clothing, and turns in for the night at 10:00 pm. Homework is done without nagging and parent/teacher conferences are a joy. Then somewhere between 10 and 12, a strange thing happens. Almost overnight it appears someone has unzipped this child and put someone else inside. No longer could this child be called sweet and loving; surly and antagonistic would be better descriptors. Gone are the days when they ask for advice and if it is offered, you can be certain it will be ignored. This teen comes to breakfast in the morning dressed in an outfit on which you would like to pin a note stating, “What this person is wearing to school today is not my idea of good taste!” The teen spends hours on the computer, but homework doesn’t get done and teacher/parent conferences are no longer pleasant.

It doesn’t take a brain scientist to tell you that adolescents can be frustrating. Most of us understand that the teen’s life is shaped by factors such as family, friends, school, and community institutions. But there are also powerful neurological issues at play. Neuroscience has made great strides in shedding light on the changes occurring in the teen’s brains and why they behave the way they do. Interestingly, the new information focuses not only on the oft-blamed raging hormones, but on what’s going on above the neck as well. Many of the new insights into the adolescent brain have been gained using the brain-imaging techniques that were discussed in Chapter One. What the scientists are seeing is that the teen years are a time of significant change in the activity, anatomy and neurochemistry of the brain.

As we have seen, the brain grows by expanding and pruning the connections between cells, keeping the connections that are used the most and getting rid of the unused ones. We have also seen that one of the most active periods of reorganization occurs early in life around two years of age when there is a huge build up of neural connections in the child’s brain. Recall that this build up is followed by a massive pruning which allows the strongest and most efficient connections to function more effectively. Until recently, scientists assumed that this period of growth and winnowing away occurs only in early childhood and that most, if not all, of the major changes in brain organization and development occurred before adolescence. This view seemed reasonable in light of the fact that the brain reaches its full size by puberty. The conventional wisdom had been that the adolescent brain is fully developed and functions similarly to an adult brain. This turns out, as many middle-school teachers and parents already suspected, not to be the case. Instead scientists have discovered that very complex changes are taking place in the brain during adolescence and that the brain is not fully installed until between ages 20 to 25. The brain is still changing during the teen years!
Changes in the Adolescent Brain

In what parts of the adolescent brain are the greatest changes occurring? A central area of focus has been the frontal lobes. A long-range study by Jay Giedd and his colleagues at the National Institute of Mental Health (NIMH) has involved using functional Magnetic Resonance Imaging (fMRI) to scan the brains of nearly 1,000 healthy children and adolescents aged 3 to 18. Giedd discovered that just prior to puberty, between ages 9 and 10, the frontal lobes undergo a second wave of reorganization and growth (Giedd, 2007). This growth appears to represent millions of new synapses. Then around age 11 a massive pruning of these connections takes place which isn’t complete until early adulthood. Recall that although it may seem like the more synapses, the better, the brain actually consolidates learning by pruning away connections. The brain is getting rid of the least-used pathways, a method for ensuring that the most useful synapses are maintained which in turn allows the brain to operate more efficiently.

In addition to this winnowing of connections in the adolescent brain, another developmental factor is also at play. One of the final steps in developing an adult brain is myelination. Recall that myelin develops in the more primitive areas of the brain first, gradually moving to the higher level functioning areas. Myelin increases the speed of the axon potential travelling down the axon, up to 100 fold compared to neurons that have no myelin. So, during the teen years not only does the number of connections change, the speed of the connections becomes faster. It is not surprising then to find that myelination occurs in the frontal lobes last. Researchers at the University of California at Los Angeles compared scans of young adults, 23–30, with those of teens, 12–16, looking for signs of myelin which would imply more mature, efficient connections. As expected, the frontal lobes in teens showed less myelination than in the young adults. This is the last part of the brain to mature: full myelination is probably not reached until around age 30 or perhaps later.

Why are these changes in the frontal lobes significant? The frontal lobes, specifically the area right behind the forehead called the prefrontal or orbitofrontal cortex is often referred to as the CEO of the brain. It is in this part of the brain that executive decisions are made and where ethical/moral behaviour is mediated. In fact, this part of the brain has been dubbed “the area of sober second thought”. Persons with damage to this part of the brain often know what they are supposed to do, but are unable to do it. In these persons the damage also appears to impair their ability to imagine the future consequence of their actions. They tend to be more uninhibited and impulsive. Observations such as these suggest that teens may have difficulty inhibiting inappropriate behaviours because the circuitry needed for such control is not fully mature. The list below summarizes the cognitive and behavioural functions of the prefrontal cortex.
These functions are practically a laundry list of characteristics that adolescents often lack. Many researchers suspect that an unfinished prefrontal cortex, with its excess of synapses and unfinished myelination, contributes to the adolescent’s deficits in these areas. Their brains often aren’t ready to take on the role of the CEO, resulting in a lack of reasoned thinking and performance.

Another factor is at play in the adolescent brain that sheds some light on their often over-emotional behaviour. Scientists have discovered that in the teen brain, the emotional centre matures before the frontal lobes. Emotion therefore often holds sway over rational processing. When we realize that the prefrontal cortex allows reflection while the amygdala is designed for reaction, we can begin to understand the often irrational and overly emotional reactions of teens. Our often-asked question when teens engage in irrational behaviour, “What were you thinking?” is difficult for teens to answer because in many cases they weren’t thinking reflectively; they were reacting impulsively. This phenomenon has been further validated by a team led by Dr Deborah Yurgelun-Todd at Harvard–affiliated McLean Hospital. They used functional Magnetic Resonance Imaging (fMRI) to compare the activity of adolescent brains to those of adults. They found that when identifying emotional expressions on faces, adolescents activated the amygdala more often than the frontal lobes. The opposite was seen in adults. In terms of behaviour, the adult’s responses were more intellectual, while the teens responses were more from the gut or more reactive. Giedd comments that adolescents can be thought of as trucks with no brakes!

The neurotransmitter dopamine plays an important role in the often reckless, sensation-seeking behaviour of adolescents. Recall that dopamine is a naturally-produced stimulant, critical for focussing attention on the environment, especially when there are conflicting options. When a goal is not obvious, reflection, not impulse, is necessary to make a good decision. Early in adolescent development, dopamine levels are relatively low which may account for their reactive behaviour. The good news is that dopamine inputs to the prefrontal cortex grow dramatically as the teen ages, resulting in an increased capacity for more mature judgment and impulse control. But until this system is mature, decisions are often made on impulse.
Substance Abuse During Adolescence

Now that it has become clear that, in contrast to previously-held assumptions, there is a tremendous amount of change taking place in the teen brain, we need to look at the possibility that alcohol and other drugs impact both brains and behaviour differently in adolescents and adults. The shaping and fine-tuning of the frontal lobes is, at least in part, mediated by experience. This raises the possibility that drug abuse could alter normal development of the brain. This is an area of critical importance. Current estimates suggest that roughly 50% of high school seniors consume alcohol at least once a month, while 17% regularly smoke cigarettes and nearly 50% have smoked some marijuana (Kann et al, 2000; Johnston et al, 2001). The National Institute of Alcoholism and Alcohol Abuse reports that alcohol kills six and a half times more individuals under age 21 than all other drugs combined.

Much of the research on the effects of alcohol has been conducted using animal studies. In studies of rats, Markwiese et al (1998) found that alcohol disrupts the activity of an area of the brain essential for memory and learning, the hippocampus, and that this area is much more vulnerable to alcohol-induced learning impairments in adolescent rats than adult rats. Rats are not humans, however, there is some evidence that the human hippocampus reacts in a similar manner. A study by De Bellis et al (2000) found that hippocampal volumes were smaller in those who abused alcohol during adolescence and that the longer one abused alcohol, the smaller the hippocampus became.

Research by Sandra Brown and colleagues at the University of California, San Diego has produced the first concrete evidence that heavy, ongoing alcohol use by adolescents can impair brain functioning. They found several differences in memory function between alcohol dependent and non-drinking adolescents, none of whom used any other drugs. In the study, the 15 and 16 year-olds who had drunk heavily (more than 100 lifetime alcohol use episodes) scored lower on verbal and nonverbal retention of information.

Additional research by Brown and Tappert (2000) is trying to answer whether or not heavy drinking at 15 is more dangerous for the brain than at 20. Their preliminary hypothesis is that drinking may be more dangerous at age 15 because the finishing touches on brain development (myelination and pruning) haven’t been completed and alcohol may interrupt or disturb these refining processes. Brown and Tappert point out that more studies will be needed to produce a definitive answer, but at least their work is an important step toward confirming what many scientists have suspected for some time—teenagers who drink may be exposing their brains to the toxic effects of alcohol during a critical time in brain development.

Not only are the frontal lobes of adolescents going through major changes, the molecular and chemical systems are being re-shifted as well. Many substances appear to have a heightened effect on teens. Researchers at Duke University found that adolescent brains respond more intensely to nicotine than do adult brains. In rat brains, the levels of dopamine receptors in the pleasure centre (the nucleus accumbens) of the brain increase dramatically between 25-40 days, the rat adolescent phase (Spears, 2000). These receptors play a huge role in the pleasure-producing properties of drugs. It is not yet clear if the human adolescent brain evidences this same increase, but many researchers think it is highly probable.
Adolescent Sleep Patterns

A common complaint of parents of teenagers is that their kids insist they can’t fall asleep until midnight, but every morning is a struggle to get them out of bed on time for school. And parents aren’t the only ones with complaints about adolescent sleep habits. Teachers of early morning classes complain that their students seem to be in class in body only, frequently nodding off or at the least, drowsy and difficult to teach. It may not be the fault of teens; biology may be behind their sleep problems. Recent research has shown that here is yet another area where adolescent brains move to the beat of a different drummer.

Our sleep cycles are determined by what is called circadian rhythms, a sort of internal biological clock that determines not only how much sleep we need, but also when we become sleepy at night and when we awake in the morning. Sleep researcher, Mary Carskadon in her sleep laboratory at Brown University’s Bradley Hospital, has discovered that teenagers need more sleep than they did as children and that their circadian rhythms appear to be set later than those of children or adults.

The conventional wisdom has been that young children need 10 hours sleep and that as we become adults, the need decreases to 8 hours. Teenagers have been included in the adult group. Carskadon has shown that teens, far from needing less sleep than they did as children, need more. In order to function well and remain alert during the day, they need 9 hours and 15 minutes, possibly because the hormones that are critical to growth and sexual maturation are released mostly during sleep. One survey of the sleep patterns of 3,000 teenagers showed that the majority slept only about 7 hours a night with more than a quarter averaging 6 hours or less on school nights. Given that sleep is a time when brain cells replenish themselves and when connections made during the day are strengthened, sleep deprivation can have a major negative effect on learning and memory.

A second finding from Carskadon’s research is that these teen biological clocks appear to be set later than those of children or adults. They do not get sleepy as early as they did when they were preadolescents and therefore tend to stay up later at night and sleep later in the morning. Most teenager brains aren’t ready to wake up until 8 or 9 in the morning, well past the time when the first bells have sounded at most high schools. Teens who have to get up before their internal clock buzzes, miss out on an important phase of REM sleep, that is important for memory and learning.

Not all scientists agree totally with the research on the adolescent brain. Giedd’s theory that brain changes are responsible for the often erratic behaviour we see in teens is speculative. The theory is somewhat controversial because the roots of behaviour are complex and cannot be easily explained by relatively superficial changes in the brain. However, if the theory turns out to be true, it would underscore the importance of providing careful guidance through adolescence, which isn’t a bad idea in any case. Giedd states “...unlike infants whose brain activity is completely determined by their parents and environment, the teens may actually be able to control how their own brains are wired and sculpted.” Adolescents are laying down neural foundations for the rest of their lives. As parents and teachers, we have an opportunity and an obligation to educate adolescents about what is going on in their brains and the role they play in determining the structure and functioning of their brains for the rest of their lives.
Teaching the Adolescent

Later chapters in this book will focus on brain-compatible strategies designed for various ages, however, given the unique characteristics of adolescents, it seems appropriate to take a look at some general considerations which may help teachers when they plan classroom instruction for these students.

In a sense adolescent brains are primed to learn, however, we often see boredom and apathy in their behaviour. When we consider the hyperactivity of the amygdala and high-energy level at this stage of brain development, this isn’t surprising. Too much classroom instruction is sit and git, adolescents’ least favourite classroom activity! Very few teens like to sit still and listen to a teacher deliver a lecture. While lectures are sometimes appropriate during the teen years, consider having the students use interactive note-taking guides. After hearing or reading new information, students can be asked to demonstrate their understanding of the content by various methods such as role play, poster demonstrations, teaching another student or writing their reflections in a journal. Most parents will attest to the fact that adolescents like to argue. This propensity can be put to good use in debates where students discuss the pros and cons of complex ethical issues. Project-based activities are especially motivating to teens. In collaborative groups they can be encouraged to seek answers to problems facing the school or community, perhaps interviewing other teachers, parents or adults for their points of view. When concepts have been learned, it is helpful to give students real-life problems to solve that require the use of the concepts.

Few of us are as proficient in current technology as adolescents. They text, download music and information on ipods, and surf the Internet with ease. Teachers should consider ways to integrate teens’ ability to use technology in the classroom. Given the option, students might prepare multi-media presentations, rather than book reports or use email to dialogue with experts in biology, history, music, mathematics, neuroscience, or other fields of study. The Internet provides a speedy manner for researching topics for term papers and projects, however, with its increasing use, many students will need guidance in determining the validity of the data.

Teens are full of promise. They are energetic, caring and capable of making many contributions to their communities. They are also able to make remarkable spurts in intellectual development and learning. But we must remember; they are not adults and need to be taught in a manner that enables their brains to make sense of information, to see what they are learning as relevant to their lives.
References


Giedd, J; J Blumenthal; N Jeffries; F Castellanos; H Liu; A Ijdenbos; T Paus; A Evans; and J Rapoport. 1999. “Brain development during childhood and adolescence: A longitudinal MRI study”. Nature Neuroscience, 2:10, 861-863.


Appendix E

Resources Available in the ATA Library

Books


**Videos**


Levine, Mel. 2007. *Understanding*. s.l: WGBH.


*PBS. The science of healing with Dr Esther Sternberg: understanding the mind/body connection*. 2009. Washington, DC: PBS.

