My teen brain

My teen brain

School Guide: Tutor Pack

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Introduction and background

Hertfordshire County Council (HCC) alongside Family Links and Professor John Coleman developed My Teen Brain (MTB) in 2014.

Family Links is a national charity dedicated to empowering children, parents, families, schools and workplaces to be emotionally healthy.

Dr. John Coleman is a psychologist who has an international reputation for his work with children and young people. He was for many years a Senior Research Fellow at the University of Oxford. He is currently a Visiting Professor at the University of Bedfordshire, and an Honorary Fellow at the London School of Economics. In 2001 he was awarded an OBE in the Queen's Birthday Honours.

MTB was developed in response to on-going, new and significant research that evidences the adolescent stage as being the next key stage of brain development after the early years between 0 and 3. Local research also showed that professionals would welcome more knowledge of adolescent development, particularly with regard to young adolescents, to enable services to be more responsive to the needs of young people.

MTB details the changes that take place in the adolescent brain and how these changes, in conjunction with environment and experience, can affect emotions, relationships, behaviours, sleep and attitudes to risk. MTB does not excuse adolescents' behaviour, but instead enables adults to support adolescents by understanding the internal changes that take place during this time.

The suite of materials consists of:

- a one day multi agency professional training day
- annual 'thematic days' that focus on one element of brain development in detail and present on the latest research
- a range of resources including a dedicated website at www.hertfordshire.gov.uk/myteenbrain
- four week parent courses. These can be found at www.hertfordshire.gov.uk/parentingsupport

However delivering MTB directly to young people requires a separate delivery method and more development to what was currently available.

HCC commissioned Professor John Coleman to develop a suite of materials based on the MTB initiative to be delivered to young people in schools.

Where should this module be delivered?

The most suitable place for this module to be delivered is in a classroom setting in school. The materials have been designed to be delivered as a universal provision. However there is no reason why the materials should not be suitable to be used in targeted provision. Here they could be used in community settings or where groups of young people are together with an adult who understands the background and rationale for the delivery of the materials. The tutor will need to be skilled in this work and have a background in working with vulnerable young people.

Does the material fit into one lesson or does it need more time to deliver?

The materials have been designed to fit into one 45 minute lesson. However there are many ways in which the materials could be extended if tutors wished to include ideas about brain development in other lessons.

What are the learning objectives for young people?

- To learn about how the brain is changing during the teenage years.
- To gain information that will help students understand themselves better.

Who is this module suitable for?

The module has been designed for those in the age range 13-15, in other words for school settings with students in years 9 and 10. During the trials the materials were delivered to those in years 12 and 13 studying 'A' Level Psychology. In most cases this worked well, but the tutor will need to be sensitive to the intellectual level and sophistication of students in the sixth form.

It is possible that the materials could be delivered to younger age groups, such as year 7. However the tutor will need to be experienced and confident in working with younger age groups.

Materials required to deliver the module

- The tutor should have access to a slide projector for a set of Powerpoint slides, together with a flip chart. If these are not available it will be possible to present the materials by holding up cards large enough for all in the group to see. These cards would need to be prepared beforehand.
- A student pack is provided. Included in this is a very simple evaluation sheet if required.
- These materials could be described as low tech. No film or video material has been included. There are a number of reasons for this, the main one being that tutors will have different preferences about what they would like to use. Clips from YouTube or other sources can be included in the module according to the wishes of the tutor.

The module is divided into six parts:

- learning objectives
- true or false quiz
- changes in the brain during the teenage years
- learning and memory
- stress and emotion
- conclusion.

What training is needed to deliver this

It is not essential that professionals have completed MTB training as this tutor pack and suggested wider reading will be sufficient. However professionals can book onto My Teen Brain training by visiting the website: www.hertfordshire.gov.uk/myteenbrain

It is strongly recommended that tutors work through both the tutor guide and the slides before undertaking the delivery of My Teen Brain for Schools in a classroom or community setting. They provide the structure for the lesson, and indicate at all points the direction that should be travelled as the material is presented to students.

Source of ideas for this module

Neuroscience is a rapidly developing field, and there are as many untested ideas floating around as there are findings that are rooted in solid empirical evidence. All the material in this module can be found in any good book about the teenage brain. All of it is based on evidence that is broadly accepted by reputable scientists. A section with references and resources can be found at the end of this tutor guide.

It is recognised that tutors who will be delivering these materials will need some background and a simple introduction to the teenage brain.

Ten things about the teenage brain that will help you deliver this training

By Dr. John Coleman

For more reading and directions to further resources please see the section at the end of this tutor pack.

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Section 1

Introduction

The brain undergoes major change during the teenage years.

Until recently it was assumed that there was little further development in the brain after the end of childhood. However we now know that the brain continues to change and develop all through adolescence. In fact, there is more change in the brain during adolescence than at any other time in human development apart from the first three years of life. For more information about this see the FSC initiative, My Baby's Brain: www.hertfordshire.gov.uk/mybabysbrain

This means that the teenage years are a critical period. What happens during this period has major implications for later development. Of course the brain does not develop in isolation. The brain and the environment interact, each influencing the other.

In this short introduction I will be describing the changes that occur in the teenage brain. I will show how these changes affect behaviour. Finally I will outline how adults can use this knowledge to encourage healthy brain development. The more adults understand what happens to the brain at this time, the more we can help teenagers manage this period of transition.

Section 2

The main changes that take place in the teenage brain

I should start by saying that the brain is immensely complex. The human brain is the most complex thing in nature. There are in the region of 100 billion nerve cells in the brain.

During the teenage years the brain undergoes substantial change. There is growth and maturation in most areas of the brain. This is something we have learnt as a result of the technology of scanning.

The maturation of the brain allows for new learning and the development of new intellectual skills. In addition the bridge between the two halves of the brain strengthens, allowing for greater connectivity, enabling the brain to use its capacity better. The material that encases the nerve fibres – called myelin – is also strengthened, so that impulses can travel faster and more effectively around the brain.

A further change that occurs in late childhood is a significant increase in the amount of grey matter. This is the area of the brain where most of the nerve cells are to be found. The grey matter is then gradually reorganised and re-arranged during the teenage years.

The networks of cells that are useful are reinforced, and the networks that are of little use are allowed to die away. This process is known as pruning. The phrase "use it or lose it" is one that readers may have heard of. It means that connections between cells that are valuable should be developed and rehearsed.

Section 3

Two main areas of the brain – those to do with emotion and thinking – are most affected.

Two of the most important areas of the brain are the pre-frontal cortex and the amygdala. Both these sites in the brain are illustrated in Slide 4, and both sites undergo very significant change at this time. The pre-frontal cortex is the area most associated with thinking, planning and problem-solving. The amygdala is the area associated with emotion, sensation and arousal. There are also areas in the brain associated with pleasure seeking, and these are more active during the teenage years.

These centres in the brain undergo significant alteration during these years. The brain is maturing, but this does not happen overnight. It takes a long time for all parts of the brain to function well together.

In some young people the amygdala may develop at a faster rate than the pre-frontal cortex, and this is sometimes considered to be an explanation for risky behaviour. There may be times when some teenagers simply do not think ahead and do not take into account the consequences of their actions. In these circumstances the parts of the brain associated with pleasure and rewards can, for a time, prove to be more powerful than the areas linked to thinking and reasoning.

A third area of the brain which is important to mention is the hippocampus, the site in the brain most associated with memory. The hippocampus is the centre that processes and encodes memory traces, and is also associated with the retrieval of memories. It is especially active in adolescence, and plays an important role in learning.

Section 4

The teenage years are a time of significant change in the balance of hormones in the body.

It has always been known that teenagers are affected by their hormones. This upset in the hormone balance is often seen as an explanation for moody or irritable behaviour. What is new in our knowledge is that the balance of hormones affects brain development. The alterations and fluctuations of hormones act on various parts of the brain that have already been mentioned, such as the amygdala and the pre-frontal cortex.

High levels of sex hormones, such as testosterone and progesterone, have an impact not only on the development of the sex organs, but they also lead to changes in behaviour. Surges of these hormones may encourage teenagers to seek out emotionally charged experiences, or to look for novelty and excitement.

It is worth noting that levels of hormones such as cortisol and serotonin fluctuate considerably during this period. The release of cortisol is linked to experiences of anxiety, whilst serotonin helps moderate anxiety. If these hormones are in flux it will be apparent that emotions may be difficult to manage.

Lastly it is important to mention dopamine. This is a hormone which is released when we get pleasure or enjoyment from an activity. The brain is particularly sensitive to dopamine during the teenage years, and some risky or thrill-seeking behaviours can be explained by increased dopamine activity at this time. However it is important to recognise that many factors contribute to the possibility of risky behaviour, as indicated in sections 7 and 9.

Section 5

The hormone melatonin affects teenage sleep patterns.

One other hormone plays a big part in teenage development. This is melatonin, the hormone which is released at night to tell us it is time to go to sleep.

In the last few years we have learnt that melatonin is released later among adolescents than in other age groups. This means that many teenagers become sleepy later than their parents. This has big implications. Sleep is important for teenagers. If they have to get up early for school, they may be missing some hours of much needed sleep. Research tells us that sleep deficit (less than seven hours a night) can influence both learning and behaviour.

In recent years there have been attempts to address this problem. One suggestion is to provide guidance about how to develop good sleep routines, so that the melatonin effect can be overcome.

Here are some ideas about developing good sleep routines for teenagers:

- Turn off all digital devices at least half an hour before bedtime
- Turn lights down, put on soothing music
- Have a hot drink of some sort (without caffeine)
- Most important of all, develop a routine. Adults can help with this. Routines make all the difference.

Recent research has shown that there is another reason why sleep is so important for teenagers. Sleep is a time of memory consolidation. The hours of sleep allow the brain a period when the learning that has taken place during the day can be rehearsed and embedded in long term memory. Teenagers often sleep late on weekends. This is no bad thing, as they are catching up on lost sleep. Young people need their sleep and will benefit from getting as much sleep as possible.

Section 6

New skills are developing all the time.

It is essential to keep in mind that the teenage years are a time of large gains in intellectual skills. The regions and networks in the brain that are to do with memory, language and learning are altering to allow new thinking and greater cognitive capacity.

As far as new thinking is concerned, as young people move through key stages 3 and 4 they begin to be able to think at an abstract level, and to pursue scientific reasoning.

Memory capacity also increases. Although this is not routinely tested in school, research shows that there is a marked change with age. As young people mature, their memory capacity expands, and there is a development of their ability to remember more facts for a longer time.

Language is another area which shows marked change at this time. Vocabulary increases, as does the ability to communicate more effectively. Adults sometimes find this hard to comprehend, since many teenagers come across as either tongue-tied or unwilling to talk to adults. Nonetheless communication skills do develop during these years as areas of the brain related to language go through a process of development. This is clearly in evidence when young people are observed in communication with friends.

Section 7

There may be links between risk-taking and brain development.

One of the most common ideas about teenagers is that they are risk-takers. As was suggested in sections 3 and 4, it may be that the area of the brain to do with thinking and planning matures more slowly than the area to do with sensation and arousal. If this is the case, behaviour may be more under the control of the parts of the brain to do with short-term rewards rather than with the areas related to problem-solving and thinking about consequences.

However it should be noted that there are different views about this. Some commentators argue that it is not “defects” in the brain that lead teenagers to do risky things. Rather it is lack of experience, combined with the desire to explore the world and look for novelty and new experiences, that are the real factors to be taken into account.

Another possible explanation has to do with the pleasure centres in the brain, and the role of the hormone dopamine. Research shows that the centres associated with pleasure are more active during adolescence. In addition heightened levels of dopamine, and the effect of this on the pleasure centres, may have the effect of leading some teenagers to seek thrills and pleasure, without having taken into account what may happen as a result of these activities.

Finally it is important to keep in mind that the environment plays a part too. What is happening in the brain interacts with the experiences of the young person, as well as the influences of key people.

Adverse childhood experiences may increase the likelihood of risk-taking because of the impact of these experiences on brain development. The behaviour of important adults and of the peer group can also influence the degree of risk-taking on the part of the young person.

Section 8

The social brain.

The term “social brain” refers to the regions that have to do with understanding other people. On the one hand the development of the social brain brings with it new skills. On the other hand there are also some short-lived deficits that make it hard for the teenager to see the wider picture.

Looking first at the new skills, these have to do with understanding the thoughts or intentions of others. Skills include being able to take the perspective of another person, understanding the mental states of others, recognising emotions and making assessments of people. All these are essential as the teenager becomes more involved with the peer group.

Strangely however, just as these new skills are developing, the young person also becomes more self-conscious and self-centred. This is sometimes described as a “pre-occupation with the self”. Developments in the social brain allow the young person to think about how he or she appears to others. This new capacity, combined with concerns about the changing body, are the factors that underlie a period of “adolescent egocentrism”.

This is also the time when young people are unusually influenced by the peer group. Studies show that increased sensitivity to what others are thinking, and awareness of the reactions of friends plays a part in influencing behaviour. Centres in the brain that take account of the reactions of others are particularly active at this time.

We should not be surprised that all this appears contradictory. Major structural change is happening in the brain, and this cannot happen overnight. It takes time for all areas of the brain to function effectively together. There will be occasions when self-consciousness will be developing alongside the growth of new skills.

Section 9

Brain development can contribute to increased vulnerability.

There are many ways in which teenagers show their vulnerability. This may be through moods and emotions, through behaviour, poor health, or troubled relationships. The brain plays some part in all this, but it is only one part. Childhood experiences and the circumstances around the young person will play their part too.

As far as the development of the brain is concerned, there are many ways in which this can contribute to increased vulnerability. As has been mentioned on the previous page, major structural change is happening, and this will not always proceed smoothly.

It is inevitable that such a degree of change brings with it a period when things are a little off-centre. It is completely understandable that things will take some time to settle down following such a period of alteration and reorganisation.

The hormone balance will have an influence as well. Hormones play a critical role in either helping or hindering the flow of messages around the brain. When hormones are out of balance this can make it difficult to concentrate in class, or to manage relationships in a sensible manner.

A good example is the role of the hippocampus, already mentioned in section 3. This centre plays a very important role in memory and learning, but is also significantly affected by stress hormones. Higher levels of cortisol, for example, will have an impact on the way the hippocampus functions, interfering with the learning process.

As far as the influence of the environment is concerned, adverse childhood experiences such as trauma and abuse will inevitably have an influence on brain development. However we still know relatively little about how these contribute to vulnerability in adolescence.

Positive experiences during the teenage years may do something to mitigate the negative effects of adverse events. It is here that adults can play such a crucial role. Stability and ongoing support during these years will have a clear benefit for brain development in adolescence.

Section 10

Adults can encourage healthy brain development.

Throughout this booklet there has been an emphasis on the fact that the environment around the teenager makes a difference. Here are four things that adults can do which will have a positive impact on brain development.

- understanding

If adults can make allowances for the fact that teenagers are experiencing a major upheaval and readjustment of their brains, this will make relationships easier and contribute to well-being.

- hormone balance

A good balance of hormones is essential if the brain is to manage the process of pruning unwanted connections, whilst developing and cementing useful neural pathways. If the young person experiences too much anxiety or stress the hormone balance will hinder this fundamental process. There is no way to avoid some degree of anxiety and stress, but adults can do all they can to keep this to a reasonable level. In addition they can help young people learn to manage these difficult emotions.

- the amygdala and the pre-frontal cortex

The more adults can do to encourage the development of the pre-frontal cortex, the better for emotion regulation. The more enriching the environment, and the wider range of activities the young person is engaged in, the more opportunities there will be for the pre-frontal cortex to mature faster.

- good routines

For teenagers routines make a difference. Where sleep is concerned, the melatonin effect can be overcome, but only with good sleep routines. This is hard to manage on your own, so adult help can make a significant difference.

Lesson plan and materials

Total time required: 45 minutes

Part 1 - Learning objectives

Time required: 2 minutes. **Slides:** 2 and 3

There are two slides that address the learning objectives. **Slide 2** indicates to the students the purpose of the lesson, or, as I have said "what this is all about". This material will be new to students. For this reason I have felt it useful to do a short introduction, explaining how this project came about, and letting them know the purpose behind the creation of the materials. The purpose therefore is to help students understand themselves and their development, and to help them manage their moods, feelings and relationships better.

Slide 3 addresses the more conventional learning objectives, i.e. what students will be expected to know at the end of the lesson. In this case I have focussed on the three main components of the lesson, namely change, memory and learning, and managing stress and other emotions.

Part 2 – The brain

Time required: 2 minutes. **Slide:** 4

This slide – slide 4 is an illustration of the human brain. The illustration is also to be found in the student pack. The teacher should highlight three main areas of the brain – the pre-frontal cortex, the hippocampus, and the amygdala. The main functions of the three areas are as follows:

- the pre-frontal cortex: thinking and reasoning
- the hippocampus: memory
- the amygdala: emotion and arousal.

Students should be told that they need to be aware of these three areas, and can refer to the illustration in their packs if they want to refresh their memory at any time. The importance of each area will become clear as the lesson progresses.

Part 3 - True or false quiz

Time required: 6 minutes. **Slides:** 5 - 12

There are a number of reasons for putting this element into the module. In the first place it is useful to have a first exercise that is interactive, with the intention of getting the students' attention, and helping them engage with the content of the lesson. The second reason is that a quiz of this sort sets up a challenge between students and tutors allowing for open discussion about issues of debate. When students respond to the quiz it provides the tutor with an opportunity to press further, asking why a particular answer was given. This will allow students to put forward ideas, as well as encourage different views within the class.

Thirdly the actual questions posed allow the tutor to introduce many of the topics which will be the focus of the rest of the lesson. Examples here include sleep, the structure of the brain, whether the size of the brain is linked to intelligence, comparisons between human and artificial intelligence, and the question of change. This is the last question, and allows a link to be developed with the following section focussing specifically on change in the teenage brain.

I should stress it may be appropriate for tutors to make changes to this list of questions. Tutors may wish to alter the questions suggested here, or to introduce additional questions that might be of interest to them or to the class. The list included here has worked well in the trials, but is not set in stone. The key objective is to get students involved, and to open discussion in the class.

Part 4 - Change in the teenage years

Time required: 8 minutes. **Slides:** 13 - 19

This is a key element of the lesson, and is the first of the three substantive topics. The tutor can pick up from the last item in the true or false quiz, outlining the fact that there is more change in the brain during the teenage years than at any other time apart from during infancy. The tutor can stress that this is relatively new knowledge, and has only become available to us as a result of the development of the technology of scanning.

There is then an opportunity to introduce the four main changes that occur. These are set out in **slides 14 - 17**. Once these have been covered, there is then an opening for the tutor to introduce the second interactive element of the lesson. The tutor can now tell students that they can look at the change questionnaire in their student pack, and ask them what changes they have experienced. The questionnaire is simple to complete, and involves the students simply putting a circle around the answer which is most appropriate for them. For example, do they think their memory is better or worse since they became a teenager.

Once the questionnaire has been completed (usually taking no more than 3-4 minutes), the tutor can then gather some feedback. **Slides 18 and 19** are prompts for discussion following completion of the questionnaire. In most cases it will not be possible to take feedback from all the questions. In trials I have concentrated on three items – moodiness, stress and sleep. These are three topics which usually get very high agreement from students, in the sense that they believe these things have changed since they became teenagers. On average I have found in the region of 90% agree that they are more moody, and a similar proportion believe that life is more stressful. On sleep it is usually in the region of 60-70% who say they find it harder to get to sleep now.

The reason I have concentrated on these items is that they can be directly related to changes in the brain. This is a good opportunity for the tutor to illustrate the links between brain development and the changes that the students are experiencing themselves. However it is also a good time to underline that the brain and the environment interact, both influencing the other. Students may find it harder to get to sleep because of pressures from social media, but this will interact with the effect of melatonin on the brain at this stage.

It is worth making two other points here. First, if possible it is really good to ask students why they think they are experiencing these changes. Why are they more stressed? This gives a good opportunity to explore these issues in the classroom. The second point I should make is that, if there is time, many of the other items in the questionnaire are also of interest. The topic of memory will come up in the next section, and even if students do not think their memory has got better, research evidence shows that there is clear improvement during the teenage years. During the trials I have also had some very lively discussions about whether it is easier or more difficult to talk to parents at this stage.

Part 5 - Memory and learning

Time required: 12 minutes **Slides:** 20 - 39

Tutors may experience surprise at how many slides are to be covered in this section. However six slides are illustrations, and will take only a moment to show. In addition two slides (**slides 29 and 30**) relate to an optional exercise which may be omitted if time is short. Because this is the most complicated section of the lesson, I have indicated each stage with a new point. This will make it easier for tutors to move through this section on learning and memory.

The section leads on from a discussion about the changes that students have experienced, and in particular whether they have noticed a change in memory. It is worth emphasising that a discussion on memory and learning is useful for them, as at the end of the section it will be possible to consider revision. This section on memory and learning requires a bit of background about the workings of the brain.

Point 1 - To commence, **slide 20** indicates a move to a new topic. **Slide 21** reminds the students that, although they may not realise it, their memory will gradually be improving during their teenage years.

Point 2 - To understand something about learning and memory, it is essential to know a little bit about the brain and how it functions. The brain consists of billions of cells, and these are connected by nerve fibres. This is covered in **slide 22** and illustrated by the image in **slide 23.**

Point 3 - The nerve fibres connect each nerve cell (or neuron) to others, but there is a tiny gap, called the synapse, between one nerve cell and another. This is important, because in that gap (synapse) there are chemicals (neurotransmitters, or chemical messengers) which either help or hinder the impulse passing along to the next neuron. This is covered in **slide 24**, and illustrated in **slide 25.**

Point 4 - Memories are formed in the same way as a path might be formed in a field of grass. The first time you walk over it, no trace is left. But if you walk over the field one hundred times the path will be clearly visible. That is how memory traces are formed. This is covered in **slide 26** and illustrated in **slide 27**.

Point 5 - This raises the question of how information is received, encoded and stored for the long term. The hippocampus plays a key role here, acting as the centre which receives information and manages the memory process. It also plays a part in the retrieval of memory. The position of the hippocampus, close to other important areas of the brain, can be seen in **slide 4.** The role of the hippocampus is outlined in **slide 28.**

Optional exercise - At this point the tutor may want to do a short exercise. In **slide 29** there are the opening words of Charles Dickens book *"A tale of two cities"*. The students can be given a couple of minutes to memorise these words. Once completed this can open up a discussion as to how the words were memorised, as prompted in **slide 30.** Did the student just repeat them until they were memorised? Is that the best way to do it? Did the student find a way to link the words to visual images, to colours or to other memory hooks?

Active memory involves finding links that assist learning. The celebrated mind palace is a good example. This is sometimes known as the memory journey, or memory palace. This involves placing, for example, different objects, or lines of a poem, in different rooms of the palace. When the individual comes to retrieve these memories, they are easier to access as they are associated with the rooms of the palace. The central point is that memory and learning can be assisted if associations are created

between information to be memorised and visual links or other clues. This is because two neural networks, rather than one, are going to be involved. Tutors may wish to explore this with students, if there is time to do so.

Point 6 - As noted before, the synapse contains chemical messengers that may facilitate the sending of the impulse, or ones that may inhibit this process. This is covered in **slide 31** and illustrated in **slide 32.**

Point 7 - It may be useful to compare this to a signalling system on a railway network. If you don't have signalling systems the trains will bump into each other. The same is needed in the brain. Messages are travelling around the brain all the time, and some system is needed to ensure that the brain can attend to the ones that are most important, and ignore those that are of less relevance. If we did not have such a system our brains would simply be overwhelmed with information. This can be illustrated by discussing how people concentrate and pay attention in class. If they paid attention to all the stimuli in the environment, they would never concentrate. Inhibition is essential for concentration. This is covered in **slide 33** and illustrated in **slide 34.**

Point 8 - We now know that sleep in the teenage years is affected by melatonin levels. During the teenage years melatonin levels rise more slowly at night, making it harder to get to sleep. Yet teenagers need their sleep. Schools that have experimented with delayed starts in the morning, allowing students to get more sleep, have achieved better exam results (but it doesn't work for parents and teachers!) This is illustrated in **slide 35** and covered in **slide 36**. The discussion about sleep can be linked back to the change questionnaire, and the numbers in the class who said it has become more difficult to get to sleep.

Point 9 - The melatonin effect can be overcome! There are things that young people can do to overcome the melatonin effect. These are set out in **slide 37**, and are as follows: do not have digital devices in the bedroom; have a "wind-down" period before sleep; turn the lights low for a period; play soothing music or find other ways to relax. The most important thing to do is to get into a good sleep routine, something parents may be able to help with.

Point 10 - New research shows that sleep is especially important, since it is a time of memory consolidation, see **slide 38**. In other words this is a time when what has been learnt in the day is laid down in the long-term memory. In addition we also know that what is learnt later in the day is likely to be more easily memorised. That is because the later in the day you learn something the less interference there is from other experiences. Both these points can be linked to the next slide concerning revision.

Point 11 - This gives the tutor the opportunity to emphasise the points that are to do with revision (see **slide 39**). These are: to think about how to get information into long-term memory; to remember the path in the field, so the more you walk over it, the stronger the trace that will be laid down; that the time of day matters; and finally that good sleep routines will make a difference to learning.

Part 6 – Stress and emotion

Time required: 10 minutes. **Slides:** 40 - 46

This section starts with an indication of a new topic – to do with stress and emotion (**slide 40**). There is then a reference back to the change questionnaire, and a reminder to the students that almost all of them agreed that they were experiencing more stress at this stage of their lives than when they were younger. **Slide 41** poses the question: how best to deal with stress and other strong emotions. There will already have been reference to the different parts of the brain, and the roles of the amygdala and the pre-frontal cortex. This is a good time for the tutor to remind students of the functions of these two major centres of brain activity. This reminder is set out in **slide 42:** the primitive bit and the sensible bit of the brain.

Slide 43 again poses the question of how to manage stress or strong emotions. **Slide 44** offers two different approaches, representing the two centres of the brain. Talking things over with someone who will help you represents an approach taken by the sensible part of the brain – the pre-frontal cortex. On the other hand to go round slamming doors and shouting at household pets represents the uncontrolled emotion of the amygdala. These two options are set out in **slide 44.**

Slide 45 highlights the exercise on dealing with stress, and the tutor can at this point direct the students to the "How to manage stress" questionnaire, to be found in the student pack. The options set out in the questionnaire are relatively benign. Given that this is an open session with a large group it was felt important to avoid anything too serious.

Students are asked to put a tick against the options that they consider to be most helpful for them. Once this task has been completed the tutor will then take feedback from the group. The point of the exercise is to start the students thinking about how they deal with stress. The tutor will have a chance to make some important points about managing stress. Some of the key points to be emphasised are set out in **slide 46.** These are:

- there are constructive and not so constructive ways to deal with stress
- different people deal with stress or strong emotion in different ways, and that is absolutely fine
- dealing with different stresses or emotions may require different strategies
- we can all take control of our coping strategies. We can choose how to respond, and we can teach ourselves, as well as helping others, to manage our strong feelings in constructive ways
- as one teacher said to me: "We can learn to beef up our pre-frontal cortex"!

There are many ways that tutors can deal with the responses to the questionnaire. It may be best just to ask a few students their preferred approaches. It may be possible to start a discussion about going to the fridge, or doing some exercise to take your mind off worrying thoughts. Each group will vary in what they can be open about, and how much discussion is possible.

In one of the trials a student wrote in the evaluation "I can't talk about my depression in a large group". It is important for tutors to recognise that this part of the lesson may provoke difficult feelings among some students. This is why the options provided in the questionnaire are what I have called benign, and do not suggest any serious behaviours. I have taken the view that the point of this section of the lesson should be about the possibility of taking control of coping strategies, rather than any exploration of mental health issues. However please see page 24 for possible sources of support to refer students too if necessary and separately to the lesson delivery.

Part 7 – Conclusion

Time required: 5 minutes. **Slides:** 47 - 49

There are two parts to this final section of the lesson, as indicated in **slide 47**. The first is the opportunity to reinforce the point made in the previous section, and to underline that there are things that students can do to help healthy brain development. In other words, there are ways to 'beef up' our pre-frontal cortex. If we can do this, it will help us manage ourselves better, especially our moods, feelings and relationships. The tutor can point out the statement at the beginning of the lesson, where this was set out as one of the key objectives.

Slide 48 outlines the four things that students can do to help healthy brain development (or 'beef up' our pre-frontal cortex). These are:

- be proactive in your use of media
- be curious – expand your interests
- practice making choices and decisions
- be active – get oxygen to your brain.

The tutor will need to provide some explanation for these points. In essence the first three points outline ways in which the pre-frontal cortex can be stimulated. Any activity that exercises this part of the brain is useful in encouraging the maturation of the centre of cognition. It is useful to remember that the amygdala and other parts of the limbic system may mature earlier than the pre-frontal cortex. However the environment around the student, and the activities and behaviours the student engages in will have an impact on brain development. The more the areas of the brain that are to do with cognition can be exercised, the faster these areas will mature. As a result it will be more likely that the individual will be able to regulate emotion, and develop constructive coping strategies.

As far as getting oxygen to the brain, this is accepted now by all neuroscientists as a key feature of behaviour that will contribute to healthy brain development. Indeed the Wellcome Trust is currently piloting a project in secondary schools where students get up and move around every fifteen minutes during a lesson. The intention is to see if academic performance improves as a result of this activity. Students may point out that they have been sitting down throughout the lesson! This can then raise the question of whether schools can make any changes to this structure. It can also raise the question of how long students should be sitting in front of a screen at home.

The final activity of the section is an evaluation sheet, as indicated in **slide 49.** The use of this may not be appropriate in all settings. It is up to tutors whether they will find feedback useful or not. However I felt it was sensible to include an evaluation sheet just in case it could be of value in some lessons.

The slides

There are 49 slides provided for use by the tutor. These follow the different sections of the lesson, and include things like the true or false quiz, a number of illustrations to support the key points in the section on memory and learning, as well as questions that can be put to the students as the lesson progresses. It is strongly recommended that tutors work through the slides before undertaking the delivery of My Teen Brain for Schools in a classroom or community setting. They provide the structure for the lesson, and indicate at all points the direction that should be travelled as the material is presented to students.

The student pack

The student pack consists of six pages, providing information as well as exercise sheets and a short evaluation form at the end.

Page 1 - Title page

Page 2 - Learning objectives

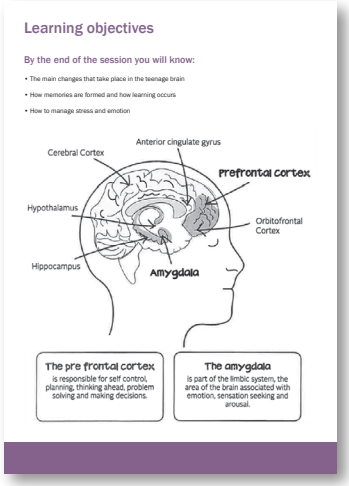
- Image of the human brain, with pre-frontal cortex and amygdala highlighted

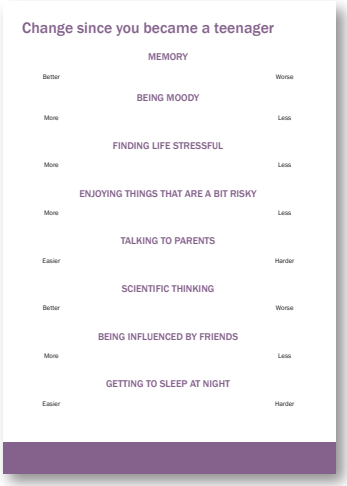
Page 3 - Change since you became a teenager questionnaire

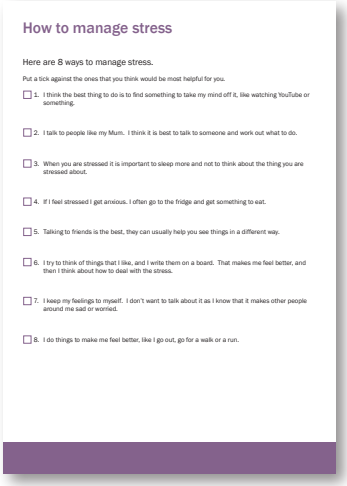
Page 4 - How to manage stress questionnaire

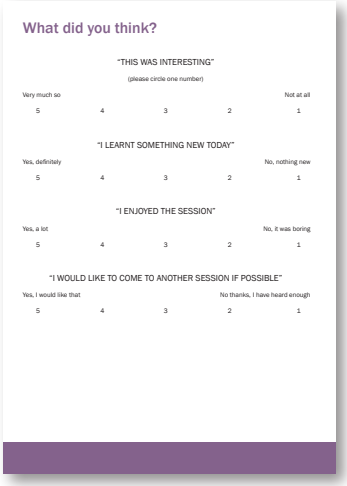
Page 5 - What did you think? evaluation form.

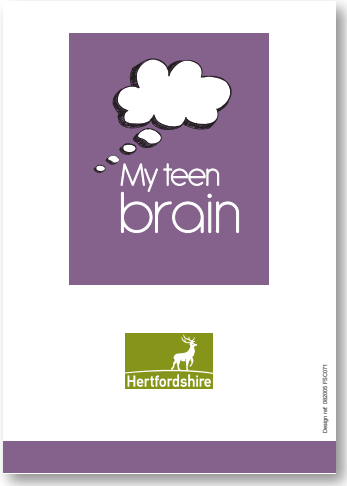
In trials I have found it helpful to have these pages put together as one pack, and handed to each student at the start of the lesson. In particular the image of the brain can be referred to at various points in the lesson. This provides a good talking point if required. Suggestions of how to use the questionnaires are set out in the tutor guide.











Further resources

The brain: the story of you

David Eagleman

Canongate. 2015. This is a general book about the brain by an expert communicator. A good read, with lots of interesting examples to help the reader understand this topic.

The teenage brain: a neuroscientist's survival guide to raising adolescents and young adults

Frances Jensen

Harper Books. 2015. The title tells it all. The author is a parent and a doctor, and she gives a refreshing insight into her experiences bringing up two boys. Strongly recommended.

Blame my brain: the amazing teenage brain revealed

Nicola Morgan

Walker Books, 2013. This is the only book so far for teenagers themselves. It has proved very popular, both with young people and adults. Easy to read, with quizzes and exercises for the reader to complete.

Why we sleep: the new science of sleep and dreaming

Matthew Walker

Penguin Books. 2017. A best-selling book by one of the world's experts. Reporting up to date research on this fascinating topic, it will help the reader understand why sleep is so important for teenagers.

Useful places to go for more information

Professor Sarah Jayne Blakemore's TED talk is entitled: *"The mysterious workings of the adolescent brain".* It can be found at www.TED.com

The Wellcome Trust has an extensive research programme on the teenage brain. It is entitled *"The neuroscience and education programme"* www.wellcome.ac.uk

The Hertfordshire programme entitled My Teen Brain can be found at: www.hertfordshire.gov.uk/myteenbrain

The Mentor-Adepis organisation is based in the UK and has useful briefing papers on the teenage brain. These can be found at: www.mentor-adepis.org

Hertfordshire's website dedicated to children and young people's mental health. there is a toolkit for school mental health leads on this website; to register visit – www.healthyyoungmindsinherts.org.uk

Keep up to date: ensure you have a mental health lead in your school – send details to camhs.commissioning@hertfordshire.gov.uk with the subject School mental health

Find parenting courses running in Hertfordshire at: www.hertfordshire.gov.uk/parentingsupport

Find a range of support for professionals and parents on the Families First Portal: www.hertfordshire.gov.uk/familiesfirst

Other useful websites:

www.healthforteens.co.uk/

www.themix.org.uk/

www.kooth.com/

My teen brain

Hertfordshire

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