

The brain, emotions and learning

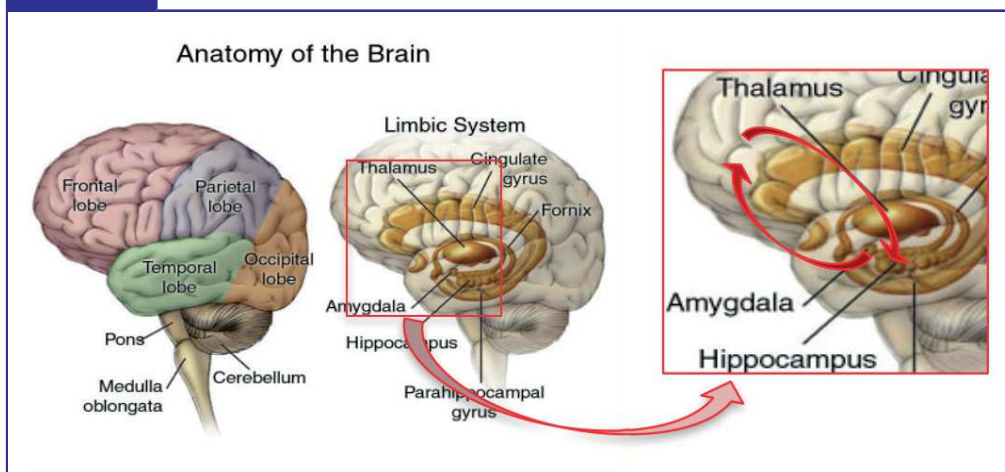
School resources

Learning occurs when an individual has a relatively permanent change in behaviour, cognition, brain function, abilities or knowledge as a result of experiences. Over the past two decades, advances in neuroscience have revolutionised the way we think about the connection between learning, emotions and the brain. We now have extensive evidence that emotions and learning are inextricably connected. We know that ‘we feel, therefore we learn’¹.

Learning is shaped by our experiences. Experiences are caused by external stimuli that are perceived by our senses and communicated to our brain for processing. However, the journey of our experience is not as simple as it might seem.

Suppose we are exposed to a new sound. The sound (stimulus) enters our senses through our ears, and the information about the sound is sent to our brain for processing. Once the sensory information about the new sound reaches our brain, it passes through different areas and structures. One of the first stops the information makes in our brain is the amygdala, a structure used for emotional memory processing. The amygdala interprets the information in order to determine the emotion that should be linked to it (for example, ‘should I be afraid of this sound?’). The information is then transmitted to our frontal cortex, the outermost, frontal area of the brain. The frontal cortex processes the information and helps the brain determine if it already knows something about the stimulus it is perceiving. The brain does this in order to establish whether it needs to spend energy on learning something new (a new sound), or not. Then the brain sends the information to an area that is essential for memory, the hippocampus. Depending on a series of factors such as novelty (how new a stimulus is) or saliency (how relevant it is to the individual), the information that reaches the hippocampus is either stored for later use or forgotten.

FIGURE 1 *Path travelled by a stimulus within the brain²*



While these are not the only stops in our experience’s journey, they are essential to our learning, emotions and memory. The path that a stimulus travels once it enters our brain (its neural pathway), moving from an emotion area to a processing area to a memory area, shows us that all our learning is affected by our prior experiences and our emotions. In order to be processed by our brain, any and all of the

environmental input we perceive and every one of our experiences must first pass through the filter of our emotions.

This fact has countless implications for our day to day life. For example, decision making, which is fundamental to our learning, is based on our memory and previous knowledge. Since everything that reaches our memory passes through the emotional filter first, decision making is affected by our emotions. Decision making cannot be separated from emotions and our decisions cannot ever be considered fully rational or 'emotionless'. Similarly, social interactions, which also relate to learning and decision making, are affected by our experiences and our emotions. Not a single memory nor a single experience we have can be detached from emotions.

The implications of this for education are just as numerous. When thinking about our students and their learning, we must think of learning processes as something that cannot be isolated from emotions. Emotions affect learning, and learning affects emotions: they are complementary and, when looking at the brain, they often overlap with each other. Emotions are essential to learning and learning outcomes: therefore, they are central to effective and efficient teaching and learning processes.

Leveraging the power of positive emotions in learning

Since we know emotions have a pivotal role in learning, we can use affect-based strategies to improve the teaching and learning processes.

Make an emotional connection to a particular class assignment and use personally relevant and authentic activities

Emotions can enhance students' memories³, and lead to deeper and more permanent learning. Teachers can improve the relevance of a learning experience by presenting students with opportunities to explain concepts using personal experiences or apply them to personal scenarios. This will lead to more authentic learning which actively engages students' emotions in the learning process.

Connecting class activities in emotionally and personally relevant ways will help students learn course concepts. Create class activities that require students to apply course material to personal situations. One strategy is to ask students to observe in their own lives a particular phenomenon that was studied in class. For example, when discussing nutrition in a health class, ask students to track their eating habits or keep a food diary for a week. Similarly, instead of asking students in a maths or physics class to calculate the trajectory of a hypothetical ball, you can ask students to calculate the trajectory of a ball in the final match of a recent or upcoming national sports tournament. You can also have students reflect on the personal significance of a topic using a 'minute paper', a short in-class writing assignment (usually taking a minute or a few minutes to complete) in which students reflect on the class lesson in response to a prompt given by the teacher.

To make learning more authentic, incorporate outings, field trips and class demonstrations where possible. Finally, if a class topic is difficult to present in a manner that is relevant to a student's life, make sure you explicitly describe to your students how and why the topic is important and relevant to their life today or in the future. Alternatively, and even better, you can ask your students to come up with a hypothetical situation in a made-up world where the topic might become relevant to their life.

Leverage emotions to selectively orient students' attention to particular material

Emotions also appear to selectively direct an individual's attention to particular stimuli⁴. Teachers can take advantage of emotions to engage students' attention in class by presenting novel activities or methods which they will find exciting. For example, a student will pay more attention to a science class activity requiring the design of an experiment if the teacher uses fictional characters they recognise

as the scientists in the activity. Changing up the physical classroom setting or routine sporadically is another great way to do this.

Use strategies that promote affective engagement

Affective engagement to school can promote deeper learning and more commitment to learning processes⁵. To [motivate students](#) and strengthen affective engagement, teachers can use numerous strategies that encourage social interaction, cooperative learning and community building.

Teachers can focus on activities that promote social interaction^{6,7}. In a literature class, for example, a teacher can pair up students and ask them to share with each other a book that changed their life or how they perceive the world. Change up the classic 'show and tell' activity where one student gets in front of the entire class to show and talk about something that is important to them (such as a toy or a picture) by having students show and tell in groups of three, making it a more personal activity. These types of activities not only promote social interaction but also strengthen relationships between learners as they get to know each other personally.

Teachers should also focus on developing cooperative learning⁸ in the classroom. For instance, a language teacher can ask students to write a short essay in class and then pair up students to read each other's essay and provide feedback. A history teacher can divide students into groups and assign each group a particular reading, asking each student to become an expert in a particular section. Students can then come together to share the information that they are experts in, and discuss it with the other team members. Finally, a maths teacher can divide students into groups of two or three and assign different worksheets to each student. After students complete the worksheet they can come together and take turns explaining the exercises they solved to the rest of the group, and listening to a classmate explain his/her exercises.

Finally, a teacher can promote community building⁹ between learners, within the school, and with the larger community. For example, a teacher might design a thematic fair where students explain course concepts through popular movies like *Star Wars* or *The Avengers*, or create non-academic events like a version of a Quidditch championship based on the sport from *Harry Potter*. School-wide external community service activities are also a great way to build a strong learning community.

Promote student autonomy and choice

None of us likes having to do something when we have absolutely no choice. Being forced to do something does not promote positive emotions and is not conducive to learning. To promote a sense of [autonomy](#), allow your students to have regulated choices.

Give students options to choose from in class projects. For instance, give students a specific research paper to work on and let them choose the topic that most interests them from a pre-determined list. You can also give students a particular topic and let them choose the way they want to present it (one student might want to do a class presentation while another student might want to do a video). You can vary this strategy by letting students have a choice regarding topics, materials to use, types of project to develop, and books to read.

You can also construct the lesson or class with your students. You might start with a clear idea of class topics and objectives and work with your students to build an activity to explore class topics, or present your students with a class outline and work with them to build a collaborative PowerPoint to address everything that you planned in the outline.

Remember Goldilocks

The story of Goldilocks tells of a little girl who eats out of three different bowls of porridge. One bowl is too hot, the other is too cold and the third is 'just right'. As humans, we crave and are motivated by challenge. However, when we are overly challenged, we cannot function adequately. Keep this in mind in your class and challenge your students to a level that is 'just right'.

It is important to design activities that are challenging to students but not so challenging that the students are overwhelmed. You can do this by taking a complex task and dividing it into smaller, more manageable pieces. For example, a final research project might be divided into three sub-parts, each of which is worth a small percentage of the grade. Students can turn in each part separately, receive feedback and build towards a final product. Similarly, you can do this with in-class activities by dividing up a laboratory activity into separate activities that students do on different days. You can also use this strategy to adapt class activities or tests to avoid high-stakes testing, which can unnecessarily stress and overwhelm students.

Keeping emotions 'in mind' in the classroom

Beside the strategies mentioned above, following are some suggestions that can help leverage our current understanding of emotions and learning for better learning outcomes.

Create a positive class atmosphere

Students will have positive emotions about a class, and have more affective engagement to the class and activities, if they feel appreciated and feel like they matter. To help create a positive atmosphere, you can look at student grades periodically and follow up with those who are not doing as well as you would expect. Show students you are available, for example, by sending out weekly announcements indicating the topics that will be covered in class during the week. Similarly, it will be important for you to show authentic enthusiasm for the topic you are discussing in class (this enthusiasm is contagious) making sure you monitor things like your body language and tone of voice. Finally, make sure that you use adequate disciplinary measures (again, remember Goldilocks). This will help students feel your class is a safe space and not feel fearful or threatened by potentially excessive disciplinary measures.

Maintain positive student-teacher relationships

The positive emotions generated through strong student-teacher relationships and an environment where students feel appreciated and supported are conducive to better learning¹⁰. For example, a teacher can provide a variety of communication channels between her/himself and her/his students such as office hours, after-class sessions, email, anonymous comments box, and discussion boards. In this way, students perceive their teacher as more present, which leads to greater affective engagement to a class. Additionally, the teacher becomes more accessible to students and creates communication alternatives for those who might not be willing to speak up in class. A teacher can also meet with students at different times during the term to understand their personal and individual needs in order to work with each student to provide the necessary support for their learning process¹¹.

Co-create rules and avoid 'because I say so' rules

Rules are important and necessary in society, but neither doing something because it is mandatory, misunderstanding why something is mandatory, nor being excluded from the decision-making process around setting rules promote positive emotions. However, you can frame rule-following in a positive light by letting your students participate in the rule creation process. Work with your students to create class rules that promote a harmonious learning environment and that they feel they are able to follow. Make sure you also work with your students to define the rationale behind the rule.

Beware of the effect of negative emotions on learning

While positive emotions can have positive impact on learning and can be leveraged for improved learning outcomes, negative emotions can have the opposite effect. When the brain is exposed to negative emotions such as fear, sadness and stress, it reacts by releasing specific chemicals (neurotransmitters) that have the effect of blocking an individual's thoughts and behaviour (emotional blocking). A student who is stressed in his personal life cannot learn effectively and will have a harder time being engaged and paying attention in class. A student who is overly stressed about a quiz or exam might have difficulty focusing while studying or have her mind 'go blank' during the test. A student who feels he has difficulty speaking in public might not respond when called on during class, even if he knows the answer.

Exposing students to negative emotions during class can have detrimental effects on their learning. As teachers, having this knowledge about human learning is invaluable, as we can adapt our classes to students' emotional needs and improve teaching and learning processes. Negative emotions in students can be triggered in many different ways, from teacher attitude, body language, and tone of voice, to exposing a student to situations that make him feel anxious, such as speaking in front of classmates, taking a major final exam, or working on an assignment with an unreasonably short deadline. However, we know that what makes one student anxious or stressed is not what makes another student anxious or stressed¹², so a teacher must keep student individuality in mind when considering negative emotions in students.

Have fun

When a teacher has fun and is enthusiastic about the topic it is contagious (this is called social contagion). When students are under the influence of this positive contagion, they, too, have fun and are enthusiastic about the topic. Having their experiences pass through the filter of these positive emotions is conducive to deep and authentic learning. Don't be afraid to incorporate fun activities in your class – and don't be afraid to have fun and show it!

Advances in neuroscience have changed how we think about the brain, emotions, and learning: we now view emotions as crucial when it comes to shaping our experiences and learning. With this knowledge, affect-based teaching and learning strategies have received increasing attention from teachers who wish to improve their teaching with evidence-based practices. By using the strategies and techniques mentioned here, teachers can leverage the power of emotions to promote better teaching and learning.

Endnotes

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PREPARED FOR THE EDUCATION HUB BY

Cynthia Borja

Cynthia Borja is a professor, speaker, researcher and consultant in neuroscience, learning sciences, special education and psychology. She is the former Dean of the School of Psychology at Universidad de Las Americas, and the co-founder of **Connections: The Learning Sciences Platform**. She has been a graduate and undergraduate professor in different universities in Ecuador for 10 years, and is also part of the teaching team in the Neuroscience of Learning course at the Harvard University Extension School. Her academic training is in psychology and neuroscience, and she currently focuses on applying principles from these sciences to help potentiate education.

<https://www.udla.edu.ec/autoridades/cynthia-borja/>