

Neuroscience & training practices

Jean-François GADECEAU
INTERPOL
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Is it true that adults are less able than children to learn because their brain is less plastic? Yes, it is.

A lot of research on the brain is undertaken mainly for health purposes and for the aging population, sometimes for the education of children, and too rarely on how adults best learn. However, lessons can be drawn from findings on the brain. Why should we care? Because countries spend millions of euros every year in capacity building activities. So we shall ensure that the training community (project managers, instructors) uses resources the most efficiently.

Let's start by something research did not confirm.

It is widely accepted that instruction should be tailored to learners so called «learning styles». Learners might be divided into visual learners, verbal learners and doers (on the basis of a learning style tests) and then provided with instruction that emphasizes pictures, words or exercises.

A recent review by researchers (*document mentioned at the end of the text*) on this assertion proved there is no evidence that validates the efficiency of managing learner styles. A thoughtful review of the data provides no support for style-based instruction.

Educators should instead focus on developing the most effective and coherent ways to present particular bodies of content, and if there is no harm in using different learning styles, efficiency is not proved.

Now, how can neuroscience findings on brain confirm or adjust our training practices?

1 - Basics on brain

- Brain ability to learn depends on the number of neurons and connection density through synapses.
- The human brain is highly plastic. Neural connections can be reformed and new behaviors can be learned. Brain however is not unlimited: old neurons must disappear to allow new neurons and connections.
- The human brain is a social organ. Why? When babies we all needed to be socially connected to people taking care of us. It was necessary for survival. Our neurons were shaped by social interaction.

Hippocampus

Neurons are created in the hippocampus. Learning and memory happen thanks to new neurons and synapses and the room made by disappearing synapses.

The hippocampus is the room for memory consolidation.

Long term memory is reinforced like when building a wall with bricks: let the cement dry. Space learning over time, rather than mass learning all at once.

Focused vs diffuse modes.

We have two different modes of thinking: the **focused mode** and **diffuse mode**.

We are in either in one mode or the other. Both these modes are highly important for learning.

The focused mode is when we concentrate on solving an issue or to make a decision. We use familiar established synapses.

The diffuse mode is when we give ourselves time to manage things; If we are trying to solve something new, we use the broad perspective of the diffuse mode. We all access this mode naturally when we do things like go for a walk.

Diffuse-mode thinking is also essential for learning. It allows for the “big picture” perspective.

2 - Consequences of age on the brain.

Brain plasticity. Brain plasticity decreases when we specialize ourselves in our adult functions. What happens ?

Grey matter is the neurons - it can increase then decrease : research has shown that grey matter volume increases when learning new skills, and can fall back to baseline after 3 months without training.

White matter is synapses for connection: Research on piano players has shown it becomes harder to rewire circuits when getting older. For complex skills, adults have difficulties to **consolidate changes in the white matter. It is a limiting factor.**

Attention is steady. Studies suggest that sustained attention shows no decline at least till the age of 70 on the average.

DECREASE

Our capacity to learn - slowly reduces as our brain specialize. In fact, we need to build patterns which we use in our adult age, otherwise we would have to constantly re-learn.

More important: the **sensors diminish** with the age. Our audio and visual capabilities decrease.

As well as the information processing speed. And the long-term memory.

However, scientists have confirmed that we continue to develop beyond middle age in the following areas.

INCREASE

The broad knowledge nurtured by the experience of life increases. This includes our ability to learn new languages at all ages, and our ability to resolve issues quicker than young people.

Do adults learn equally effectively?

No, everyone is different. Differences rely in:

- The attention
- The motivation
- Pre-existing experience
- Pre-existing structure of brain tissue
- Neural plasticity which is a genetic thing.

There is gradual decline in human brain plasticity but teaching methods can mitigate limiting factors. Learning is possible all life-long.

3 - Factors stimulating the adult brain.

How to enhance brain plasticity and maximise learning ?

Social interaction by maintaining social networks. We value interaction with rushes of dopamine. The latest research findings invite us to also consider the collective dynamics of groups. Group interaction is so important in the learning curve.

Emotional regulation. Emotions have a big impact on the way we learn. Stress triggers adrenaline or cortisone which alter concentration, problem solving and human relations. To learn efficiently, we have to manage our emotions: for interacting with others, and be comfortable to learn.

Motivation. One of the strongest factor for motivation is to UNDERSTAND. One of the highest pleasures that the brain feels is probably when we solve a problem. Our brain reacts very well when we understand a new concept. We experience the adrenaline rush of insight if we make the connections ourselves.

Staying intellectually engaged i.e. Reading and mental activities. Neurons need a social life and stimulation to get connected. We are the ones that finally decide what neurons to kill or connect. Cognitive stimulation compensates cognitive decline.

Challenge assumptions

Researchers say that one way to create neurons is to challenge our tight assumptions. Stretching our synapses is what scientists say best keeps a brain in tune; get out of the comfort zone.

Physical exercise. exercises increase the flow of blood and oxygen in the brain and increase the hippocampus volume, hence we create new neurons and augment cognitive ability.

Maintain a healthy diet. water is needed for neurons.

Sleep allows to clean the brain. When we sleep toxin crap is deleted.

4 - Good practices in training.

Learning through collective problem solving

The brain makes patterns and desires to create new connections. When people solve a problem themselves, the brain releases a rush of positive neuro-transmitters.

Problem-based learning enables the participants to interact with each other, and work out their solutions.

Remove the threat to engage.

Activities shall reduce the participant threat to engage. Why ?

For thousands of years, Our brains wonder : how new people we meet threaten or support us ? It cannot be assumed that groups of diverse persons will trust each other. Trust must be earned.

When people make strong social connections, oxytocin is released in the brain in order to disarm threat response.

Learning is a complex exchange between cognition, emotions and physiology.

Chunks

Provide smaller chunks of information and facilitate the full attention of the participants will make easier to store in

and retrieve the information from long term memory.

Alternate focused and diffused modes of thinking.

Motivation

Research was conducted on learning tasks under conditions of monetary reward, punishment or with no reward. All groups learned equally well. But those in the reward group retained the learned skills better 30 days later.

The brain is not a passive device.

Online education : engaging strategies.

One thing only on games. Games touch the rewarding zones of the brain: dopamine activates pleasure, motivation and automaticity. Games use different parts of the memory which consolidate information.

The illusion of competence

Short term memory can be filled with material that allow the participants to have the correct answer. However, once the test is completed, the learning goes away if not in the long-term storage.

Test the participants frequently. Mistakes allow us to catch illusions of competence.

Evaluations must assess the long-term memory.

Automaticity through practice

The aim of practising a new skill is to achieve automaticity. Automaticity is “being able to do one task while performing another task simultaneously”.

It is not yet clear to what extent automaticity can be established for adult education. More research needed. However, practice is crucial if it is to achieve automaticity and not just competency.

Exaggerate perceptual features

Research for militaries demonstrated exaggerating the shapes of planes by the time of the learning is efficient for recognizing them in the field.

In languages, Exaggerating phonetic sounds for learning a language also works.

Schedule of practice (unpredictable time)

to build the new neural structures, practice at random intervals, is better than blocked practice. One possible reason for this is that participants have to work harder for a task performed randomly compared to one performed repeatedly.

Encourage participants to get enough sleep. Long-term memories are created during sleep.

5- Future research endeavors

Just a few projects among many.

- Transcranial stimulation . A weak electrical current on the head stimulates neurons. According to the latest findings, electrical stimulation during learning can increase the speed of calculation and memory recall.

- Medicine is another way. For instance drugs used as anti-epileptic has been found to enhance the learning in adults.
- In 2013, Obama launched the BRAIN Initiative. These research explores how the brain records, processes, and retrieves quantities of information.
- The US Defense works on the body's peripheral nerves. The program is called Targeted Neuroplasticity Training (TNT). They want to know how activation of our nerves can strengthen neurons connections in the brain. TNT could reduce the time needed to learn.

Conclusion

Remember a few key notions: diffuse and focused modes are useful, engage and challenge people, divide new content in small chunks, give time to cement the bricks, consider acquiring automaticity by repeating exercises at unpredictable time, and check the performance as long as it is finally stored in the LT memory.

I hope this sensitized you about how brain works so that we better understand how and why adjusting training practices.

A lot more from research is to come and should raise our attention.

3 documents of reference:

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