



## Neurodidactics: A New Approach in Learning Processes

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### Abstract

*Over the last thirty years, research on the human brain has provided teachers with new tools about the relation among how our brain works, the important role of our thoughts and emotions and the capability to be efficient. Thus, the main target of this article is getting a closer approach to the implementation of neurodidactics in class, outstanding the importance of a cognitive training in which new concepts will be built on the base of the old ones offering intellectual relevant activities to promote neuroplasticity and neurogenesis among my students. Since learning is a cognitive and motivational process, I have worked on implementing socioemotional learning with varied challenging activities in class to stimulate the functional diversity in our brains for cooperation and to develop prosocial attitudes and develop their growth mindset (Moser, J.S. et al 2011). Throughout this article, we will deal with the cognitive components in learning together with the interrelations among three constructs of motivation in my class, considering self-concept and goals in learning. I will focus on extrinsic and intrinsic motivation in class, the impact of prospective and retrospective emotions in learning and efficiency and the contextual variables in motivation applied in my groups at the Official Language School in Spain and how to maintain attention, wakefulness and alertness in memory processes and learning. Thereby, the present article is meant to critically evaluate the implementation of neurodidactics in class to work on students' motivation and goals in learning to fulfill their potential (Dweck, C. 2008).*

**Keywords:** Neuroscience, Neurodidactics, Motivation, Attention, Learning

### 1. Introduction

The remarkable recent scientific developments of neuroscience have provided us with new tools to understand how our brain works and have confirmed the constant growth of new neural connections and thought patterns throughout life, which means our brain is flexible and we are all involved in a constantly improving learning process. Guillén states that neuroeducation offers a new flexible, positive and optimistic approach as it is in line with varied active learning methodologies and because it enhances the development of competences for life [6]. As educators, we have the responsibility to provide students with relevant information and challenges to awake their curiosity and motivation and develop their learning experience by being active participants of their learning-teaching process. Indeed, it is experience that makes our brain change by creating new synapses and repetition and practice make changes permanent. Thus, neuroeducation offers a holistic approach from the fusion of neuroscience, psychology and pedagogy.

The human being is supplied not only with cognitive abilities but also emotional, social, moral, physical and spiritual capabilities which come from them all from our brain. Despite constituting 2% of our body mass, it requires 20% of our energetic needs. Moreover, the growth of the human brains and massive development in neocortex throughout history accounts for over 40% of the whole-brain energy consumption [8]. It holds approximately 86 billion neurons [7] which can establish about 10.000 connections or synapses each. This leads us to a new concept of learning as our brain is constantly creating new synapses according to the stimuli and changing environment.

Each hemisphere of our brain consists of four lobes with different functions. The occipital lobe is related to visual processes, the temporal lobe to auditory processes, and it contains the hippocampus and the Wernicke's area, which are basic for memory and language processes. Furthermore, neurochemical systems have different abilities to influence learning and memory [10] as dopamine will help us have a motivated student, serotonin will be present in a glad student whereas we could find low noradrenalin levels in a distracted student or acetylcholine in bored learners listening to a traditional master class [6]. Thus, neurotransmitters, such as adrenaline and noradrenalin, are essential to keep our students' attention once the information has arrived at the prefrontal lobes, where executive functions take place.



## 2. Executive functions and learning as a cognitive and motivational process

Executive functions have a main role in cognitive and behavioural processes and are crucial not only in our daily life, as they help us organize our time and tasks properly and be flexible to get our conduct adapted, but also for our students' educational paths as learners whose executive functions are better developed are often those who perform and succeed best in school and university [10]. The most relevant components of executive functions are the abilities to [15]:

- Set goals: motivation, self-awareness and the way human beings perceive the world.
- Plan strategies to get your goals: analyzing situations to evaluate the circumstances and plan how to lead an activity.
- Fulfil plans: ability to start, continue or stop sequences in a clear integrated way to achieve the objective.
- Control, readjust and be aware of the time, intensity and other qualitative aspects [6].

The three following elements of executive functions [1] are essential when planning for our students' appropriate academic and personal development, which constitutes a must for teachers:

- Inhibitory control helps to intentionally control behaviours and automatic responses, so that students keep their attention on what they are doing without getting distracted and know when to interact. For instance, in a role-play activity, a conversation or teamwork.
- Working memory is important for reasoning, decision-making, and behaviour.
- Cognitive flexibility is the capacity to change from one task to another, mental processes and objectives [5], which permits us to develop our critical thinking. For example, when proposing different uses for one object or when choosing among different ways to continue a story.

Integrating these processes with emotional and motivational ones will allow the most complex behaviours, as learning is both a cognitive and motivational process [2]. Consequently, students need both the ability to learn, as they need the cognitive elements such as knowledge, strategies, and skills required, and to be willing and motivated to do it [11].

Among the different theories there are three main interrelated constructs in academic motivation:

- Causal attributions patterns, in which achievement strivings are in part determined by causal attributions. For example, students high in motivation attribute success to the effort on the task [16].
- Self-concept, which in the academic context will be built not only by the student's self-perception but with the feedback received by their classmates, teacher and parents.
- Learning goals [3], which can be internal, if related to their curiosity or their will for challenges or learning, or external, if related to rewards, marks or parents' approval.

Thus, intrinsic motivation involves an internal desire to engage in an activity to develop oneself, to learn and it is related to a growth mindset [3], whereas extrinsic motivation involves doing something to get a reward or somebody's approval, so students with extrinsic motivation will evade academic challenges to avoid failure.

Emotions play a crucial role in students' motivation [14], and cognitive strategies such as acquisition, storage, and recovery of the students' information and, consequently, in learning and academic achievement [12]. Pekrun states that prospective emotions are directly linked to results, such as good marks or parents' and teachers' appreciation leading to a satisfying state, which will lead students to positive extrinsic motivation. Whereas, retrospective emotions such as joy for the results, sadness, shame, pride, disappointment or anger have evaluative functions to develop extrinsic motivation [4]. Additionally, there are relevant contextual elements in motivation to consider such as a respectful teacher, the positive relationships created among students and relevant contents, which are indispensable elements to guarantee significant learning and maintain their attention, wakefulness and alertness, in which the Ascending Reticular Activating System (ARAS) plays a main role as when a stimulus is positive for students, dopamine appears and encourages them to set in motion. Consequently, neurotransmitters such as adrenaline and noradrenaline are released holding their attention until they get their reward.

Hence, learning a language must be a rewarding experience in a positive learning environment. For this reason, systematic careful planning of learning situations is essential. At the Official Languages Schools in Spain, teachers deal with tremendously heterogeneous classes regarding interests and ages, which range from 16 to 70 approximately, so planning considering their competences, abilities, and limitations, the previous knowledge on which to build the new concepts and linking the contents to their interests and experiences helps to encourage them to continue learning a language. Furthermore, objectives must constitute a challenge to make them abandon their comfort and teachers, as guides, must help them analyze mistakes showing them their positive expectations about



their learning process to help students manage the stress that could arise during the process. Once positive associations with the language have been created, by means of dynamic activities including movement to activate their prefrontal brain area at the beginning of the class in which they mainly socially interact, teachers must plan to guarantee the students' success offering attractive activities in which students will be active participants, such as problem-solving and group activities to boost enriching cooperative work. Additionally, the positive emotional components in my class are the key to stimulate students' learning, as when they get positive feedback, dopamine acts as a reward. Along with this, waking up their curiosity will make them focus their attention, for example using new technologies to present some information, using a story or an anecdote or setting real examples. All this must be based on mutual respect, knowing each student's name, trying to also guide them individually and appreciating mistakes as something natural from which we all learn and in which we are all interested.

As a teacher, letting my students become autonomous learners too, make their own decisions and develop their skills has been a reward. Active participation makes them feel at ease in written and spoken English activities and contributes to information consolidation and reflexion upon the teaching-learning process as well as reducing school drop-out and increasing resilience and motivation among them.

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