INNOVATION IN LANGUAGE LEARNING International Conference

Memory Processes and Significant Learning

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Abstract

Neuroeducation has provided us with new approaches towards teaching-learning processes to leave traditional techniques behind and bet for a real change in education. Regarding to this, understanding how our brain works provides us with the tools for obtaining the desired effecs for a more effective teaching practice which will ensure more motivating experiences and permanent knowledge for our students. Throughout the present article, we will point out varied approaches and theories about memory processes and we will deepen into concepts such as short-term memory, long-term memory and working memory, as well as their importance in learning. Moreover, in the following articulated text, a synthesis of Ebbinghaus' contribution about how to maintain knowledge in time. To conclude, we will mention some of the main substantiative instructions to obtain our students' lifelong knowledge and how to implement the most efficient practice in class by means of basing our programming on our students' previous knowledge and awakening their curiosity and attention carefully planning motivating dynamics, which will be suggested in the following lines.

Keywords: *neuroeducation, neurodidactics, memory, learning, teaching.*

Introduction

The aim of every teacher is making an eternal mark on their students, as well as transmitting knowledge in the most relevant way for them. In the present article, we will consider the contributions of neuroscience in education and different authors' approaches in memory classifications, outstanding short-term memory, long-term memory and the importance of working memory in learning processes. Moreover, we will analyze knowledge consolidation or loss, outstanding Ebbinghaus's forgetting curve, and mention some noticeable strategies in permanent knowledge acquisition.

Types of memory in learning processes

Throughout the history of education, many have been educated with the strong belief that if there is no pain, there is no gain. To our delight, pain, repetition and passivity have been displaced by more innovative techniques to develop our students' capacities through reflection and action. .

Neurodidactics has highlighted the importance of meaningful learning based on learning by doing and awakening curiosity among our students. Moreover, learning is linked to emotion [13] and it must be connected to previous experiences or charged with emotional value to enhance memory and learning[5].

Many have been the researchers who have postulated about memory,such as Ebbinghaus or Lashley, Pavlov, Skinner Thorndike and Watson. [5]. William James distinguished between primary memory (immediate and transitory) and secondary memory (long-term or permanent) and later multistore theory emerged [7], according to which three types of memory are differentiated.

- Sensory memory (SM). The stimuli that we receive in our sensory organs have a short duration and we will only store those that capture our attention and are meaningful to us.
- Short-term memory (STM).
- Long-term memory (LTM).

Short-term memory, Long-term memoty and Working memory

Short term memory (STM)

Short-term memory (STM) is the prelude to long-term memory (LTM) as we can keep a limited quantity of information for a short time that will be discarded or sent to the LTM depending on its relevance. Thus, the STM has an essential role in the reading and listening comprehension, since remembering the beginning of the text will help us to understand the following information.

As our brain uses different areas for STM and LTMm, in cases where the areas involved in short-term memory are affected, long-term memory can remain intact. Milner's research classifies the phases of

memory into three [9]. The first one is the coding of information, for which the individual's concentration, attention and motivation are essentia. This will be followed by information storage and retrieval

Long-term memory.

Within long-term memory (LTM) we will distinguish between explicit or declarative memory and implicit or procedural memory. In long-term memory, conscious memories pass from the prefrontal cortex (STM) and the hippocampus will help transform them into long-term memory memories [5].

- **Explicit memory** helps us to incorporate objective knowledge in a conscious way. It is subclassified into semantic memory, which we can be verbalized and whose function is to store general facts and knowledge of the outside world and its meaning, and episodic memory, which treasures our personal experiences [17].Thus, semantic memory allows us to remember our home address or your child's first day of school.

- **Implicit memory** is the one in which learning happens unconsciously, for instance, when we write with a pencil, walk or wash our faces in the morning. In this type of memory, the hippocampus or the medial region of the temporal lobe does not intervene, but the striatum, the amygdala or the cerebellum [5].

Working Memory (WM)

Working memory is a type of STM in which the prefrontal cortex is activated to retain some information for a short period. It is developed during childhood and it is closely related to the student's academic performance,reflection and problem solving [5].
It is fundamental for the understanding linguistic information, emotion regulation, behavior and any other situation that requires rearrangement and mental manipulation of the information, for the establishment of cause-effect relationships [20]. Likewise, WM is essential in the development of reading and mathematical competence and variables related to academic success should be studied, being essential in these skills of great importance for children's development inside and outside their schools [20].

Ebbinghaus forgetting curve

Hermann Ebbinghaus carried out significant memory experiments in terms of retention and obviliscence according to the number of repetitions and the passage of time [4] and revealed that forgetting information can occur between short intervals and it increases within time, in more elevated proportions.at the beginning and slowlier as time draws on during the first week and, from there, even slowlier [4].

Ebbinghaus demonstrated that 75% of what had been learned had been forgotten after 48 hours and identified a number of factors [15] that could delay forgetting, such as:
The relationship with the previous content.
The format in which the information is presented (words, images, audio, etc.).
• The attention given.
• The level of rest.
• The study in intervals.
• The way in which stimuli are presented to us and how they are forgotten over time.

This theory, also supported by Bloom, defends the Decay Theory, which holds that the reason why we forget certain information is because it is not used and what we do not use disappears from our brain. To avoid this, we must guide learning towards meaningful repetition.
How?
Designing our teaching work to guide students towards reviewing and putting the information learned into practice. Thus, they will use the information learned in different ways, for example, through various dynamics in which they have to use what they have learned, group work exercises in which they build with the learned structures, individual work through diagrams, summaries, concept maps, etc.
How much and when?

With a first review after 24 hours and intermediate reviews between days seven and 15 from the first apprenticeship and a final review prior to the memory test or exam. According to the Ebbinghaus study, 50% of information is lost within twenty-four hours so we should use it again on the same day and the next day.

What helps me to study and fix knowledge properly?
Considering it all, we must develop certain techniques or strategies that, in general, we could synthesize as follows:
1.- Building on previous knowledge, so that new information is built on previous knowledge and logical connections are more easily made.

2- Choose the time of day to study. According to the Interference Theory of Jenkins and Dallenbach [8], the optimal moment to fix a knowledge would be before sleeping, since there are no more activities afterwards. However, the brain is sensitive to mood so it is also important to consider if we are "owls", with greater capacity for concentration in the late afternoon, or "larks", if we are more productive from the early hours of the morning after resting at night [16].

3.-Periodicity of the review. Establish an appropriate review routine, with a first review within the first 24 hours of learning and with intermediate reviews between the week and fifteen days, and another before the memory test or exam.

4.-Use of mnemonic rules to remember data sequences or sentence structures in a new language by relating information to images, words, symbols, etc. [12]

5.- The usefulness given to knowledge improves learning. It is essential to give it a practical use.Thus, for example, the use of role play simulating real and motivating situations will be an incentive to open them to this learning.

6.- Visualization and attitude [19].Emotions are an essential factor and having a positive attitude visualizing success will help us to open our minds to new concepts more easily

Conclusions

Research on the functioning of our brain has provided us with a greater understanding of memory and learning processes. The contributions of neuroeducation have multiple benefits for our students and teaching must be based on the formation of the mechanisms of our brain in the learning processes to activate our students' prefrontal cortex through surprise and store information in their LTM, as well as promoting their attention and motivation through active participation in a positive and conscious learning environment, based on which, we can obtain relevant experiences and lasting knowledge.

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