KNOWLEDGE OF THE BRAIN – REASONS FOR SCHOOL SUCCESS

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ABSTRACT
The aim of this article is to raise awareness of the impact that knowledge of the brain can have on the profitability of the teaching-learning process. As an opinion piece, the aim is to reflect on the reality of schools, which must be based on the paradigm of quality, both quantitative and qualitative; which inherently requires knowledge of the brain, the noble organ of learning at a structural and functional level. The foundations of this process can be found in knowledge from educational psychology, pedagogy and neuroscience. It is also essential for educators to devise strategies that are optimized and compatible with the teaching-learning process. It is recognized that there is a long way to go and a lot of good research needs to be carried out. We also understand the openness to other research paradigms.

Keywords: Brain. Teaching. Learning. School performance.

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INTRODUCTION

Currently, it is believed that no one questions that it is necessary to know the brain better if we want higher quality education. In this way, knowing how the brain, the noble organ of learning, is constituted, how to develop and make it profitable, are important premises, to be considered, if we really want a school with more quality. All of this is justified by the relevance of knowing how the brain works, as well as the satisfaction of sharing this information with teachers.

From Spitzer's (2007) perspective, a cook to work with higher quality should know how digestion is processed. That is, if he understood the process of digestion in the various stages from a structural (anatomical) and dynamic (physiological) point of view, he would have a better chance of success. Just like the beautician, if he knows what the skin is, which constitutes our natural frontier and by knowing it from an anatomical and functional point of view, this organ will certainly be better professional, which will allow him greater "*Know How*" in his intervention in a professional capacity. So, what happens to the professional who works to teach, if he has deep knowledge at the structural and functional level of the brain (as we know, he constituted the noble organ of learning), can't he be a more competent professional? These are questions of this nature that we will analyze, based on the knowledge coming from educational psychology, pedagogy and neurosciences. Relatively recent research (e.g. Jamaludin, Henrik, & Hale, 2019; Moreno, & Schulkin, 2020; Thomas, Ansari, & Knowland, 2019), corroborate this perspective. In this logical sequence and according to Torrens (2019), everything that educators have always had the ambition to know about the brain of their students, which helps a better knowledge of human nature and the teaching/learning phenomenon.

SO, AND WHY THE BRAIN?

Inside our braincase, a fantastic organ is housed, which weighs about 1,500 grams. It is made up of billions of small cells (neurons), which allow us to feel, hear, think, dream, speak... The human brain is considered the most complex organ in the body and most likely on earth. Several authors (e.g. Aires, 2022; Eagleman, 2017; Lashley, 2014; Kaku, 2014), believe that when the brain is better known, we will necessarily have a more fruitful brain.

Many researchers believe that the better we understand the human brain, the more capable we will be of devising strategies that are compatible with how we best teach and learn (e.g. Ansari, Coch, & Smedt, 2011; Blackmore, 2010; Erlauder, 2003; Fisher, 2009; Howard-Jones, 2018; Howard, Jones, Wasbrook, & Meadows, 2012; Thomas, Ansari, & Knowland, 2019; Toukhama-Espinosa, 2014; Wolfe, 2004).

We are still in very morning regions with regard to the knowledge of the constructs of perception, memory, emotions and associations with the school environment; But the potential of the area of neurosciences to improve the teaching/learning process and cognitive processes is recognized. It is also recognized that the road to be covered would be long, but a considerable journey had already been made.

OECD (2002; 2007), Goswami (2004; 2005), Stern (2005), Howard-Jones (2009; 2014; 2017; 2018), among others, have provided significant research, already in a remarkable number.

In Hennemann's (2015) criterion, neuroeducation offers us a more detailed approach to learning. Neurosciences tell us that our brain has enormous plasticity, undergoing profound and constant changes, if properly stimulated. It will be from these stimuli that the individual learns, and learning means modifying behavior, hence the information to be processed needs to be coherent for the students (Relvas, 2012).

Neuroeducation results from the confluence of three areas of knowledge: Neurosciences; Psychology and Pedagogy. This understanding stems from the connection between neurosciences and education, and also results from the way education is structured and instituted (School), as well as from the synergies with the areas of Psychology and Psychopedagogy and is part of the current scientific paradigm in force, scientific positivism, based on the evidence that stems from the empirical character that covers the logic of scientific knowledge and discovery.

In conclusion, neuroscientific knowledge, associated with education, should be part of the initial and continuous training of teachers, and can contribute decisively to the planning of more relevant teaching methodologies, which will certainly enhance the performance of teachers and student learning. History is on the side of the new discipline *Mind, Brain and Education (MBE*), a project that began at Harvard almost 30 years ago, but there is still much important work to be done to make neuroscientific discoveries accessible, understandable and relevant to educators (Ferrari, & McBride, 2011).

In childhood, an important period of our ontogenesis, many learnings take place, we also witness the extreme dependence of caregivers. Sensorimotor activity is also visible; coordination; general motor skills; walk; run; jump and also occurs, language learning; intense social interaction, namely between parents and children or other guardians. According to the WHO (2021), the 1st childhood that is between birth and 2 years of age; and the 2nd childhood, which extends significantly until the entry of puberty, is markedly specific with regard to autonomy, with the child spending a lot of time playing alone and with peers. It is also in this period that more complex language and reading skills begin.

In turn, intermediate childhood extends from kindergarten to pre-adolescence, around 10 – 11 years old. At this stage, significant academic learning takes place, as children become more connected to activities and fundamental skills in reading, writing and arithmetic. There is also self-regulation of behaviors.

Biologically, the child is determined by programs and trends, together *Nurture versus Nature,* are the influencing factors that mark the child and in which all possible combinations of different factors will converge (Arievitch, 2017). Corroborating these ideas, Galvan (2017) considers that some changes are driven by genes or physiology, others driven by the environment. We have, therefore, a period of biological interaction and the environment, that is: it is an epigenetic process.

The high brain plasticity in childhood ensures that the stimuli received can generate the formation of new synapses, creating a solid basis for the acquisition of more complex future skills. This is because knowledge about the impact of stimuli on early and second childhood is essential for the teacher to be able to think about pedagogical activities, in order to promote a wide range of alternative learning activities that are meaningful for children (Erlauder, 2005; L'Ecuyer, 2016).

> It is indeed essential to understand the relationships between children's functioning, brain development, environment, stimuli, memories and learning during childhood. Research conducted in the tradition of Vygotsky emphasizes the idea of the zone of proximal development (ZPD), focusing on children's interaction with adults and peers, in a broad sociocultural context and various educational environments (Arievitch, 2017).

Although it is notorious for the child how easily he learns various *skills*, for example, in language, it is known that he has a significant increase in vocabulary lexicon; in the acquisition of another language; in the performance of algebraic operations, and his concentration levels are not very stable. Here too, neurosciences inform us that there are more favorable moments in the teaching/learning of most cognitive processes, those time windows in which the occurrence of certain types of experiences has greater resonance. So, given this reality, teachers at this level of education should choose to dose the tasks, since the children's attention/concentration capacity is very reduced. It is therefore advisable that the tasks be diverse, motivating, playful and mediated with breaks to play, socialize, do sports, etc.

Only at 4-5 years of age, children begin to realize that what they think is different from what other people think, as proposed in the theory of mind (Meltzoff, 1999; Meltzoff, & Decetty, 2003).

Zabalza (2018, p. 10), considers that one of the most significant contributions from neurosciences lies in the elucidation of how the brain "configures itself, how it works, how the processes of reception, storage, conservation and retrieval of the information it receives are produced within it".

According to (Machado, 2004), the brain is developed in a process of interaction, in which genetic inheritance and the environment will determine this organ, in structural and functional terms, within cognitive and socio-emotional abilities. Children learn various skills at great speed because their brain is endowed with enormous neural plasticity, according to Gazzaniga, Irvy and Mangun (2010). The evolution of working memory, the effectiveness of abstract reasoning and the improvement of attention span are important aspects that stand out in the improvement of cognitive functions. This effective improvement is also associated with cognitive functions, changes in hypothetical-deductive thinking, exploratory attitude, power of concentration, critical capacity and constant search for challenges.

PARTICULARITIES OF THE ADOLESCENT BRAIN

Neuroplasticity in the adolescent brain means that neurons have the potential to modify their structure, through the process called dendritic arborization and axonal branching, that is: there is less efficiency of information through synapses. According to Eagleman (2017), the secret lies in the way cells are connected. This is essential for the development of young people. According to this researcher, the scheme of connections is not pre-programmed, genes are important, they give very generic information, but it is the experiences during ontogenesis that adjust the rest of the connections, in order to allow the brains of young people in critical stages of their formation to adapt as best as possible. The problem of adolescent brain development consists of the readjustment of brain connections, and in this case, the educational process is essential in its regulation. On the other hand, only by understanding the activity of the amygdala in the interaction with the prefrontal lobe, can we understand the impulsive behaviors of adolescents, who often misinterpret socio-emotional signals, thus participating in risky behaviors, acting impulsively without reflecting on the possible consequences of their behaviors.

Some researchers (e.g. Spear, 2020; Steinberg, 2004), consider that during adolescence and until about 24 years of age, there is not full coordination between thoughts and emotions, which implies that in adolescence, the best decisions are not always made: this is identifiable in risk behaviors, translated into accidents, involvement in fights, less investment in school, risky diets to lose weight. In adolescence, there is also the emergence of the most abstract form of thinking: formal thinking; sometimes further aggravating the resolution of certain situations. These facts can be explained by the profound physical changes induced by the hormonal process, by the maturation of the prefrontal cortex, as well as other cortical structures, which occur in the period of adolescence.

Researcher Esther Thelen, author of dynamical systems theory, considers that the adolescent brain is an open, dynamic and complex system, just like developing organisms, which are complex systems, with many individual elements embedded and open to a complex environment, which can imply changes in behaviors (Smith, & Thelen, 2003). Applied to brain development (complex system), this coherent theory suggests that the brain is composed of individual regions, which may work together in order to produce *outputs*. In addition, in these regions (complex system), they develop through a dynamic process with self-organization, in which changes occur after repeated experiences. In this sense, brain development occurs as an unfolding of normative development, informed by a genetic matrix, as in the case of puberty and resulting from the brain's response to the environment.

In summary, brain development can be favored if it finds conditions in the environment that provide active and meaningful experiences for the subject in his or her developmental path. For this to happen, it is crucial that educators are aware of the dynamics of brain functioning, which allows the teaching-learning process to have quality.

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