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Neurosciences and Education: An Integral and Interdisciplinary Learning

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Abstract

A bibliographic analysis was carried out, which aims to present the contributions of neurosciences to education and their relevance in the teaching-learning process. The method used was the inductive-deductive in which an analytical-descriptive methodology is applied with a non-experimental approach based on the contents of several specialized bibliographic sources. It was determined that the study of neurosciences can contribute to the integral development of the student, demonstrating on the one hand the importance of emotions as an enhancer of the teaching-learning process, as well as providing guides to detect learning problems in time to treat them by the hand of techniques and methods provided by pedagogy and teaching experience.

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1 Introduction

Within the contributions, which intends to leave the following research work, is to present the contributions of neuroscience in the teaching process. The objective was to assess the contributions of neurosciences to education and their relevance in the teaching-learning process. The issue of neurosciences linked to education has its defenders and detractors, due to the fact that they are sciences with different essences, one based on exact sciences and another in human or social sciences. Among them there is a common point of interest, learning, while neurosciences seek to understand their brain bases, for education. Learning is a point of arrival that must be permanently improved, based on common languages and exchange of questions and data "(Gruart, 2014), (Barrios-Tao, 2016).

Barrios-Tao (2016), also says that the contributions between the two sciences must be reciprocal and understand neuroscience by itself, could not generate new teaching models and education has the possibility of strengthening its strategies thanks to some results of neuroscientific research. Even neurosciences are expanding, much more in Latin American education that is booming in different postgraduate institutions, but few in the daily practice of teaching.

Thanks to new technologies, it has been possible to discover or reaffirm theories presented by other sciences in previous times, they have also made possible new techniques of neural exploration, for studies in people who do not necessarily have any pathology, but in order to understand different cognitive processes, behavioral, emotional, communicative, etc. (Terigi, 2016). In Ecuador, a research carried out by Segovia (2016) states that in the country there are few studies on neurosciences and their relationship with most schools that are formed under a traditional system and also adds, that this system is pyramidal and paternalistic, based on the memorization of the greatest amount contained and moves away from the construction of a flexible curriculum. Here it is important to point out the different realities according to the school, cultural and economic context that is evident in several locations in the region.

It is relevant to mention that in the province of Manabí, there is no research on neurosciences applied to education in the practical field, so this article takes value in explaining certain approaches and positions on the relationship of these two sciences and how they can complement the benefit of the student training process.

2 Materials and Methods

To carry out the investigation, the inductive-deductive method was applied, the analytical-descriptive methodology was used, with a non-experimental approach based on the contents of several specialized bibliographic sources where the adores can be mentioned (Hernández, Fernández , & Baptista, 2010).

3 Results and Discussions

To introduce the topic of neurosciences, you must know all the concepts related to the topics and studies involved, including its influence on education.

3.1 Neuroscience approach to education

Education is a dynamic science, in which many factors intervene for its evolution, that dynamism is present in the brain, the predominant organ when talking about learning. Approximately since 1990 the studies of neuronal activities and the observation of the brain bases against certain actions took off, which allowed to open the perspective on the behavior of the brain before learning situations and the way in which this can change, for that Neurosciences are increasingly present in different areas (Pérez-Esteban *et al.*, 2016).

In recent years the term neuroeducation is in vogue, this approach between the sciences of the brain and that of capacity building seeks to explain through neuroimaging techniques how the brain interacts with its environment in each teaching-learning process, as it explains Béjar (2014), neuroeducation seeks to create bridges to harmonize the results of basic neuroscience with education and thus improve the teaching processes of teachers and consequently optimize the performance of their students.

Benarós, Lipina, Segretin, Hermida, & Colombo (2010) propose several bridges that allow neurosciences to be brought closer to education, emphasizing not looking for certain aspects of the first to replace the second but that the studies and aims of both allow a better teaching process in the classroom, one of those proposals are the "Bridges

based on human resources training". Educators should consider that between neuroscience and education are interaction links in different fields of knowledge, where they allow to know other difficulties in the teaching-learning process of students.

In this "Bridge" a teacher training in different areas of neurosciences is proposed that allows the educator to have information on levels of analysis and generate questions that help evaluate different conceptual positions that have practical implications and that also researchers in the area of Neurosciences have training in theories, methodologies and other aspects of educational practice due to the discrepancies that exist between classroom laboratory contexts (Benarós *et al.*, 2010). In relation to the metaphor used previously (Bruer, 2016; Alcívar et al., 2020; Ansari & Coch, 2006; Carew & Magsamen, 2010; Louw et al., 2011), he explains, that two bridges must be built for one that unites the educational practice with cognitive psychology and the latter with brain science. Figure 1 shows the construction of this interdisciplinary bridge. Teachers would use the results of research given by cognitive psychology in favor, in which memory, perception, learning, everything that happens inside the brain is studied, then those results when linking them to neurosciences and creating a complementary cycle to improve methodology and practices in education.

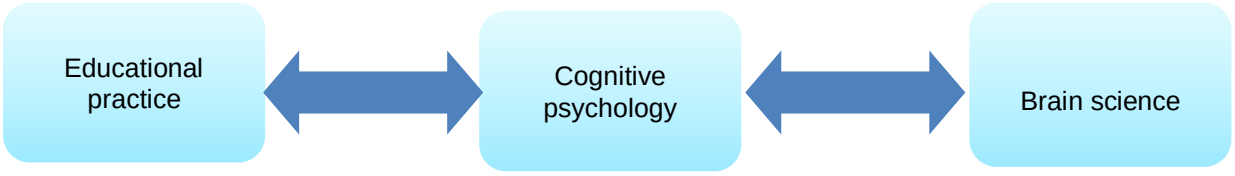

Figure 1. *Bridges between neurosciences and education*
Source: Own elaboration taken from Bruer (2016)

3.2 Contribution of the neurosciences to the integral development

For a true development it is significant that this alliance of sciences is seen in an equitable way and not to fall in prophesying the neurosciences since although their contributions are very important and necessary to enhance certain aspects of education, Teachers have the responsibility of taking these results and using them according to their experience and pedagogical knowledge, taking into account psychological, social, emotional, behavioral aspects, etc. A holistic study for the benefit of learning will build a comprehensive and solid education (Ocampo, 2019).

3.2.1. Improvements in cognitive and emotional processes

Neuroscientific results are already put into practice, in experimental field research such as Cantó (2015) he presents it in his article where, he shares applied actions based on the discoveries of neurosciences to the teaching-learning processes of children from 3 to 5 years old and exposes that so far there are a series of strategies that, in the opinion of teachers, do work and improve the environment in the classroom. These strategies were based on: Connecting emotionally for later, redirecting cognitively, Alphabetizing behaviors and emotions; besides appealing to the upper brain and moving to activate the brain.

According to the authors (Requena, Álvarez & Salto 2016), they share the emphasis on emotions when teaching, indicating that to learn it is necessary to feel what is happening (what is happening around), it is for this reason that teachers transfer experiences of incomplete learning when their teaching learning methodologies do not contain resources that activate the emotional and cognitive processes of the brain with equal importance. From another perspective (Valerio, Jaramillo, Caraza, & Rodríguez, 2016), they demonstrated that the motivation, attention and academic performance of the students improved when the teaching practices used were based on neurosciences. From small differentiating actions in the classroom such as changing seats or bringing a striking object to the class, to more complex ones including implementing open-ended questions of reasoning, and changes in the way of working innovating, if possible with new technologies for An example is the influence of ICTs on the teaching process (Meneses, Moya & Rodríguez, 2020), in addition to other project-based forms (López, Vegas & Rodríguez, 2020; Manca et al., 2017; Mendoza et al., 2019; Sebastian et al., 2011).

3.2.2. Early diagnosis of learning problems

Before neuroscientific research through neuroimaging, learning problems in reading or mathematics could only be described by the behaviors presented to the naked eye, but today thanks to scientific studies it can be demonstrated as in the case of dyslexia, a decrease in activity in the left hemisphere - Responsible for oral and written language-, but it is also indicated what it is necessary to know how to interpret neuroscientific analyzes and to make the diagnosis more effective the behavior is also studied of the child or adult (López, 2007)

In this case (Carreiras, 2012), he adds that cognitive neuroscience or thought neuroscience can contribute significantly in the capacity for early detection of learning disorders, taking into account genetics and socio-economy, in addition the use of new technologies to improve the proc that of learning, like the latest findings, has allowed us to observe how the brain works and how it changes when acquiring new knowledge such as reading. Thanks to several of these discoveries, you can identify which areas of the brain are used and in what percentage, and the difference with children who might have a problem such as dyslexia or dyscalculia.

Thus, this discipline would provide education with aspects and results that would favor when designing a curriculum, but for this there must be a coordination between those in charge of government education and teachers who are the ones who live in the field every day in the field or young boys.

Another relevant contribution is presented by Bravo (2018), who with 60 years of experience referring to neurosciences, expresses that, among his main contributions to education, there are investigations of the development of children's cognitive and verbal processes, language, memory, thought, phonological awareness, visual perception, multiple intelligences and executive brain processes, which has allowed us to better discover the biological basis of school learning and the causes of some learning disorders. Different authors were reviewed and analyzes related to neurosciences and education are shown in Figure 2. The most significant are observed.

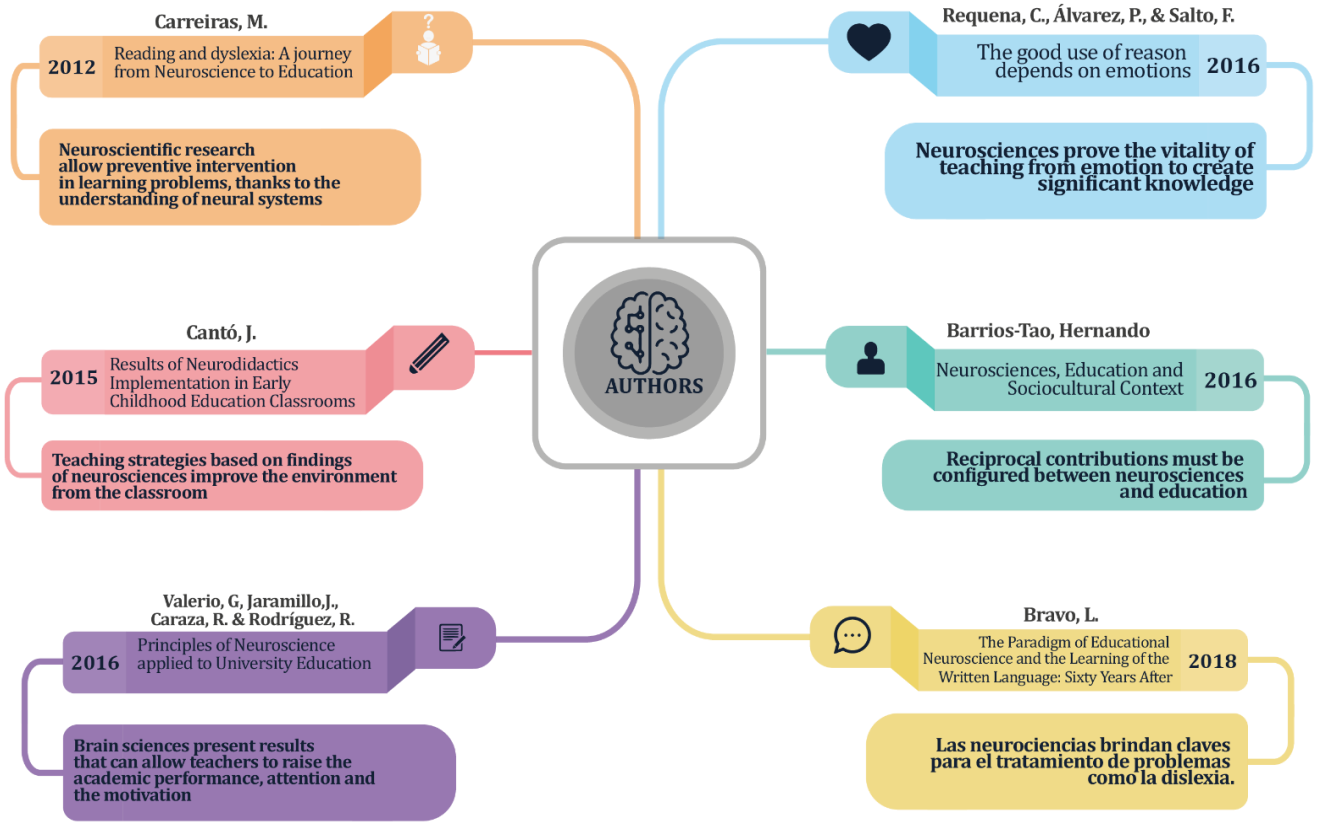

Figure 2. *Author criteria*
Source. Own elaboration taking from (Barrios-Tao, 2016) and (Carreiras, 2012)

In Figure 2. the main authors mentioned in this research show the positive value that neurosciences have in the educational field, they can help improve the environment within the classroom, motivation and academic performance, applying the correct pedagogical strategies and materials indicated to enhance learning.
The relevant impact of emotions in the teaching-learning process opens new horizons to transmit knowledge, at a level complementary to the cognitive process, traditionally seen as paramount.

4 Conclusion

1) Education and neurosciences are complementary, educational processes would be enhanced by the tools offered by neuroscientific studies and the new technologies applied in them.
2) Among the most important contributions of neurosciences to education is the technological advances of neuroimaging to identify and diagnose learning problems in time; and next to the pedagogical knowledge to be able to look for new methodologies that enhance skills, motivation, attention and academic performance.
3) The reinvention of the way in which it is taught and learned is necessary, the local reality still leaves to be desired but the way in which new professionals will approach a class in the future will be the key to revolutionizing education, leaving behind certain processes or improving them, in a much more effective and enriching way.

Conflict of interest statement
The authors declared that they have no competing interest.

Statement of authorship
The authors have a responsibility for the conception and design of the study. The authors have approved the final article.

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