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Contribution of Neuroeducation in the Degree in Physiotherapy of the American University of Puebla, Mexico

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A B S T R A C T

At present, education in the municipality of Teziutlan in the state of Puebla (Mexico) is characterized by developing a learning process for the correct improvement of students in different areas, however, school performance and the failure rate have launched the search for new innovative strategies for the optimal functioning of students studying the different degrees de la of the career of Physiotherapy. The fundamental fact of school permanence is the result of the implementation of multiple scientific investigations, with the purpose of rethinking and strengthening the teaching methodology. However, the American University of Puebla, Teziutlan campus, in Mexico, has 210 students enrolled in the different semesters. The field of health care for people with disabilities or injuries that cause loss of normal function of the human body have increased. Consequently, physiotherapy school enrollment increases, and the probability of school dropout increases, in this sense, education has advantages for research aimed at improving teaching processes. In the municipality of Teziutlan, Puebla, Mexico, the demand for the academic offers of educational institutions in the field of health sciences is growing. Neuroscience in education is fundamental for the knowledge of a new educational strategy that is based on the neurophysiological understanding of the brain, to understand in detail how synaptic mechanisms influence, brain behavior, for example, in empathy, and use them as a tool in improving learning. This article aims to provide a new learning strategy within the educational area in the Degree in Physical Therapy at the American University of Puebla. Likewise, it is important to clarify knowing the neurophysiological mechanisms as well as the way in which they intervene in educational processes.

Keywords: Neuroscience in learning, brain behavior, mirror neurons, neuroeducation.

1. Introduction

At the present time, science has contributed to the different sectors of education, mastering the specific reactions of the cerebral cortex to take advantage of them in the integration of knowledge. Scientific research on the subject of neuroeducation has been a watershed to generate controversy and to know what has been effective in student populations. All this allows us to transform neuroscience as a positive criterion to improve learning processes. The structure of the article is supported by a documentary review which mentions elements from education combined with the mechanisms and functioning of cortical areas, to the issue of mirror neurons. Due to the aforementioned, it seeks to give a clearer picture of how neuroeducation intervenes as an important role in meaningful learning (Altamar et al., 2022).

In the first part, it will be contextualized on how neuroscience has a fundamental role in learning, taking as evidence the strategies based on neuroeducation for educational strengthening. As a second point, the specific functioning of the different cortical areas is described, from neurophysiological mechanisms to their intervention in the integration of knowledge. In the same way, behaviors at the brain level are pointed out and how they intervene in a fundamental way in understanding. Thirdly, it analyzes how mirror neurons are activated in different daily situations inside and outside the classroom to be used fruitfully to generate empathy and school performance. As a last point, a conclusion is developed where it is determined if neuroeducation is a favorable discipline to be used as a learning tool in the classroom in the students of the Physiotherapy Degree of the American University of Puebla, Campus Teziutlan.

Although the University does not have access to scientific databases such as Scopus or the Web of Science, an open review of the literature will seek to answer the following research question: What is the contribution of neuroeducation in the school performance of the students of the Degree in Physical Therapy of the American University of Puebla, Teziutlan?

2. Literature Review

Current education has many possibilities to train generations of young people with productive learning in the future, multiple tools have been proposed such as notes, underlining, oral presentations to improve the learning process. However, we have encountered difficulties that are not handled with proper intervention (Cuzme& Montes, 2021). The teacher sometimes does not achieve the expected objectives within his class session, this causes innovative strategies to try to correct this deficiency and, therefore, by not achieving the desired results, ends up using the methodology in a general way for all students. This raises several unknowns, so it is essential to be clear that all integration of knowledge is based on the main receiving organ, which is called the brain. The application of a correct stimulus will cause the activation of specific areas of the cerebral cortex to achieve meaningful learning. So, a teacher, knowing the field of neuroscience aimed at education can help to understand in the most viable way the correct integration of knowledge (Revelo-Sánchez et al., 2018).

Mirror neurons are a type of neurons that are activated when an individual performs an action, however, they also intervene when observing a similar action performed by another person. One of the most important elements of this event was when Giacomo Rizzolatti investigated in primates' visual properties in the motor system which implanted electrodes in his brain and observed the manifestation in the F5 area of the premotor cortex (Rizzolatti&Craighero, 2004; Rizzolatti et al., 1996), consequently one of the researchers of his group, the neurologist Vittorio Gallese, noticed that certain motor neurons associated with prehensile movements caused neuronal activity (Gallese& Goldman, 1998). The striking thing about this event was that the primate remained motionless, in this sense this neural mechanism was activated only with observation (Murata et al. 1997).

According to Bautista and Navarro (2011) thanks to neuroscience, with the discovery of the mirror neuron system, the learning of motor skills and abilities can be enhanced, but mainly, those neurons that involve human movements. He also points out that learning not only depends on observation but on imitation. In a study with professional dancers who looked at the movement patterns of each gender, both male and female, they found that the activation of the mirror neuron system was greater when the subjects observed the movements.

In 2022, William has concluded that learning is a theory where optimal brain development can help be effective in achieving complete learning. In the same way, it uses the term "jungle brain" which raises how a classroom can be characterized by maintaining a scenario as real to social life and not as a traditional classroom with desks, tables, blackboard and, above all, without windows. In fact, a contribution according to the Council for Curriculum, Exams and Evaluation (CCEA) (Suprayogi et al., 2021) indicates that learning is commonly the direct responsibility of the professor in front of the group, however, even using the most innovative strategies that can be implemented to achieve assertiveness in the objectives set, knowledge is built by the student himself.

In a study conducted by Sánchez (2022) indicates that a series of surveys, interviews and different learning techniques were used in a population of 350 university-level students. The purpose was to monitor the behavior of both hemispheres, which he called central brain, left hemisphere and right hemisphere. The results obtained was that the hemisphere that has more predominance is the right, with 52% of cerebral predominance and academic performance while the central brain with 35% and the left with 13%. According to Rodríguez (2018) he affirms that the dominant laterality of each individual has an unpredictable role in school performance. Similarly, it ratifies that poor school performance is related to not having a dominant side, which is characteristic mainly in children (Repila, 2014).

Koning (2019) has concluded that to activate mirror neurons within teaching, no positive effect was found in applying certain educational strategies using visible hands, since this author does not provide activation of the regions involved and, therefore, does not produce any feasible cognitive process. As well as the results of Schroeder and Traxler (2017) indicate that unpleasant agents that can alter the appreciation of the instructor's hands can also distract from students' own learning. However, the study conducted by Rahnert (2021) which designed a technique based on basic accounting exercises that consisted mainly of the use of both hands directly applied in their learning methodology, its results were positive. He achieved a learning measurement with consolidated experience and this is how the students manifested it when carrying out the proposed exercises.

In Mexico, the work of Morandín-Ahuerma (2022; 2022a; 2022b; 2022c) should be highlighted, who states that learning is, in reality, plasticity of the neural network by external stimuli and education is the systemic structure that points to a network imbricated through the adequate control of those stimuli. The so-called neuroeducation, therefore, is for the author an attempt to put at the service of pedagogy and andragogy the advances of the brain sciences.

3. Methodology and Results

Through a test on the Google Forms platform called "how we learn" a series of questions were asked with the aim of achieving a general concentration of data. The application of this tool was applied mainly to be answered in second semester students of the degree in Physical Therapy of the American University of Puebla on July 28, 2022. The questions were designed from an educational approach combined with

neuroscience. The first question is related to knowing the impact that a good transmission of knowledge can have within the classroom, considering who participates more, if the teacher or the student. The second question was directly focused based on the classroom environment; this question was based on how a classroom influences the different from the traditional. The third question dealt with the impact of good humor on learning within the classroom during the explanation of any topic. The fourth question is how they would most effectively understand a physiotherapy technique, placing the teacher as an intermediary. In the fifth question, empathy was properly used, using the concept of emotion as an answer to choose. While the formulation of the seventh question was completely directed to neuroeducation, using the plastic arts. The eighth question within our test was aimed at the comprehensive care of a patient, which was analyzed and raised with the aim of being able to choose between a traditional approach and a didactic approach. Finally, the final question was aimed at the optimal understanding of a patient, using empathy, values such as qualities of respect, professionalism, and communicative capacity in between.

The participation of the students during the test was used to have a more individualized margin of thought. As such, we sought the opinion of how they learn inside and outside the classroom; This data collection instrument was not implemented to enter debate or discussion with the other teaching methodologies. Therefore, this test was performed on 9 students of the second semester of Bachelor of Physiotherapy. The corresponding questions remained online throughout the day, this to facilitate their answer. These records were automatically recorded in percentages, which allows us to consult in detail each of the questions and their answer obtained.

Finally, a general analysis was carried out to determine which was the best answer in each of the questions. Therefore, the results were as follows:

- The first question related to the transmission of knowledge within a classroom, is obtained or66.7% of students participate during the course of class, 22.2% students only perform exercises without the participation of the teacher or student and 11.1% the teacher only speaks in class.

- The second question aimed at how they learn best within a classroom, had 55.6% a classroom where it is designed with colors, murals or real things, 44.4% a classroom with chairs, tables and paint and 0% a classroom where the light is turned off and watching videos on television.

- The third question asked in the good mood within the classroom to be more productive in understanding physiotherapy issues was achieved 100% yes and 0% no.

- The fourth question related to how they would learn better a manual technique of physiotherapy was obtained 88.9% the teacher explains and at the same time the student replicates the technique, 11.1% the student explores alone and the teacher guides the technique and 0% the teacher occupies his hands to teach the technique.

- The fifth question supported by mirror neurons within the classroom to know if learning a concept of anatomy, 44.4% exciting and attractive, 33.3% with analysis and writing exercises, finally, 22.2% reading a book.

- The sixth question focused directly on neuroeducation is about how they would learn the anatomy and structure of a bone in a better way, which was determined, 55.6% making a model with plasticine, 33.3% presenting with slides by the teacher, and 11.1% reading a chapter of anatomy.

- The seventh question, penultimate of our test of "how we learn" is based on the use of knowledge application combined with empathy, the results were 100% using a combination of respect and knowledge, 0% using only theory to treat it and 0% using respect and values.

- The last question aimed at understanding a complicated injury within physiotherapy, the results were 88.9% being empathetic and listening, 11.1% being unfriendly and applying knowledge, while 0% without taking any data from the patient and acting with their own criteria.

Table 1. Test "How we learn"
1. Within a classroom, how do you think the transmission of knowledge is better?
2. How do you learn best in the classroom?
3. Do you think that a good mood in the classroom is more productive for understanding physiotherapy issues?
4. When you are taught a physiotherapy technique, how to learn better?

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5. If we were to study a concept of anatomy right now, how would you like to learn?

6. If you had to learn the anatomy of a bone, how would you learn best?

7. How would you relate to a patient in an interpersonal process?

8. How do you think you can better understand a patient's injury?

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4. Discussion

Neuroscience has demonstrated the impact it can have directly in multiple contexts to get new ways to answer complex questions. Science intervenes in social, cultural, and personal contexts. However, in the educational part, the information with proven support has been scarce at least in Latin America, it is proven by the little scientific evidence found in platforms or open access digital libraries, all this information has been reusable to dominate certain areas within the university sector, however, in physiotherapy applied in education it has been insufficient.

The extensive evolution of advanced technology brings us closer to develop new research projects with more accessibility. The contributions of previous research related to neuroscience applied in education have proven effective. This type of scientific contribution is positive in different areas of study for the correct intervention of applied neuroscience in university education. However, it does not benefit for the correct participation of neuroeducation strategies in the field of physiotherapy. The theory of mind is an innovative topic for the proper functioning of life in general, favors the deeper understanding of brain activity within the educational field (Prosperini& Filippo, 2019).

Let's reconsider directly in the educational levels of which most are controlled for the correct functionality in the work processes. The updated scientific documentation (Araya & Espinoza, 2020) approves that, if there is a correct performance in a consolidated learning, it will be more used for practical purposes. It is important to consider the new educational strategies implemented in the different bachelor's, engineering or postgraduate degrees, this mainly in order to increase their level of academic performance, their high degree of retention within the institution and their impact on the labor part. When the brain is used for practical purposes, different results can be achieved than traditional, this has been shown in the studies that this research contributed for theoretical support. Humans do not know the very functioning of our brain, this leads to not using it properly, occupying the information transmitted involuntarily in the cerebral cortex, for meaningless tasks. By implementing neuroeducation strategies from a transdisciplinary vision during the learning process at the higher educational level, it seeks to raise the academic performance of students to be used as significant skills in life. The educators of each of these sectors occupy and intervene with learning techniques that achieve general results, as well as replicate educational practices carried out by their professors in their academic training process. It should be considered, on the other hand, that situation-based learning strategies that facilitate collaborative problem solving, such as the incorporation of play in non-playful spaces and development of socio-emotional skills, reincorporates all this, without noticing the intervention of neuroscience aimed at education. It should be noted that this educational intervention does not generate interest on the part of the classroom instructor to take him to a research process, that is, to control student populations for measurement and verification. Obviously, by not carrying out this methodological process, the idea of considering it a totally scientific argument is rejected, but the principles of neuroeducation still apply.

The classroom has an indispensable role within the student's learning, it is proven that a scenario wrapped in cold colors, meaningless and totally dark, does not guarantee a correct integration of knowledge. Students in the process of learning by unconsciously capturing this information through the sense of vision the brain modifies their sensory perception to a change of apathy causing poor school, cultural, social and work productivity. A clear environment, free from darkness, with windows or the closest thing to an environment of everyday life generates productive knowledge. People's brains are unconsciously absorbing information without having control over it, if the teacher does not contextualize or understand this situation, he will probably educate nonsense.

A fundamental point in education in general is empathy, which can be transmitted correctly during the learning process. In the information collected in this research, it confirms that the first step to achieve functional learning is to awaken curiosity and attention, this thanks to emotion, then intervene with complex cognitive skills. By not doing this with complex problems, students may have a mandatory pass to meet the course, but no guarantee of being productive in real life. On the other hand, mirror neurons, as mentioned above, by knowing their functioning, allows to identify a different way of transmitting information to facilitate learning. These neurons used correctly will be able to become an educational tool in the modern age, mainly to arouse the interest and curiosity of students.

Neuroeducation strategies have a positive contribution to achieve a more complete education, this because it is not only involved in learning within a classroom, but is also surrounded by elements of the social, personal and even cultural sphere. This transdisciplinary discipline allows us to visualize different educational models with the aim of properly occupying the main recipient organ, the brain (Abas et al., 2019). The purpose is to achieve productive elements for the learning process, which allows us a more appropriate educational strategy, and then transform it as an innovative tool from neuroscience. When students are provided with an optimal learning environment, graduation rates increase, learning difficulties and discipline problems decrease; love of learning also blossoms, administrators focus on real problems, and learning organizations

thrive (Jensen, 2008). In short, creating an organization around how the brain naturally learns best may be the simplest and most critical educational reform ever initiated. In fact, of all the reforms, none provide a better return on your investment of time, energy, and money, than developing a brain-based approach to learning (Jensen, 2008).

5. Conclusion

Today it is considered that education grows progressively due to science and new man-made discoveries in the field of neuroscience. The most up-to-date research data has left its mark on scientific journals, which has a firmer and more stable margin of how to correctly address the education of students at all levels.

Human training is the process through which brain configurations are established, thus forming affective, cognitive, and instrumental communications systems that allow human beings to create and/or modify neural communication networks and circuits in order to facilitate autonomous, authentic and neuroconfigurative learning (Ortiz, 2015). This information allows us to understand the importance of the effectiveness of science aimed at education.

Teachers intervene in a methodological way for the correct learning of students, institutions, in most cases, do not implement this job opportunity. The scarce research in Mexico related to neuroscience applied to education has provoked interest in the search for new alternatives for educational improvement. However, international scientific studies related to learning go on to achieve effective results for more integral and scientific management.

The need to intervene by applying peer-reviewed academic articles on student outcomes provides an overview of utmost importance for the effectiveness of educational processes within the classroom. Likewise, the intervention of application of tests in groups of students is substantial to check in detail the results related to the retention of knowledge, problem solving and decision making.

The research carried out in the present study has been objective primarily for the search for new educational strategies and is scientific evidence of the real importance of neuroeducation applied in the classroom. The results obtained in the applied survey were tangible to conclude its effectiveness in this field of education and physiotherapy. The goal is also to continue looking for new results, in different latitudes.

The research carried out does not end here, however, it is of great value to use the present study to continue with a new line of methodology based on neuroeducation, with the aim of carrying a certain group of student population and the correct fulfillment of measurement, analysis, and interpretation of future results.

Acknowledgments

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