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UPDATE

Ethics, neuroethics and teaching practices

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Abstract

This article aims to elucidate the contributions of neuroethics and neurosciences to the field of education. The bibliographic study was carried out based on research and analyzes of literature. Concurrently, we observed that Neuroscience research has been raising a series of precautions and questions that call for ethical debate and demand a critical look in order to avoid inadequate and distorted conducts as well conducts that could create obstacles to human beings. Through this study, we recognize that neuroethics is born within this scenario in order to steer the debate in the direction of adjusting the knowledge acquired from Neuroscience so that it can effectively contribute with the pedagogical processes and improve students performance during their learning. This article aims to direct discussions, fomenting the already existing debates on the subject addressed. Therefore, it considers that ethical zeal in crucial in research involving the brain, avoiding any damage to the physical and moral integrity of the human being.
Keywords: Neurosciences. Ethics. Education.

Resumo

Ética, neuroética e práticas de ensino

Este artigo visa elucidar as contribuições da neuroética e das neurociências para a área da educação. Trata-se de estudo de cunho bibliográfico realizado a partir de levantamento e análise da literatura. Observou-se que pesquisas em neurociências vêm suscitando uma série de cuidados e interrogações que clamam por debate ético e olhar crítico para que sejam evitadas condutas inadequadas, distorcidas e com entraves ao ser humano. Com este estudo, reconhece-se que a neuroética nasce neste cenário para balizar o debate com o objetivo de ajustar os conhecimentos advindos da neurociência, para que possam contribuir com os processos pedagógicos e melhorar o desempenho dos estudantes. Este artigo visa direcionar discussões, fomentando os debates já existentes. Portanto, considera-se crucial o zelo ético em pesquisas que envolvem o cérebro, evitando qualquer prejuízo à integridade física e moral do ser humano.
Palavras-chave: Neurociências. Ética. Educação.

Resumen

Ética, neuroética y prácticas de enseñanza

El presente artículo tiene como objetivo elucidar las contribuciones de la neuroética y de las neurociencias al ámbito de la educación. El estudio es de cuño bibliográfico y fue realizado a partir de compilacion y análisis de la literatura. Concomitantemente, se observó que las investigaciones en neurociencias vienen suscitando una serie de cuidados e interrogantes que reclaman el debate ético y demandan una mirada crítica para que no haya conductas inadecuadas, distorsionadas y con inconvenientes para el ser humano. Por medio de este estudio, reconocemos que la neuroética nace dentro de este escenario para situar el debate en orden a ajustar los conocimientos provenientes de la neurociencia para que puedan efectivamente contribuir a los procesos pedagógicos y mejorar el desempeño de los estudiantes en sus aprendizajes. Este artículo procura orientar las discusiones, fomentando los debates ya existentes sobre el tema abordado. Por lo tanto, considera crucial la vigilancia ética en investigaciones que involucran el cerebro, evitando cualquier perjuicio a la integridad física y moral del ser humano.
Palabras clave: Neurociencias. Ética. Educación.

Declaram não haver conflito de interesse.

Starting the dialogue

This article elaborates an earlier study, conducted in 2015 [1], which sought to evaluate the influence of cognitive neuroscience in teaching practices. The research [1] analyzed the current challenges faced by the teaching-learning process and the need to invest in new strategies designed to train teachers, especially those who work in Early Childhood Education and in the initial years of Elementary Education.

Over the last decades, great scientific and technological development took place, more specifically the advances in cognitive sciences, neuroscience and neurotechnologies, which contributed immensely with the deeper exploration of the human brain. Similarly, to other advances, this exploration has also created a lot of controversy, in addition to raising few ethical questions about mind-related studies. In order to discuss neuroethics, this article will not distinguish between mind and brain, although it is recognized that, from a methodological point of view, the brain is the physical, anatomical, material organ; and the mind, its functional internal dimension. In order to understand them it is necessary to conceive them as indivisible, corroborating Damásio's opinion [2], which states that it makes no sense to separate them, since they exist as a unit.

Similarly, Cruz and Nahra [3] state that neuroscientific and neuroethical studies emerge as new fields of research and, as such, are subject to criticism and, consequently, to moral and ethical precepts. Because they involve research focused on human beings, these areas of study are given a high degree of complexity, observing moral and ethical behavior related to the moral dilemma faced by researchers, technical personnel, and patients. In this respect, it is important to note, as Damasio [2] puts it, that "moral conscience" is a complex function that really requires awareness, but it goes far beyond and belongs to the sphere of moral responsibility.

Given the relative novelty of this article, including its content, it is necessary not only to problematize neuroethics, but also to divulge and socialize concepts and knowledge that have not been discussed much in Brazil yet. Ethical issues arising from social context and scientific research in neuroscience require more familiarity with this field of study, since daily practices generate contents of different nature that must be addressed and no longer ignored.

As educators and learners, we must prioritize this discussion, which has been growing progressively while requiring extensive interdisciplinarity and awareness towards the need to create a common space of dialog among the public power, families and the educational sphere so that diverse contexts and experiences can be fully integrated. It is fundamental to know, clarify and explore universal concepts in order to reach the interdisciplinary dimension and to establish the interface between the "neuro" and the educational scenarios.

This article, written in 2018, results from an extensive qualitative research and is based on the reading and analysis of theoretical references on the subject, including relevant bibliography. The discussion complies with ethical precepts related to studies of the same nature, based on the principles of beneficence and non-maleficence.

Neuroethics, a new concept

The effervescence of knowledge resulting from relatively recent studies has led to the emergence of a new discipline or field called neuroethics, which discusses the consequences and inferences of neuroscience and associated research in the ethical, legal, educational, and social fields. According to Kandel, Schwartz and Jessell, today's neuroscience is cognitive, *a mix of neurophysiology; anatomy; developmental biology; cellular and molecular biology; and cognitive psychology* [4].

This paper intends to prove that the range of neuroscientific knowledge is broad, accessible and can be definitely used by educators. In addition, it discusses the relationship between the work of educators and neuroscientific knowledge, addressing the importance of the learning environment and providing specific information on the knowledge required by different areas of education.

Neuroscience has been way more familiar to European, Asian and North American countries as compared to Brazil, where it is still incipient. Likewise, neuroethics is a very recent discipline as compared to other sciences, emerging from the interaction between neuroscience and bioethics happening towards the end of the 20th century.

Neuroethics studies date back to the 1990s. In 1995, the bioethics committee of the *United Nations Educational, Scientific and Cultural Organization* (unesco) developed studies that applied ethics to neuroscience. However, the scientific literature has been using the term "neuroethics" since 1989, becoming more widespread with the conference "*Neuroethics: mapping the field*" [5], held in 2002.

According to Figueroa, during this event neuroethics was defined as t*he study of ethical, legal and social issues that arise when scientific discoveries about the brain are addressed by the medical practice, legal interpretations, and health and social policies* [6].

Scholars, physicians, scientists, and other professional categories who share their interest in neuroscience created the *Neuroethics Society* in 2006 to study policies related to the advances in this area, as well as their social, ethical and legal repercussions. In 2007, the journal *Science* published an editorial suggesting that neuroethics studies should receive substantial funding and support, matching the funding provided to other institutions engaged in neuroscientific research. According to the editorial, this would be the only way to control ethically and morally the discoveries and advances of this branch of science [7].

Now, the need to delve even further into neuroethics has become more urgent than ever. For Marino Júnior [8], neuroethics is a new specialty that analyzes the ethical implications of studies and interventions on the brain, based on imaging obtained from a fully functioning brain. In this sense, decisions made on research involving neuroimaging need to be discussed in order to preserve human dignity.

Decisions related to moral behavior, based on their narrow or broad definition, involve conscious deliberation and are made over long periods of time. In addition, they are processed in an off-line mental space that prevails over external perception. The subject at the center of conscious deliberations, the self in charge of analyzing the future, is often distracted from the external perception and fails to heed unpredictability. And there is a very good reason for this distraction, caused by the physiology of the brain: the space allocated for processing imagery, as we have seen, is the sum of the initial sensory cortices; this same space needs to be shared with processes of conscious reflection and direct perception, which usually does not happen unless one of these tasks takes precedence over the other [9].

According to Cortina [10], neuroethics focus on ethical, legal, and social issues that arise from the roots of neuroscientific findings. The author states that these discoveries occur in the fields of genetics, brain imaging and diagnosis, including prediction of diseases. *Neuroethics must analyze how doctors, judges, lawyers, insurers, and those in charge of designing public policies deal with these discoveries* [11].

Neuroethics can be understood based on two approaches: as a study area and, more specifically, as an academic discipline. For Almada [12], it is prudent to separate neuroethics as a general expression from its specific expressions; in other words, "ethics of neuroscience" and "ethical neuroscience". According to the author, the neuroethical field of action involves two specific propositions: *(i) ethical issues and considerations that may emerge during the planning and execution of neuroscientific studies, and (ii) the evaluation of the ethical and social impact caused by the results, taking into consideration social, ethical and legal structures. The first group may be grossly called "practice ethics", and the second as "ethical implications of neuroscience*" [13].

Almada also establishes limitations to what he considers the object of the neuroscience of ethics, which can be *applied to the field of knowledge that uses the results of neuroscientific research to philosophically equate human behavior issues, such as those concerning our decision-making process and the formation of our social judgment* [14]. The neuroscience of ethics, for him, is quite specific because it refers to the *field of knowledge that deals with the impact and influence that neuroscience and neuroimaging technologies have on human life* [15].

According to Figueroa, this *means distinguishing within neuroethics two different branches: applied neuroethics, which would properly belong to medical bioethics; and fundamental neuroethics, which would propose the neurochemical and cerebral bases of ethics itself* [6]. Given the limited scope that is intended to be given to this article, only neuroethics as a comprehensive and general expression will be discussed.

For Pallarés Domínguez [16], it is important to note the existence of two interdisciplinary routes in this area. The first is scientific and experimental, showing the development of genetic, molecular and cellular structures. The second reveals purely experimental scientific *knowledge*, allowing us to delve into essential human cognition issues.

The same author [16] considers these questions troubling and stresses, for example, that human beings who experience social stress before starting a task or activity end up using imitation or repetition unconsciously more often. Once, imitation played an important social cohesion role, since the production of mimicry requires "energy expenditure" that induces the brain to better manage its resources [16]. Pallarés Domínguez also states that *it is quite possible that imitative behavior is an evidence of functional normality of social skills that function correctly*.

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Imitation is a social sign that indicates the presence of a crucial social capacity, that of recognition [17].

The search for social recognition and competition regularly present in our society has been worrying many bioethicists for possible reversal of ethical principles arising from this process. For example, what would be the ethical parameter to limit or develop drugs that improve memory or concentration? Is it ethical to define who should use them? Is it legitimate to fragment or forget what is unwanted? Is it legitimate to accelerate the learning process or performance by using them? In this case, neuroethics can make a significant contribution to establishing criteria and scientific norms, in addition to analyzing and assessing the need and coherence in each case.

In this context, neuroethics can be called "educational neuroethics". In addition to considering the ethical issues of this study and the pedagogical application of neuroscientific knowledge, neuroethics also covers the evaluation of the ethical and social impact of neuroscientific practices in this new area of activity, based on the existing ethical structures of society.

However, the interdisciplinary debate on the study of neuroscience is considered essential because through this path it can be observed that the neural dimension enables the in-depth investigation of the physiological basis of the brain. But it fails to substantiate social and moral processes. It is because this critical need that ethics was called upon to expand on the moral discussion about this foundation. This is because one needs the other, but only ethics can analyze certain situations.

But how can neuroethics deepen ethical knowledge? One of the most important contributions is the creation of meaning. The values dealt with by ethics, such as responsibility, trust, dignity, and the reason for being are undoubtedly constructions of our brains, but as our lives progress, we gain control over them. Neuroscience must delve deeper into the meaning to these notions, seeking a physiological substrate that complements the reasoning that ethics has attributed to them [18].

After explaining the possible neuroethical conceptions and their subdivisions, it is necessary to define the main focus of this approach. Although there are perspectives for *ethical neuroscience* or *neuroscience of ethics*, and that the tendency is to consider them to be more oriented towards the field of health sciences, law, philosophy, and psychology, there is also an opportunity to deal with ethical implications related to education. It is known that not much has been done in terms of academic research so far, but the need to explore the ethical implications on education is widely recognized, reason why this study came to be.

Ethical implications of neuroscientific knowledge

When analyzing the scholarly literature on neuroethics, it is possible to verify the nonexistence of a specific pedagogical proposal or theory for teaching. However, the literature available can contribute significantly to broaden and disseminate research and discoveries among the different areas of knowledge, establishing the dialogue on learning limitations and solutions based on pedagogical strategies that observe the cognitive processes of the brain.

The challenge imposed upon the field of education is not limited to evaluating or judging knowledge, but to the ability to know how to teach or evaluate what has been taught, acknowledging that each individual learns differently – after all, *brains are absolutely individual. Each brain is unique* [19]. Neuroethics integrates with other sciences by expanding and building new knowledge. The more the biological aspects related to individual learning skills, abilities and limitations are understood, it becomes clearer that not only the school, but also the family and the social context in which a person is embedded are responsible for the task of teaching. To elaborate educational actions based on the ethical knowledge of neuroscience is to have instruments capable of taking into account the course of learning in order to reach the potentialities of each individual.

Learning has not always been understood as a process that occurs in the brain. The structure of the organ, as well as its functions and properties were only identified at the end of the 20th century. At the same time, these findings were not confined to major research centers; instead, they fostered interests and discussions among professionals representing social, human and exact sciences. They have broadened the debate on how learning occurs.

Subsequently, the field of education became interested in analyzing brain functioning. Observing the language, memory, performance, motivation and limitations of students while performing their activities implies analyzing empirical evidence. For example, why do some children like to draw and others to paint? What makes some like math

and others biology? Why do some learn easily and others do not? These issues are part of the routine of education professionals, but many remain unanswered while others continue to expand.

Neuroscience is the area of knowledge that enables the approximation to the knowledge of how neural circuits are constructed and which participate in the elaboration of memory, emotions, feelings, decision-making, and even the judgment and thought involved in ethical conduct [20].

Educators need to establish a dialogue with neuroscientists, since it is necessary to become familiar with daily issues and those related to the educational process of each individual, making it possible to evaluate both the neural functioning and the pedagogical practices experienced in the most diverse spaces. In this case, the analysis of the pedagogical proposals conducted by institutions can help the field of education to establish interdisciplinary communication.

Neuroscience can inform education, but it cannot explain it or provide prescriptions and recipes that guarantee results. Psychological theories based on brain mechanisms involved in the learning process can inspire educational goals and strategies. The work of educators can be more meaningful and efficient if they get to understand cerebral functioning, which enables them to develop more adequate pedagogical strategies [21].

The research and application of their results in education must always be led by ethics, which, however, should not be considered opportune only when guiding teaching interventions. It must also be used to monitor the administration of medication that changes the normal functioning of the human mind, or enhances learning capacity, as demonstrated by the use of psychoactive substances responsible for neurocognitive enhancement. Ethics is also welcome when questioning the indication of drugs to students by health professionals without an in-depth diagnosis and adequate criteria.

The different areas of interest and study encompassed by neuroscience lead to several questions about the use, purpose, results and methods employed:

In which situations do patients have the right to know or not what their brain images reveal about themselves and their future? Who could know about this? Would it be right to allow the government and marketing professionals to benefit from this knowledge by gaining access to preferences, interests, personality, skills, and thereby manipulate the population for their own interests? What would be the privacy boundaries of the human mind? [22].

The ethical inquiry in this field is not restricted to the results presented by neuroscience or by its past or present conclusions, but it also encompasses what is yet to come, its possibilities. Ethics is not just the science of past behavior. It is more appropriate to understand ethics as a science of the future which has not yet been witnessed, but it may represent a threat that could lead to negative consequences.

Neuroethics must also be interpreted as a cutting-edge science and inquire about possible future effects, preventing the misuse or abuse of knowledge. Paiva and Paiva report that improper use *has serious implications, ranging from stigmatization, social discrimination, coverage of health plans, social and labor inclusion, among others* [22].

Neuroscientific studies have been broadening discussions on the ethics involved in attempting to "manipulate" the human mind. Even if the effort to change the cognition of individuals attempts to enhance human capacities for their own good, it must be followed by discussions that include the medical field and social sciences. This is indispensable because "interventions", although positive, will affect individuals and society as a whole.

Thus, it is only fair that neuroscientific studies and experiments are guided by moral and ethical principles, so that they are actually conducted in a responsible and less error-prone manner. Only then it will be possible to demystify ideas and fallacious theories, and adopt scientific ethics when observing, recording, systematizing and applying new knowledge, especially in the educational field.

Contemporary research is more objective and already promulgates fresh knowledge, grounding much of what was known in the area of education that can now be applied with greater awareness. The hypothesis that human actions and the individual's own development are driven by the nervous system include emotions and the possibility of adaptation to social situations and contexts.

It is important to note that, in this article, the term "education" refers to the teaching-learning process and the interaction of different academic participants, including human relations and range of other aspects that is quite complex. This reflects the very credible and ethical intention to discuss and introduce better quality education. Therefore, the

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formation of teachers must include neuroscientific knowledge, so that they can effectively reach the classroom and truly improve their teaching practices.

Some of the possibilities based on neuroscientific knowledge were chosen to establish considerations and to exemplify why neuroethics is urgently needed. It is necessary to ensure that there is no ethical transgression or exaggeration when transposing this knowledge to the field of education, given the euphoria resulting from this knowledge and the existence of "neuromyths " (myths created based on the possibilities of neuroscience as a pedagogical tool), which distort the application possibilities of neuroethics in educational practice. The insertion of this knowledge into education requires patience and prudence [23]. Scientists are careful when they signal the importance of the dialogue between neuroscience and education:

It is necessary to establish a mediating language between the two areas, which clarifies scientific findings and their real possibility of use in education. This requires responsibility and ethical commitment of the means of scientific dissemination and critical judgment of the target public so that this knowledge is applied properly towards the academic routine. It is important to understand the difference between knowing the brain mechanisms and the resulting mental processes, in addition to how they can be applied towards the pedagogical practice. The rigorous and scientific investigation of neuroscietific findings applied to the classroom is essential before any other educational application is established [24].

Those who get to know the workings of the mind are able to control it and gain advantages over other people, inducing them to adopt, unknowingly, a certain type of consumerist behavior aimed at benefiting the commercial interests of others. It is not a matter of mastery over the mind in the strict sense, but using results obtained from scientific research for shady purposes: *We know, in fact, that neuroimaging technologies are currently far from being able to control the mind. But we also know that they are advancing to offer resources able to influence the feelings and behaviors of other people. Hence, why does research on how technologies can be used, both for consensually beneficial purposes and for partially or wholly questionable purposes, need to be conducted ever so carefully?* [25]

Neuroimaging technology is a prime example of how it is possible to identify the modus operandi of the brain and use it to manipulate the different states of the brain. It is clear that this knowledge enables noble interventions: treating people with epilepsy, improving their learning, helping them to better adapt to a particular environment, etc. However, it is well known that the history of mankind exposes facts that prove that *Homo homini lupus* – "a man is a wolf to another man" – an expression used by Hobbes [26] to state that human beings tend to be evil or to act against others. Evers is emphatic when talking about the perverse face of the use of scientific knowledge:

Due to its strong explanatory power, neuroscience, as a theoretical basis for ethical reasoning, could be considered as controversial as genetics, or perhaps even more so. Science can be ideologically diverted – it was so in many situations – in much more dangerous ways rather than more powerful [27].

Almada [12] cites oxytocin and how it may be dubious or directly linked to good or bad intentions of those who administer it, prescribe it, or know its effects to engage in indecent practices. *Based on knowledge that can generate socially acceptable and desirable uses, it is also possible to extend it to an unacceptable use, such as neuroendocrine manipulation as a strategy used to steer relationships in the business world* [28].

This ambivalence can also be found, for example, in medical indications for attention-deficit/hyperactivity disorder (ADHD), as in the case of ritalin [12]. It can be harmful if prescribed indiscriminately or unnecessarily. This medication is used primarily by inattentive children with low-concentration or, in some cases, to inhibit interaction and hyperactivity. However, medication is often used with misdiagnoses, disguising social problems that involve external relationships and require more attention to understand the facts.

Inaccuracy or lack of care related to diagnosis (such as in cases where a restless and healthy child is treated as a child suffering from ADHD), associated with the "mindset" of a world that advocates obedience, standardization, discipline, and productivity are factors that have contributed significantly to a serious public health issue, personified in a generation accustomed to taking the so-called obedience or productivity pill. These drugs, as we know from wide dissemination in scientific journals and newspapers, have been explicitly marketed for the improvement of our emotional and social behaviors [29].

It becomes fundamental to clarify facts and separate them from untruths, avoiding the trap for easy and miraculous solutions. Facing these distortions is the role of ethics in defense of honest, fair action and integrity. It is necessary to understand these issues from a panoramic point of view by considering social behaviors resulting from the use of digital technologies and from living in societies in which the senses are intense and often stimulated. These circumstances result in behaviors that make life "hasty", using the same expression as Bauman [30], characterized, above all, by rapid learning and immediate forgetting: *Forgetting is as important as learning, if not more* [31].

In addition to the aspects mentioned, the fight against "neuromyths" exposes several distortions and fallacies regarding neuroscience in education, as well as its discoveries on the functioning of the mind and the learning process. The appropriation of this knowledge and its use as "recipes" or dogmas resulting from "scientific" evidence may prejudice or discredit the actual intent and possibilities of neuroscience.

Final considerations

Ethics must guide human conduct, for we see it as a possibility of being. In the field of neuroethics, it will be increasingly used to distinguish what is acceptable and desirable from what is to be rejected for being harmful or compromising the physical and moral integrity of human beings. As Berlanga points out, *the reason seems obvious as there is great scientific production and vertiginous progress from a technical perspective, with studies and publications that are not always well projected or prepared, often demonstrating the lack of an underlying ethical reflection* [32].

The human being (brain and mind) is not an object to be manipulated at will, since there are conditions and rights that must be respected to represent the value of the individual. The use of neuroscientific knowledge must remain under a watchful and critical eye to separate its benefits from situations that promote illicit businesses or practices, which aim to turn man into an object of profit and consumption.

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Participation of the Authors
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