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The neurobiology of curiosity as a lesson for teachers

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Abstract

The central idea of the present text is to show that in the formation of the students of tomorrow's world, a fundamental role belongs to the idea of curiosity. Scientific knowledge has recently become, thanks to technological development and the increasingly computerized era, a way of life in which the skills to understand and handle the applications and software increasingly present in everyday life have become inherent requirements of a life quality. Therefore, there is a need for education based on scientific knowledge to be much more present in the school curriculum of the students who will form tomorrow's society. Perhaps one of the most effective means by which students benefit from a science education is the systematic stimulation of native curiosity. We show some ethological and neurological foundations of curiosity that we consider sufficient for a reformulation of standard pedagogy.

Keywords: Curiosity; neurobiology; ethology; education; imitation; neophilia; exploration

Introduction

The most appropriate context to discuss curiosity, if we consider the education of children, is that of understanding curiosity as a fundamental trait of being human. A kind of natural or imposed instinct that pushes anyone to learn new things, a force that characterizes every human being, even if in varying degrees. From the point of view of education, this tax would constitute the best justification for the public education system. One could hardly imagine a more natural justification for compulsory education: school meets the natural desire of students to learn new things. Therefore, the school responds to a natural need that characterizes the human species. Whether or not the school actually takes this perspective is debatable and not the subject of this study. Here we try to draw attention to the prospect of correlating institutional education and natural child development as it emerges from the latest research in biology, psychology and ethology. At issue is the question of who needs the school more, the society, the community or the student, the child. Does the school meet the primary needs of the child or society? These considerations of the philosophy and sociology of education are not the subject of our study either, but at the introductory level at least, conclusions or general inquiries of the above type are necessary for a correct education of the next generations. In the current educational landscape, a new character has appeared, the student as a biological being. Of course, this character is not absolutely new, in fact, he

has always been present in the history of pedagogy and in the conceptions of education throughout time. But at the same time he lacked or failed to impose himself. Each time a different type of student was in the foreground, usually the one that best corresponded to the educational ideal contained in the educational paradigm that invented it. In one way or another a perfect student, a student who became a special case of a perfect student, was conquering the whole scene. The Greeks called this ideal paideia. From the ancient Greeks, through the Middle Ages and into late modernity, the natural, biological student was secondary. Only with J. J. Rousseau the biology student gets the spotlight, but not for long, as he is quickly rejected and sent to the back of the class. However, naturalistic pedagogy gained an important presence in contemporary pedagogy, especially under the pressure of research in psychology that forced pedagogy to consider themes such as personality, attention, motivation or imagination, all analyzed from the perspective of effective learning. Today, the student is the subject of pedagogical and biological analysis, especially from the perspective of age psychology, which proposes a harmonization between teaching tools, analytical programs and lesson contents with the intellectual and physical capacities of children. Within these concerns, a more pronounced intervention is still needed. We believe that in the family of research that is relevant for education, it is necessary that, in addition to psychology, ethology should also appear.

Curiosity, imitation and education – an ethological perspective

The evolutionary development of the human being culminates for many of us in the ability to learn and its reverse, education. Thus the preoccupation to learn, to form the new progeny, knew a fundamental social approach and became education, that is, a founding story about man himself, as if we were born to learn. Indeed, human cultural and social development, technical progress and social innovation have been very closely intertwined with education. Through education, man rewrote the entire evolutionary past from the perspective of a present that placed homo sapiens sapiens at the top of the pyramid of life. Education, like a mirror, from Plato until today, is mainly responsible for the vanity with which we call ourselves sapiens, i.e. beings superior to nature. This complacent image began to lose ground dramatically in the face of scientific discoveries brought to the fore by ethology and comparative psychology. In reality, ethologists such as Morris (2015) show us, the roots of educability are found in a process of raising and caring for young in mammals, and this process is the expression of a balance between two rival forces, self-preservation and exploration. The closest form of education to self-preservation is imitation. The child directly takes on behaviors of the surrounding adults who provide him with the security and affectivity necessary for natural development. In addition, many of the behaviors exhibited in adulthood were acquired as imitative absorption during childhood. It was only in the 20th century that ideas such as the absorbing mind of the child came to the attention of educators, and it continues today that the understanding and acceptance of this idea is transformed into current pedagogical practice. M. Montessori stated that we discovered that education is not something done by the teacher, but that it is a natural process that develops spontaneously in the human being (Montessori, 2017, p.12). The spontaneity in question here refers primarily to imitation as an unmediated transfer process made by the young child from the self-confident adult in handling the surrounding reality.

The child's final behavior is not the result of a process of internalization and awareness of moral or coexistence values considered good or desirable in themselves so that these values form a panacea from which all members of the community can be nourished. This panacea is in reality a philosophical dream of humanity's morality, a dream we have moved closer to or moved away from historically speaking, but in the end it will remain a dream. At least until the next humanity. The behavior of the young child is the fruit of imitation, and some developmental processes begin with imprinting, as a standard lesson that will turn into copies or repetitions all subsequent events similar to those that generated that template lesson, the pattern. In D. Morris's terms: it is the unaltered obedience to these imprints (along with our carefully hidden instinctual starts) that makes it so difficult for societies to change their habits and "beliefs" (Morris, 2015, p. 119). That is precisely why education is such a difficult bet to win. Our chances of winning the bet, however, increase once we ethologically reinterpret the human being in the school: the student. The instinctive force with which humanity clings to its own imprints and forms of imitation is formidable, never stifled. The only hope is only the diminution of this inner voice that holds humanity prisoner in a few fundamental experiences and that is heard again and again when something new does not fit perfectly into the pattern. The fear of the new, neophobia, is not by chance primordial in the inner consciousness of humanity because she was the one who ensured his survival. We are born to survive, not to learn. The biological purpose of life is to remain personal in life as much as possible, and if this is impossible, then let's find an impersonal form of survival: reproduction. In this way, the inadequacy between education and the child's natural development becomes even more significant. Fortunately, the story of humanity does not stop at imitation, even if it is the seal that will follow us on whatever planet we go. In addition to the great imitation, we also have a little curiosity.

The science of human behavior focused on the biological dimensions of all life, ethology, convincingly shows us that in addition to imitation leading to behavioral patterns exportable to all individuals of the species, there is an unequal opposing force that balances the final behavior of mankind enough to transform the primate from the genus homo into the dominant life form for the entire planet. It's about curiosity. Once an individual's security has been assured to a reassuring degree, then the impulse to seek something new sets in, something that does not fit into the repetitive patterns that thus become boring. Curiosity is manifested on the one hand strictly individually, as an instinct present in every human being, but on the other hand, curiosity is transferred to the species level, as a general specific behavior. There are curious people, just as there are curious communities. The proportions may differ depending on the balance line of the individual or the group he belongs to. A man's life is the expression of a balance between the behavioral patterns of childhood and the tendency towards something new or something else that emerges from these patterns. This relationship can shift throughout a lifetime and have high or low points, which psychologists will call crises. Likewise, a community can find a balance between internal stability and periods of exploration. Many times this need for exploration has turned into wars in history. Exploration and related aggression spawned empires and social innovation on a scale throughout history. Intelligence itself, so proudly placed by homo sapiens as a jewel on the crown of masters of nature and life, is the expression of humanity's need for exploration. Surpassing security generated intelligence, war and aggression entailed

advantages gained by exploring the environment. Human intelligence is a product of war (Storm, 2015). If today we prefer to define ourselves as the most intelligent being on the planet, then we will have to accept that we owe this position to aggression and that we will also be forced to accept the title of being the most cruel on the planet. In order to bring out the uncomfortable realities about our deep nature, including when we talk about our most human behaviors or capacities, authors like F. de Waal spend a lot of work of persuasion and adopt styles of expression that can surprise unsuspecting audiences, for example in works which apparently question our human intelligence in appreciating animal intelligence (de Waal, 2019). In de Waal it is not necessarily human intelligence that is questioned, but rather our intelligence and especially our sincerity in accepting truths about us as a species that do not coincide with our desires about ourselves. For the world we live in to be a peaceful place open to values that value life above all else, we must accept that we are the most formidable social product of war and cruelty.

At the social level, the relationship between imitation and exploration can be seen as a struggle between conservative forms that tend to give absolute value to those behaviors that respect past traditions or forms of life and the tendencies to replace these ancestral behaviors. Religion based on ancestral rituals is a good example. The very widespread tendency of associating national identity with the oldest possible forms and traditions is also another eloquent example. Value comes from preserving traditional culture. Divinity is present in the religious act to the extent that it respects an initial mode of manifestation. Initiates are the keepers of the pattern that must remain unchanged. Social novelty must therefore overcome well-rooted instincts. Rigidity in maintaining patterns can endanger the viability of a community just as the unproblematic openness of a community to novelty can impair its continuity. Fortunate is the society that enjoys the gradual acquisition of a perfect balance between imitation and curiosity, between slavish, mindless copying and progressive, rational experimentation (Morris, 2015, p.121).

In terms of education, things happen in a similar way. There is a broad class of pervasive behaviors that form the core of teaching practices in most schools, along with a smaller class of practices that encourage didactic exploration and experimentation. A kind of conservative pedagogy that imitates and an exploratory pedagogy that innovates. The instinctual tendencies of didactic practice respect the principle of imitation and self-preservation. Pedagogical novelty is a secondary instinct that balances the balance to the extent that it manages to pair symbiotically with self-preservation. Given that today's social environment is one in which the security of the individual and the satisfaction of basic needs are no longer a chapter of urgency and alarm as in the olden days, the balance between imitation and curiosity should give more weight to curiosity. The primary mission of the new education is to respond to students' need for exploration. The best way for the school to achieve this is to become a school of exploration. If school remains in the area of securing the individual's future, with a job or social integration through imitation, then exploration and creativity will suffer, and students will lack the courage to explore an uncertain future. Lacking the exploratory exercise that involves risk management based on accepting the unpredictable, students will be hesitant in the face of the unknown and will inevitably resort to the tendency to return to the safe ground of the forerunners. In the face of an ever-increasing flow of newness induced by the revolution of artificial intelligence and cognitive and moral

bioenhancement, the most natural reaction is to freeze and resist processing the newness, which will make the future even more difficult to manage. Without children able to handle the unknown and unpredictable we cannot hope for a future balanced between innovation and imitation. Childish, native curiosity, as a thirst or love of novelty, can be extended to a satisfactory level towards mature ages only by educational intervention. Children with good cognitive and emotional tone never stop exploring, but adults easily give up exploring as they get older and become conservative and resistant to the new in old age. To prevent this from happening, we have only one remedy: exploratory education. A self-teaching school of ethology is one in which the search for answers is the daily task, not the answers. The student in such a school is engaged in searching, never satisfied by any answer, however clear and reassuring it may be. The ethological educational ideal is one of engagement in the search for new perspectives. Each answer or task completed must generate another question that calls for further exploration. Without a pedagogy of exploration, students will learn conservation reflexes at an early age and fall behind in imitation and conformity. Curiosity killed the cat, but saved humanity and a future for education.

The ethological perspective on the relationship between neophobia and neophilia invites us to look at things with caution. The link between the two fundamental behavioral traits cannot be reduced to a two-sided coin, as if the two balance symmetrically. Researchers such as W. Pisula have provided experimental data that well describe this complicated relationship: The data (..) demonstrated that the genesis of fear of novelty is complex and cannot be reduced to one extreme on the novelty seeking dimension, as a simple opposite of novelty-preference (Pisula, 2009, p. 79). But all the more the expectations that this relationship finds a balance through education and schooling grow, as long as ethology itself shows us the importance of this relationship for the becoming of the individual.

The neurobiological argument of the exploration-based school

More recently, W. Pisula (2009) speaks of a genetically predetermined behavior of research, of exploration, which once satisfied produces functional changes in the individual, brain and behavior, a kind of bi-directional connection, which is nevertheless a behaviorist scheme, as D. O. Hebb and D. Berlyne once thought, without reducing themselves to this scheme. For example, Pisula claims, at the end of a remarkable effort to synthesize information about the neural mechanisms involved in the search for novelty (exploration), that the whole process of curiosity, explained as relationships between neurotransmitters, leads to a behavior regulated by the satisfaction of curiosity. A modus vivendi for evolved brains, especially in mammals: Research into the neurobiological basis of exploratory behaviors and novelty seeking is far from complete. However, we have made considerable progress. Among neurotransmitters, dopamine seems to be the most important factor regulating exploratory behavior. Functionally, we know beyond any doubt that the rewarding value of novelty is strictly related to universal reward mechanisms. Structurally, we associate curiosity mechanisms with such cerebral structures as: nucleus accumbens, hippocampus, amygdala, dorsal cortex in reptiles, and medial prefrontal cortex in mammals. (Pisula, 2009, p. 110). In other words, although the neurobiology of exploratory behavior (novelty seeking neurobiology in Pisula's terms) is still in its infancy, we already know

with a satisfactory degree of confidence that the impulse/instinct/drive of curious human behavior is integrated among the dopaminergic reward mechanisms at the limbic level. Therefore, curiosity, along with other stable and known rewarding behaviors - hunger, sleep, relating - ensures the balance between neophobia and neophilia (Pisula, 2009, p. 67). Curiosity is therefore one of the mechanisms to reduce stress hormones, and satisfied curiosity becomes an anxiety-reducing behavior. The lesson for pedagogues is that stimulating and maintaining students' interest in knowledge is at the same time a way of education for a quality of life, well-being and, last but not least, mental health. Well-being education, for both students and teachers, must consider the balanced ratio between exploratory behavior and resistance to the new. Moreover, the teacher now has the task of exerting a regulatory role from the outside to the inside on the student, and the path based on the neurobiology of exploratory behavior is one of the best. If the educator has in mind a learning through discovery in the sense presented here, then education becomes its own reward, that is, we are dealing with a stimulation of intrinsic motivation. For illustration we reproduce below the scheme of cortical mechanisms of behavior oriented towards exploration according to Pisula (2009, p.107).

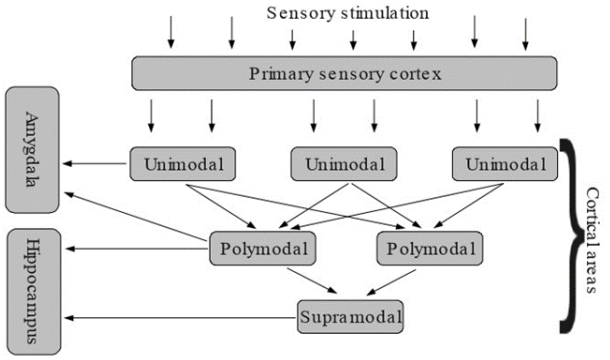


Figure 8.1. Main connections between amygdala, hippocampus, and sensory input.

Fig.1. Jellestad F.K., Folleso G.S., and Ursin H. (1994),

The connection, better said regulation, between the amygdala, responsible for the automatic mechanisms related to stress as a manifestation of fear (neophobia), and the hippocampus, located under the cerebral cortex, involved in the management of memory and orientation processes (neophilia), is visible. The behavioral grid interpretation of these electrochemical reactions between neurotransmitters shows us concretely the importance we must give to the management of curiosity, both in the classroom and the processes related to research and discovery, but also in the wider context of maintaining mental health through training people in activities where the stimulation of exploratory behavior is the main objective.

Bibliography

1. Waal de, F. (2019), Are we smart enough to understand animal intelligence? Humanitas, Bucharest.
2. Furtună, D. (2015), Homo Aggressivus, Chișinău Publishing House.
3. Montessori, M. (2017), The absorbing mind, Vremea Publishing House, Bucharest.
4. Morris, D. (2015), The naked monkey, Art Editorial Group, Bucharest.
5. Pisula, W. (2009), Curiosity and Information Seeking in Animal and Human Behavior, Brown Walker Press.

Neurobiologia curiozității ca lecție pentru profesori

Rezumat

Ideea centrală a textului de față este de a arăta că în formarea elevilor lumii de mâine un rol fundamental revine ideii de curiozitate. Cunoașterea științifică a devenit în ultima perioadă, grație dezvoltării tehnologice și erei tot mai informatizate, un mod de viață în care competențele de înțelegere și manevrare a aplicațiilor și softurilor din ce în ce mai prezente în viața de zi cu zi au devenit cerințe inerente unei vieți de calitate. Prin urmare este nevoie ca educația bazată pe cunoașterea științifică să fie mult mai prezentă în programa școlară a elevilor care vor forma societatea de mâine. Poate unul dintre cele mai eficiente mijloace prin care elevi beneficiază de o educație științifică este stimularea sistematică a curiozității native. Arătăm câteva temeiuri etologice și neurologice ale curiozității pe care le socotim suficiente pentru o reformulare a pedagogiei standard.