

Description and impact of neuroscience advances on the development of artificial intelligence



Descripción e incidencia de los avances de la neurociencia en el desarrollo de la inteligencia artificial

Ferdy Carina Arguello Muñoz
Didier Eduardo Muñoz Vanegas
Mónica Isabel Herazo Chamorro
María Isabel Loaiza Hernández
Edita del Socorro Álvarez Serpa

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ABSTRACT

The development of the research allows the descriptive writing of this article, this writing is the result of a research conducted to twenty-five respondents with teaching training in the field of education at undergraduate and graduate level in Colombia and Spain, all the actors involved participated voluntarily, where they gave express and clear authorization for the treatment and use of the answers in the forms, The purpose of this research is to describe in an exhaustive way the incidence of the advances in neuroscience in the development of artificial intelligence, this research has a quantitative approach, which is oriented to describe the incidence of Neuroeducation in front of the reality of AI for the education of the XXI century, in which determines own characteristics and own steps of the research, where Hernandez et al, (2014) states that data collection occurs in natural and participatory scenarios, using the survey as the

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Tutor Virtual y director de tesis de Maestría
UMECIT, Panamá
<https://orcid.org/0000-0001-5102-5986>

Estudiante de Psicología, Almería, España
<https://orcid.org/0009-0006-6114-5088>

Docente de pregrado CECAR, Sincelejo Sucre
<https://orcid.org/0000-0003-4193-832>

Docente de la Fundación Universitaria María Cano,
Medellín, Antioquia.
<https://orcid.org/0000-0002-4480-0507>

Docente de la Fundación Universitaria María Cano,
Medellín, Antioquia.
<https://orcid.org/0000-0003-0743-0970>

main instrument for data collection, finally, and as a result it is defined that neuroscience makes a significant contribution to the improvement of AI digital tools in education, since it allows understanding the learning processes, designing friendly and appropriate interfaces according to the content with human cognition, are arguments that respondents consider important, with a social, mental and positive representation in various aspects, from the condition of preparation, instruction and even safety and ethics in the use of AI, Corvalán, (2018).

Keywords: Neuroscience, Artificial Intelligence, Teachers, Disruption, Resilience.

RESUMEN

El desarrollo de la investigación permite la redacción descriptiva del presente artículo, este escrito es resultado de una investigación realizada a veinticinco encuestados con formación docente en ámbito de educación a nivel de pregrado y posgrados en Colombia y España, todos los actores involucrados participaron de manera voluntaria, donde otorgaron la autorización expresa y clara el tratamiento y uso de las respuestas en los forms, estas indagación tiene como objeto de estudio describir de manera exhaustiva la incidencia de los avances en neurociencia en el desarrollo de la inteligencia artificial, esta investigación tiene un enfoque cuantitativo, la cual esta orientada a describir la incidencia de la Neuroeducación frente a la realidad de la IA para la educación del siglo XXI, en la cual determina características propias y pasos propios de la investigación, en donde

Hernández et al, (2014) afirma que la recolección de datos ocurre en escenarios naturales y participativos, utilizando la encuesta como principal instrumento para la recolección de la información, finalmente, y como resultado se define que la neurociencia hace una contribución significativa a la mejora de las herramientas digitales de IA en la educación, ya que permite comprender los procesos de aprendizaje, diseñando interfaces amigables y apropiadas de acuerdo al contenido con la cognición humana, son argumentos que los encuestados consideran importantes, con una representación social, mental y positiva en diversos aspectos, desde la condición de preparación, instrucción e incluso la seguridad y la ética en el uso de IA, Corvalán, (2018).

Palabras Clave: Neurociencia, Inteligencia Artificial, Maestros, Disrupción, Resiliencia.

Introduction

The correlation between neuroscience and artificial intelligence has made it possible to generate a ground for exploring the complexities of the human mind and, in turn, to enhance the capabilities of AI. In this paper, it is immersed in a description and incidence of those advances that neuroscience has had in the development of artificial intelligence, and that symbiotic relationship between these two disciplines that are disparate but that reveal a horizon that promise a reflection from research and neuroscientific discovery that allow to nurture the foundations from theory to practice of artificial intelligence and neuroscience in construction of neurotechnology.

In this introduction, a detailed and clear contextual framework is leveled today, which allows to lay the foundations for this deep understanding of the intersection between what is neuroscience and artificial intelligence addressing the spaces of results in front of neurotechnology as a tool to accompany the human being. Today we will address

key concepts, which provide a vision of that historical evolution of these two disciplines and that convergence in times of the XXI century, in this way, today we will quote some authors within the entire article that highlights and has contributed significantly to the dialogue on the integration of neuroscience and artificial intelligence in educational, economic, social, cultural and highly intercultural fields from diversity approaches.

The fundamental intent of this research is to explore how advances in neuroscience have influenced and continue to influence the significant development of artificial intelligence. By understanding these bases from biological human cognition, researchers design efficient algorithms and models that are inspired by the complexity of the brain of the real human subject, reflective and inspiring Meaningful spaces in an increasingly changing world. In this sense, we detail those advances that impact neuroscience and transform the algorithms that govern the conceptual core of this research articulated to the 25 respondents who freely gave answers.

As we dive into the following pages, it will be possible to see the threads that connect brain activity with AI algorithms in the face of deep learning, seeing achievements and challenges that arise from this re significant convergence from the human being's own work to focus selective understandings of the brain in the face of the learning process in various scenarios. This not only promises to revolutionize, advance, reflect and innovate those mysteries of the human mind that accompany the emergence of these new advances in the disruption of information and communication technology.

Theoretical Context

Neuroscience, for Barrios et al, (2020) refers to lines applied to education and the teaching-learning process, neurostructural bases in the study of the brain in action, which actively participate in the processes that articulate cognition and emotion, revealing a selective communication in the brain statement in front of the learning process. Thus, Artificial Intelligence for Flores-Vivar, et al, (2023) is structured from that disruption in which every day is immersed in the educational field, favoring the influx of material for teachers and students, allowing an interpretation of information and more sophisticated decision making. According to the UNESCO document (2021), it recommends that AI are technologies that allow information processing by integrating a high range of algorithms that learn according to the skills anchored to result in various learning activities and the realization of cognitive functions in disruptive ICT environments. The category of teachers for Arguello, (2020) "is called the professional subject in education, which externalizes skills (innate aptitude), in the production, realization and construction of specific activities from the attention and

education for all from the approach of plurality - "diversitas" (p. 59). Teachers should generate innovative tools in education, strengthen disruptive and change processes according to the diverse learning rhythms of their disciples, as cited in Arguello et al, (2020). To conclude, AA Resilience, (2013). In the Resilience Manual, it allows to discover the ability to overcome critical moments and experience unexpected situations, adversity and assertiveness to integrate fronts of diverse situations to the learning of life, a change, a transformation from the disruption of new innovations, where it configures the articulation of the resignification of knowledge, cognition and reflection in changing environments.

Materials and methods

For the following research the quantitative approach was used, using methods and techniques according to methods of measurement of the units of analysis of the research project such as the survey and anonymous reflection of each respondent, in this way, a rigorous sequence is organized for the testing of the hypothesis, therefore, the type of descriptive research is chosen as shown in the following image:

Its purpose is to review the characteristics of a given group, 25 master voices at national and international level, on the incidence that neuroeducation has against AI for the education of the XXI century, to finally, undergo the analysis of the results, according to Hernandez et al, 2014.

which allowed to meet the objective of the proposal, To comprehensively describe the incidence of advances in neuroscience in the development of artificial intelligence, exploring the convergence of these disciplines and assessing whether the resulting applications are perceived as disruptive that radically transform the field or as resilient solutions that integrate harmoniously into society and existing ICT, De La Cruz, et al, (2023).

Results

The results of the research are presented below according to the study objectives, followed by the analysis of each one.

In the first phase of findings, a 10-question Likert-type survey on neuroscience and artificial intelligence was analyzed. Participants indicated their degree of agreement with each statement on a scale of 1 to 5, where 1 means "Strongly disagree" and 5 means "Strongly agree", where responses are 100% anonymous.

The first section addressed demographic data such as gender, age and professional level of each participant surveyed.

Table 1. *Demographic data*

Naturaleza	Variable	Frecuencia	Porcentaje
Genero	Masculino	15	60
	Femenino	10	40
Edad	25 – 34 Años	8	32
	35 – 44 Años	12	48
	45 – 54 Años	4	16
	55 o más años		4
	Pregrado	10	40
Nivel de educación	Posgrados	15	60

Source: Own elaboration

Sixty percent of the participants are male, while 40% are female. This indicates a slight male predominance in the sample. The majority of the participants are in the 35 to 44 age range, with 48%. The second largest group is in the 25-34 age range, with 32%. Sixteen percent belong to the 45 to 54 age range. There are 4% of participants aged 55 years or older. Sixty percent of the participants have postgraduate degrees, while 40% have undergraduate degrees. This suggests that most of the participants are highly educated.

Overall, the sample assumes a balanced gender distribution, with a majority in the 35-44 age group and a hegemony of collaborators with postgraduate degrees compared to those with undergraduate degrees. This analysis provides an overview of the demographic composition of the research.

Table 2 *Neuroscience and Artificial Intelligence*

Item	Totalmente en desacuerdo		En desacuerdo		Neutro		De acuerdo		Totalmente de acuerdo	
	F	%	F	%	F	%	F	%	F	%
The incorporation of neuroscientific					5	20	11	44	9	36

principles in the development of artificial intelligence improves its capacity to understand and adapt to the environment.										
The application of techniques inspired by the functioning of the human brain contributes significantly to the advancement of artificial intelligence.	1	4	1	4	2	8	11	44	10	40
Neuroscience can be key to improving the ability of machines to learn in a similar way to humans.			7	28	1	4	12	48	5	20
Integrating knowledge about the structure and functioning of the brain into artificial intelligence increases its efficiency and performance.			1	4	2	8	16	64	6	24
Understanding human cognitive processes through neuroscience is essential for	1	4			4	16	13	52	7	28

developing ethical and safe artificial intelligence systems.										
The influence of neuroscience on artificial intelligence enables better interpretation of information and more sophisticated decision making.	1	4	1	4	2	8	11	44	10	40
Collaboration between neuroscience experts and artificial intelligence developers is crucial to maximize the potential of both disciplines.	1	4	1	4	1	4	12	48	10	40
The implementation of neuroscientific concepts in artificial intelligence can improve the emulation of human intelligence in specific tasks.	1	4	1	4	3	12	15	60	5	20
Neuroscience can offer solutions to address current	1	4					17	68	7	28

challenges in artificial intelligence, such as model interpretation and applicability.							
Neuroscience research will continue to be fundamental to the future development of artificial intelligence.	1	4		8	32	16	64

Source: Own elaboration

On the first item, 80% of the participants agree (44% agree and 36% strongly agree). This suggests strong support for the idea that the application of neuroscientific principles improves the capability of artificial intelligence. Next, 48% of the participants agree (44% agree and 4% strongly agree). There is a positive perception, but to a lesser extent than in the first item. Thus, 76% of the participants agree (48% agree and 28% strongly agree). The majority support the importance of neuroscience in improving the learning capacity of machines. Thus, 88% of the participants agree (64% agree and 24% strongly agree). There is strong approval for the effectiveness of integrating neuroscientific knowledge into artificial intelligence. Similarly, 80% of the participants agree (52% agree and 28% strongly agree). There is significant support for the idea that neuroscience is essential for ethics and safety in artificial intelligence. The influence of neuroscience yields 84% of participants agree (44% agree and 40% strongly agree). The majority consider that neuroscience improves the ability to interpret and make decisions in artificial intelligence. Collaboration between shows that 88% of participants agree (48% agree and 40% strongly agree). There is strong support for collaboration between neuroscience experts and artificial intelligence developers. The implementation of neuroscientific concepts in artificial intelligence results in 80% of the participants agreeing (60% agree and 20% strongly agree). Most of them consider that the implementation of neuroscientific concepts improves the emulation of human intelligence. Neuroscience can offer solutions so 96% of the participants agree (68% agree and 28% strongly agree). There is strong support for the idea that neuroscience can address current challenges in artificial intelligence. This is

followed by 96% of participants agreeing (32% agree and 64% strongly agree). There is significant consensus on the continued importance of neuroscience research for the future development of artificial intelligence in the face of ICT disruption in the 21st century, a globalized framework of skills that align with individual subject interests, Sandoval, (2018).

Finally, the findings indicate strong support for incorporating neuroscientific principles into artificial intelligence, with positive perceptions in a variety of areas ranging from learnability to ethics and safety. Intelligence developers are also viewed critically, Castro, M. F. Z. et al, (2019).

In a second moment, a second survey titled "Neuroscience and AI Digital Tools For 21st Century Education" is analyzed in which the following data is analyzed:

Table 3 *Neuroscience and AI Digital Tools For 21st Century Education.*

Nature	Variable	Frecuencia	Porcentaje
familiarity with neuroscience and artificial intelligence in education	• Muy familiarizado	4	16
	• Familiarizado	12	48
	• Neutral	6	24
	• Poco familiarizado	3	12
	• No familiarizado en absoluto	0	0
artificial intelligence digital tools improve teaching in the 21st century.	• Personalización del aprendizaje	6	24
	• Mejora de la retroalimentación	2	8
	• Acceso a recursos educativos en línea	8	32
	• Adaptación a estilos de aprendizaje individuales	9	36
	• Otras	0	0
Neuroscience can play an important role in improving pedagogical strategies.	• Si	24	96
	• No	0	0
	• No estoy seguro/a	1	4
neuroscience contributes to the creation of more	• Comprendiendo mejor los procesos de aprendizaje	8	32
		2	8
		9	36
		6	24
		0	0

effective digital AI tools in education.	• Diseñando interfaces más amigables. • Adaptando el contenido según la cognición humana • Personalizando la experiencia de aprendizaje • Otras		
	• Privacidad de los datos	7	28
		3	12
	• Sesgo algorítmico	8	32
	• Dependencia tecnológica	7	28
		0	0
	• Falta de accesibilidad		
	• Otras		
concerns about the use of neuroscience-based digital AI tools.	• Si	19	76
	• No	3	12
	• Otras	3	12
The implementation of these technologies could benefit all students equally.	• Si	14	56
	• No	5	20
	• No estoy seguro/a	6	24

Source: Own elaboration: Own elaboration

Open spaces for reflection by respondents are highlighted below: anonymous 3 "very appropriate for today's society, emphasizing that everything must be in line with the Psychosocial situation of the participants in the educational process", anonymous 4 "The integration of neuroscience and artificial intelligence presents a challenge for teachers in the 21st century. Understanding how students' brains work at the neural level can inform more effective pedagogical strategies, while artificial intelligence offers innovative tools for personalizing instruction. However, it is essential that educators approach these advances with caution, making sure to maintain an ethical and humane balance in the use of technology, and continue to foster key social and emotional skills in the educational process." anonymous 8 "Thanks to neuroscience and AI tools, it allows neuroscientists to give the tools to make further discoveries and interpret them." anonymous 10 "Artificial intelligence can contribute tools that when thought about from pedagogy help create new learning with appropriate learning

gains." anonymous 11 "Neurotechnology is widely linked to this interdisciplinary field that combines neuroscience with ICT to develop tools that allow us to advance in generating critical thinking and articulation of teaching the future generation to think through technology" anonymous 12 "Neuroscience allows AI to provide relevant aspects regarding the creation of new algorithms for an education personality in the 21st century" anonymous 14 "Neuroscience and artificial intelligence (AI) are interrelated in several ways, and the impact of neuroscience in AI is significant", anonymous 21 "I consider that the use of this tool helps us so that the learning process can be understood much more easily", anonymous 22 "I think it is a very interesting topic that as it advances in the future will be beneficial for the study" anonymous 24 "We cannot ignore that technologies are taking giant steps in current pedagogy, so they should be included in teaching practices", anonymous 25 "Active processes, use of methodology to strengthen critical thinking".

In conclusion, and as a result of the survey table 3, it is defined that neuroscience makes a significant contribution to the improvement of AI digital tools in education, since it allows understanding the learning processes, designing friendly and appropriate interfaces according to the content with human cognition, are arguments that respondents consider important, with a social, mental and real representation in various aspects, from the condition of preparation, instruction and even safety and ethics in the use of AI that must continue to advance to support quality processes.

As far as it is concerned, neurotechnology extends to the interdisciplinary field that allows the combination of those principles of neuroscience guide applied to science and research and the disruption of technology to study the activities of the human subject in the reality of the brain with various interface, allowing a bidirectional communication between these two and a deep stimulation that influences or assimilates neural activities from the algorithms today that are implanted in these artificial intelligences, and that will never overcome the human race, resignifications own use and help that can provide the human. In this order of ideas, the technology will always be neutral, being seen for better or for worse, the humanization, principle and dimension of ethics in front of neurotechnologies that implies a reflection of thinking about the ethical, social and cultural that impact society and the revolution of this in the economy and in our own lives in front of diverse intercultural networks.

For Yuste, (2019). "New neurotechnologies are playing a crucial role in neuroscience and will impact medicine, economy and society of the future" (p. 7). Thus, these interdisciplinary fields merge and study that understanding from the self-development of advanced devices and techniques for deep brain stimulation and the

combination that we want to reach in the achievement of new algorithms in front of AI, as a reward of technical help for human beings.

Conclusions

This research highlights relevant aspects of the importance of understanding the structure and functioning of the human brain, so that artificial intelligence can design and be inspired by the beginning of the search for similarities, configurations and structures that have led to inspired and structuring models from the neuronal. Within this framework, the trend of neuroscience and artificial intelligence today allows an impulse to new active developments within the neurotechnological spaces, such as ICT allowing to make use of an information from the study of the brain itself to go improving the capabilities of AI, hence, to open new fields and possibilities in front of brain vs computer interface. Consequently, the ethical and privacy challenges within the incorporation of neuroscientific knowledge in AI should raise those challenges in the use of data for individual autonomy of an information and a need to regulate from ethics the development of these applications from the disruption of information technology and communication. Indeed, the research highlights an interdisciplinary boom today between various neuroscientists, researchers and AI itself, allowing to bring those discoveries between innovation and the benefit of that understanding that one has of the mind of the subject as the own development of new technologies in front of the algorithms that have been opening paths in relation to the interconnection of the two scientific fields that are named here.

Otherwise, neuroscience and AI are related, since from the diversity of advances in Neuroscience positively influence the development of AI algorithms, in such a way, that it has an impact on the inspiration of a structure and functioning of the brain looking for the anatomy and function of a human brain, Clark, et al, (2019), in this way, allows us to glimpse that artificial intelligence will never surpass human neural processes, only artificial neural networks will remain according to their algorithms in terms of imitation of structures and functionings of the human species.

Thus, the neural networks of the subject simplified model that emulates the information process of the human brain, so that the relationship between artificial intelligence and neuroscience or v / s neuroscience and artificial intelligence focuses points such as deep learning from neural networks in mixed approach, Martinez, (2021), in which are used according to multiple research plasticity and the influence of human beings in the algorithms to design and train machines that serves from its neuro technology in teaching processes, cognition and interface of various tools of exchange between the human and information and communication technology in a

disruption between the human mind and artificial intelligence, understanding that AI will never surpass the understanding of cognition and rational information processing of the human species facing the creation of new machines in operation and support to the species, Martinez, & Mendez, (2013).

In conclusion, Gomez, et al, (2022), advances in neuroscience have had a great significant impact on the development of artificial intelligence providing an inspiration of diverse models and key points of knowledge to favor the efficiency and effectiveness of human-created technological disruption algorithm systems, thus, the intersection and inclusion between neuroscience and artificial intelligence will be an active research area for the current century, thinking the transversal points of an education in diverse intercultural, multicultural and highly diverse scenarios that emulate the ability to inspire realities in the creation of super advanced and ethical algorithms for insertion in educational, commercial areas among others.... It provides a basis between theory, conceptual and ethical principles addressing privacy, equity and transparency of processes, Mira, (1999).

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