REFLECTIONS ON THE EDUCATIONAL POSSIBILITIES OF STUDYING THE EMERGENCE OF CONSCIOUSNESS BASED ON A WEB CONFERENCE

Reflexões sobre as possibilidades educacionais do estudo da emergência da consciência a partir da realização de uma webconferência

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Recebido em: 07/05/2023
Aceito em: 20/11/2023

Abstract

This article investigates the experience of holding a web conference on the origin and characteristics of consciousness in 2021, with simultaneous transmission to anyone interested on YouTube. This work sought to articulate research, teaching and extension, with the objective of examining the possibilities of approaching the theme of the emergence of consciousness in the context of scientific dissemination and science teaching activities. To support the investigation, a broad theoretical review was carried out on different topics related to the study of consciousness. Particularly, conceptions present in the field of Philosophy of Science were analyzed on the concept of emergence of new characteristics in more complex levels of organization. Academic works generally stress the importance of an interdisciplinary approach to the study of the phenomenon of consciousness. A questionnaire was prepared, in the format of a "Google Form", to investigate the conceptions of the participants of the web conference about the themes addressed in it. This questionnaire was answered by a total of 19 participants. The data obtained point to the importance of implementing scientific dissemination activities on frontier topics in science, as is the case of the study of the emergence of consciousness.

Keywords: Consciousness; Mind; Teaching.

Resumo

O presente artigo investiga a experiência da realização de uma webconferência sobre a origem e as características da consciência em 2021, com transmissão simultânea para quaisquer interessados pelo YouTube. Este trabalho procurou articular pesquisa, ensino e extensão, com o objetivo de examinar as possibilidades de abordar a temática da emergência da consciência no contexto de atividades de divulgação científica e de ensino de ciências. Para fundamentar a investigação foi realizada uma ampla revisão teórica sobre diferentes tópicos relacionados ao estudo da consciência. Particularmente foram analisadas concepções presentes no campo da Filosofia da Ciência sobre o conceito de emergência de novas características em níveis de organização mais complexos. Os trabalhos acadêmicos em geral salientam a importância de uma abordagem interdisciplinar para o estudo do fenômeno da consciência. Foi elaborado um questionário, no formato de um "Formulário Google", para averiguar as concepções dos participantes da webconferência acerca dos temas tratados nela. Este questionário foi respondido por um total de 19 participantes. Os dados obtidos apontam para a importância da implementação de atividades de divulgação científica sobre temas de fronteira da ciência, como é o caso do estudo da emergência da consciência.

Palavras-chave: Consciência; Mente; Ensino.

Introduction

This article aims to investigate a web conference that dealt with the subject of the origin and characteristics of consciousness, that is, mental states, and which was held in 2021 through an open transmission accessible to all interested people via YouTube; since the event took place, its video recording is available on this video platform. This is an investigative work with an educational purpose on a topic of increasing importance and that has reached the internal and external communities of the IFSP, seeking, in this way, to articulate the three basic aspects of every university institution: research, teaching and extension.

After the introduction, a theoretical foundation is made on topics such as consciousness and the mind, based on the reading and systematization of academic works considered relevant on these topics. Next, the methodological procedures used to carry out the web conference on consciousness are explained and the results are presented and discussed, in particular, based on data obtained through a Google Form, answered by participants of the web conference. At the end, the final considerations are made, with some reflections about all the work carried out.

This is a work in the field of science education and the references used, for the most part, are from this area of knowledge, with contributions that discuss the history of science and the nature of consciousness within the scope of natural sciences. As this is a field still in development and on which there is no scientific consensus, the references do not provide certainties, but rather clues and projections.

Studying the phenomenon of consciousness in the field of science education is crucial for several reasons. First, it promotes interdisciplinary learning by integrating biological, philosophical, and psychological perspectives. Additionally, understanding consciousness contributes to a holistic approach to life sciences, encompassing both objective and subjective dimensions. Exploring consciousness raises ethical considerations in emerging scientific fields like artificial intelligence and neuroscience, fostering discussions on scientific responsibility. Moreover, delving into this topic can enhance student engagement, as consciousness involves fundamental questions that stimulate curiosity and critical thinking. Lastly, studying consciousness provides an opportunity to investigate the nature of science, acknowledging its limitations and encouraging students to think critically about unresolved scientific inquiries. Overall, integrating the study of consciousness enriches scientific education by offering a comprehensive and thought-provoking perspective on the scientific effort to build knowledge.

Consciousness and mind

The best way to characterize and explain mental phenomena is a challenge that has been faced by philosophers and scientists for a long time until today. This is the famous mind-body problem (Bunge, 2014) that was highlighted by Descartes (1596-1650) in the 17th century. The main difficulty faced resides in the fact that mental states are not directly accessible to observation, making them, to a certain extent, subjective. To try to unravel this question, the interrelationships between mind and brain will probably be a growing focus of study and research in the future.

It is possible to notice that chemical substances influence the mind and that people with damaged portions of their brains also lose part of their mental activities: thus, mind and brain may be different, but they are connected in some way (Teixeira, 2016). On this problem, there are two

basic approaches that are at the heart of the Philosophy of Mind: monism and dualism. Monism holds that there is only one kind of substance in the universe, the matter that makes up our bodies and the objects we interact with; therefore, mental phenomena must be able to be reduced in some way to physical phenomena. In turn, dualism supports the idea that there are two types of substances, with the existence of a fundamental difference between mind and brain: from this perspective, minds are not in space and their operations are not subject to the laws of mechanics, contrary to what happens with human bodies (Ryle, 2009). At the current stage of development of scientific knowledge, it is not possible to decide on one of these approaches: both have "virtues", but also problems. Existing knowledge about the nature of thought and consciousness remains very scarce: these are problems at the frontier of current science.

The issue of the origin of consciousness is closely associated with the debate between emergentism and reductionism, and this is a discussion that has important consequences for existing conceptions about the nature of scientific knowledge produced by human beings. In basic terms, the concept of emergence refers to a state of affairs in which the properties of a certain domain of an area of knowledge do not completely reduce to the properties of its parts in another domain of a lower level. The properties that emerge at the top level would therefore be autonomous, despite being produced and related to the most basic level (Pessoa Jr, 2013).

Reductionism, in turn, is associated with the position that it is possible to explain all systems, objects and phenomena by reducing them to their simplest and most elementary parts, about which there is a basic level of understanding (Sommerman, 2011). Laplace (1749-1827), through a mental experiment, made the reductionist paradigm explicit by imagining a sufficiently intelligent being – and with a great capacity for calculation – who knew, at a given moment, all forces exerted and the positions, velocities and masses of all particles in the Universe; for this hypothetical being (called "Laplace's demon") nothing would be uncertain and the future, as with the past, would be entirely predictable from the laws of physics, in particular, the laws of mechanics (Bassalo; Caruso & Marques , 2021). With regard to the relationship between mind and brain, a consequence of this extreme reductionism is that free will is just an illusion (Lestienne, 2013).

Reductionism can also be seen, not from an epistemological point of view, but as a method for understanding nature, like the methodology used by Galileo to "reduce" and simplify phenomena in order to better understand the reality around us; it was this approach that made it possible, for example, to conceive the idea of inertia by imagining a thought experiment in which there would be no friction or air resistance (drag) opposing the movement of a body (Bastos Filho, 2005).

According to the emergentist paradigm, even if the elementary entities of a science X obey the laws of another science Y, from this hierarchical relationship does not follow that science X is just a simple application of science Y: therefore, X is not reducible to Y, because at each level new concepts are needed to explain new phenomena that arise. For example, when we reflect on the origin of consciousness, it is essential to clearly understand that Psychology is not a kind of applied Biology (Anderson, 1972).

There are several complex adaptive systems that show emergent behavior, such as, for example, anthills, brains, software that learn ("machine learning") and cities. The movement from lower-level rules to higher-level rules is called emergence and occurs in the direction of the development of greater organized complexity (Johnson, 2003). An example is in the study of nonequilibrium thermodynamics, which seeks to explain how, locally, higher-level orders can spontaneously emerge from the underlying chaos (Prigogine & Stengers, 1984).

In studies on how consciousness arises, from biological matter, in human beings, the emergent properties appear to be not structural, as they are not fundamentally related to concepts

such as constitution and causation (Wong, 2010), having characteristics of autonomy with respect to the phenomena considered more basic. However, as consciousness is, probably, a state that emerges from a set of neural circuits in the brain, it is important to study the behavioral and neural aspects of consciousness in parallel to obtain a complete understanding of the phenomenon (Crick & Koch, 2003).

Perception, thinking and self-awareness are mediated by different spatially organized regions in the brain, while the temporal dynamics of neuronal activity can be characterized by different wave frequencies: the integration between the spatial and temporal dimensions of neuronal activity is fundamental for the emergence of consciousness in its integrated form (Northoff & Huang, 2017). Studies of patients with brain injuries also point to the importance of understanding the temporal dynamics of neural processes underlying consciousness and identifying the neural circuits that sustain these processes (Dehaene & Changeux, 2011). The states of unconsciousness, as with the use of general anaesthesia, are characterized by an "uncoupling" of sensory and cognitive information in the brain, i.e., a disconnection of neural processes that normally make up conscious experience: this is, additionally, a fundamental phenomenon for the study of consciousness (Mashour, 2013).

On the one hand, consciousness appears associated with the fact that human beings have immediate knowledge of their own psychic activity (Ferreira, 1986) and know of their own existence (in the sense of self-awareness), which also refers to the certainty that every human being has that one day he will die (Pinto & Veiga, 2005); on the other hand, the notion of consciousness is also associated with the ability to make decisions to solve complex problems using mental faculties to judge the gains and losses in the case of each of the possible existing options, in a cost-benefit reasoning. In men, consciousness can be understood as a state of extrasensory belief about different subjects. The attempt to define the criteria associated with the existence of a consciousness involves the discussion about whether only beings capable of expressing themselves explicitly about their own conscious processes (as is the case of human beings) would be conscious (Pereira Jr, 2003). In this regard, the documentary “My Octopus Teacher”[1], awarded an Oscar in 2021, shows how even an invertebrate animal (a mollusk) shows signs and manifestations that it has different levels of consciousness.

Consciousness is the main characteristic that makes us human (Damasio, 2011), however, paradoxically, despite being very familiar to human beings, it reveals properties that still remain mysterious (Chalmers, 1996). The difficulties involved in understanding and defining what is meant by consciousness, both in the philosophical and biological fields, are faced by professionals in the field of computing who seek to develop systems equipped with Artificial Intelligence (AI), which seek to simulate this property, because it only seems to exist in nature itself (Quaresma, 2019). The issue of consciousness in machines is a promising area of research in the future, but much progress is yet to be made in understanding the nature of consciousness and in creating systems that can replicate it (Koch & Tononi, 2008).

One possible explanation for the "emergent" phenomena that occur in our brains – involving, for example, ideas, hopes, images, analogies, intuition, creativity and desire – is that they arise from a kind of feedback, an interaction between two different levels, in which a superior level influences and, at the same time, is influenced by what happens in the inferior level, creating a kind of self-reinforcing "resonance" that allows the consciousness to come into existence (Hofstadter, 2001).

[1]The trailer for the documentary is available at: <https://youtu.be/3s0LTDhqe5A>. Retrieved on: April 27, 2023.

The study on the origin of consciousness – and on the definition of this concept – needs, in order to be successful, to seek knowledge from a wide variety of disciplines, such as Neuroscience, Psychology, Philosophy and Artificial Intelligence, among others. In this sense, an interdisciplinary approach allows a positive exchange of ideas and concepts between these areas (Baars, 2003).

The field that studies the origin of consciousness can be considered as a form of "extraordinary science" associated with a period of intense theoretical fermentation in which the practices of the so-called "normal science" are relaxed due to an enduring anomaly that resists having a solution within the limits of prevailing normality (Kuhn, 1996). The future regarding the evolution of this debate is not something predefined, because, a priori, it is not possible to say if a scientific revolution will be necessary or not in this case (Van Gulick, 2001). Analyzed a posteriori, it is possible to try to give some logical and linear sense to the course of events in the History of Science, but in the "eye of the hurricane", that is, when History is unfolding, several dilemmas and problems are being faced by scientists: in this context, the scenario is often confusing, with different options making sense and seeming equally likely. Therefore, this type of discussion about the origin of mental states, within the scope of teaching activities, can effectively contribute to a better understanding of the methods that science uses to build knowledge, to demystify distorted and oversimplified views about this.

Regarding the problem about the body-mind relationship - in particular, brain-mind - and about the nature of consciousness, perhaps another kind of reduction may be necessary, instead of the more traditional attempt to reduce the mental to the physical: for example, it is possible to explore an alternative reduction according to which the mental and the physical are different aspects of the same basic constituents of the world (Abrantes, 2005).

The article "What is it like to be a bat?" by Thomas Nagel (1974), which has a Portuguese translation available on the internet, intitled "Como é ser um morcego?" (Nagel, 2013), can be quite useful in didactic terms by encouraging imagination about a type of sixth "sense" – such as the five senses of human beings: sight, hearing, smell, taste and touch – that emerges for bats and which is something very different from human experiences: it is the sense of echolocation obtained by the reflection, from the objects located in the vicinity, of the waves of high-pitched screams, emitted in the ultrasound range by bats, and which allows them to perceive the world around them in a certain way and navigate it through this kind of sonar. This problem-situation can be used as a pedagogical tool to think about the emergence of mental states, due to the fact that consciousness keeps a close relationship with the senses with which we perceive and capture information about the world around us (Bonjour, 2013).

The relationship of consciousness both with other cognitive functions, such as perception, attention and memory, as well as with subjective lived experiences, can contribute to a more rigorous and precise approach in defining this concept, which is necessary to overcome the gaps of current science (Rosseinsky, 2019).

So, currently, there exists a rich diversity of perspectives regarding the phenomenon of consciousness. Neuroscientists study the intricate workings of the brain, attempting to unravel the neural underpinnings of subjective experience. Philosophers engage in nuanced debates on the nature of consciousness, exploring questions about self-awareness, and the mind-body relationship. Furthermore, within the realm of cognitive science and psychology, various theories and models offer distinct frameworks for understanding consciousness. The coexistence of these diverse viewpoints highlights the complexity of the subject, illustrating how different disciplines contribute to a multifaceted exploration of one of the most profound aspects of human existence.

Methodological Procedures

In order to investigate the existing didactic possibilities, within the scope of scientific dissemination, in activities involving studies on consciousness, the authors of this work organized, in 2021, a web conference entitled "Chemophysics of Consciousness" and which was lectured by the physicist and philosopher Osvaldo Frota Pessoa Junior, who is currently a professor at the University of São Paulo (USP). Carrying out this action is the main focus of this article's investigation.

The decision to invite Professor Osvaldo came after an internet search that found that he is the author of a series of academic works on studies of the origin of consciousness, including maintaining a website with a series of important articles by different authors in this regard[2]. Professor Osvaldo was then contacted by email and kindly agreed to hold this conference remotely, to meet the social distancing needs imposed by the COVID-19 pandemic and expand the potential audience to be reached.

The date and time for this web conference was decided well in advance, in agreement with the lecturer. It took place on October 4, 2021, a Monday, starting at 5 pm and with simultaneous transmission on the YouTube channel "Debate Consciência"[3]. This channel was created in August 2020, to enable scientific and cultural dissemination activities like this one, in the context of the COVID-19 pandemic.

Eleven days before the event took place, an informative note was published on the website of the Caraguatatuba campus of the Federal Institute of São Paulo (IFSP), where the authors of this article work, announcing a summary of the event, including the transmission link, in order to invite those interested in this matter. Two days after the event, a second note was published on the IFSP-Caraguatatuba website, informing about how the web conference took place and about what topics were discussed, in order to publicize the event as much as possible, its characteristics and the topics addressed, including to reach those who did not participate in the activity during its simultaneous transmission on YouTube.

The virtual room in which the web conference took place was created through the StreamYard platform[4], in free mode and with resources that are relatively easy to use. This virtual room was created more than two weeks before the event, which made it possible to generate an event on YouTube inviting and informing interested persons about the transmission link, the date and time of its beginning, the title of the conference, the name of the lecturer and a poster publicizing the event with all this information.

The authors of this present work met with the lecturer in the Streamyard virtual room, approximately 30 minutes before the start of the event to carry out tests, with the aim of correcting in advance any possible technical problem that arose. From the previously determined time for the beginning of the transmission, the web conference started as planned. The simultaneous transmission of the web conference (actually, with a slight delay of a few seconds) was recorded on the YouTube platform[5], as a legacy of this research, and can be watched by anyone interested or curious about the topic.

[2] Available at: <https://opessoa.fflch.usp.br/>. Retrieved on: April 27, 2023.
[3] Available at: <https://www.youtube.com/@debateconsciencia8921>. Retrieved on: April 27, 2023.
[4] Available at: <https://streamyard.com/>. Retrieved on: April 27, 2023.
[5] Available at: <https://youtu.be/P25ha3po_Xc>. Retrieved on: April 27, 2023.

After the initial presentations made by the organizers of the event, the lecturer spoke on the subject of chemophysics of consciousness, using slides that were prepared so that the ideas discussed became clearer for the spectators participating in the activity.

During the web conference, participants were requested to voluntarily answer a “Google Form” questionnaire containing questions both about the profile of the person who was responding (such as gender, age group, ethnicity and education level) and about the central theme of the activity (consciousness) and related topics. The questions on this form were previously prepared by the authors of this article with the aim of helping to understand the motivations and conceptions of the public participating in the event. People who volunteered to answer this form received a declaration of participation in the event by email. The link to this form was provided to participants via the broadcast chat and it was open to receive responses until a few minutes after the end of the web conference.

The web conference investigated in this work addressed the topic of the chemo-physics of consciousness, with an emphasis on the ways in which current scientific research studies how states of consciousness are structured in the brain. In particular, it was highlighted the so-called “phenomenal consciousness”, which involves the subjective qualities, or “qualia” that we experience and that involve the relationships between things. Qualia could be internal properties of some region of the brain, traditionally called “sensory”, which would be the immediate brain correlate of each modality of phenomenal consciousness. However, it is important to make it clear that there is no scientifically consensual definition of consciousness.

Results and Discussion

The web conference “Chemophysics of the of consciousness” addressed topics related to the origin and characterization of consciousness, with a reasonable degree of complexity, such as the “qualia” that are associated with individual instances of conscious experience and the subjective qualities of our perception, such as colors. The duration of the video for this web conference was approximately 1 hour and 44 minutes. By May 5, 2023, 578 days after the event, the video of this web conference had already had 182 views, with 60 of these views occurring during the transmission and 122 after the publication of the video, after the end of the transmission.

The broadcast quality with regard to the image and sound of the presenter's voice was good. During the broadcast, more than 20 people expressed themselves via chat, asking questions or making comments about the event, with a total of 58 messages via chat. The peak in the number of concurrent viewers was 22, many of whom were university students at the IFSP-Caraguatatuba.

Despite the intrinsic difficulty surrounding the topics addressed, the lecturer, during the activity, sought to use accessible language and exemplify the concepts in focus through analogies and thought experiments that could make them as understandable as possible: for example, during the web conference, the lecturer tried to provoke a reflection on where “colors” as attributes exist, if in external nature or if only in the mind of those who have the sensation of seeing a color. Analogies were also used to explain about other concepts associated with the study of consciousness.

During the activity, the importance of research in this area of knowledge was highlighted, as can be seen from the activities carried out within the scope of “The Association For The Scientific

Study Of Consciousness”[6]. Works considered essential in this area of knowledge were also cited, such as the article “What is it like to be a bat?” (Nagel, 1974).

During the web conference, a link to a Google Form was provided via YouTube chat and participants were asked to access it and answer their questions. The number of viewers who responded to the form provided by the chat during the web conference was N=19.

Firstly, the percentages of responses given to the questions about the profile of the people who responded (the respondents), with regard to gender, age, race/color and level of education, will be described.

With regard to gender, around 53% of those who answered the form were male, while 47% were female, indicating a certain balance in this subject. With regard to age group, about 74% of those who responded (the vast majority) were aged between 18 and 29 years old, typical age of university students who made up a large part of the public attending the activity; of the remainder, 21% were aged between 30 and 59 years old, while 5% were adolescents aged between 13 and 17 years old. With regard to race/color, 58% of respondents declared themselves white, 32% declared themselves brown and 10% declared themselves black. Finally, with regard to education level, 84% of respondents reported having completed or incomplete higher education, while 11% claimed to have completed or incomplete secondary education and 5% reported having completed or incomplete postgraduate education, responses that are consistent with those given for the question about their age.

Next, four closed questions (with alternatives as possible answers) and one open question (discursive) on the subject of consciousness were asked, with the aim of investigating the participants' conceptions about the topics addressed.

The first of these questions was: “What do you consider to be the best definition of consciousness?” Three response options were provided: “Consciousness is being able to experience the five senses”; “Consciousness is knowing that you are alive and that death is a certainty”; "Consciousness is the ability to reason to solve problems". In addition, it was also possible to check “Another option” and write a text as answers. For this question, 37% answered that consciousness was being able to experience the five senses (sight, smell, taste, touch and hearing), while another 37% answered that consciousness was knowing that one is alive and that death is a certainty; in addition, 21% answered that consciousness was the ability to reason to solve problems and 5% answered that consciousness was something that was associated with all three of these previous characteristics added together, text written after the alternative “Another option” was chosen (Figure 1). Consciousness is something entirely private which occurs from the relationships established with the mind (Damásio, 2015). Although conscious experience is personal, it is influenced by many other factors, such as genetics, environment and culture: thus, consciousness is a complex and multifaceted phenomenon, which involves the ability to perceive, think, feel and make decisions.

[6] Available at: <https://theassc.org/>. Retrieved on: April 27, 2023.

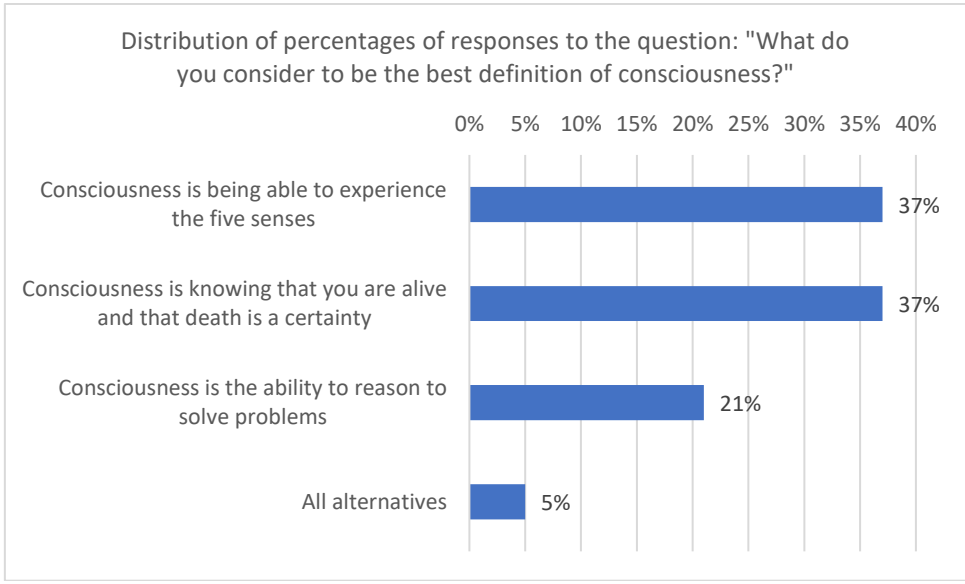

Figure 1: Distribution of percentages of responses to the question: "What do you consider to be the best definition of consciousness?" (N=19)
Source: Authors (2023).

The second question about consciousness was as follows: "Imagine that all the neurons in a person's brain are gradually replaced by nanochips that do the same function as those neurons. In the end, does this person, in your opinion, have a consciousness?" Among the two possible answers (positive and negative), approximately 53% answered "Yes, if all the chips do the same function as neurons, then there is consciousness in the same way", against 21% who answered "No, because consciousness can only exist if the neurons are natural", while 26% responded by choosing the alternative "I don't know" (Figure 2). This question, in its most general sense, refers to the so-called paradox of the ship of Theseus proposed by Plutarch in antiquity and which has been debated by many philosophers since then (Rose, 2020). The relevance of being able to reflect on a problem like this that has crossed human history for about two millennia points to the importance of the philosophy discipline in the formation of young people during high school.

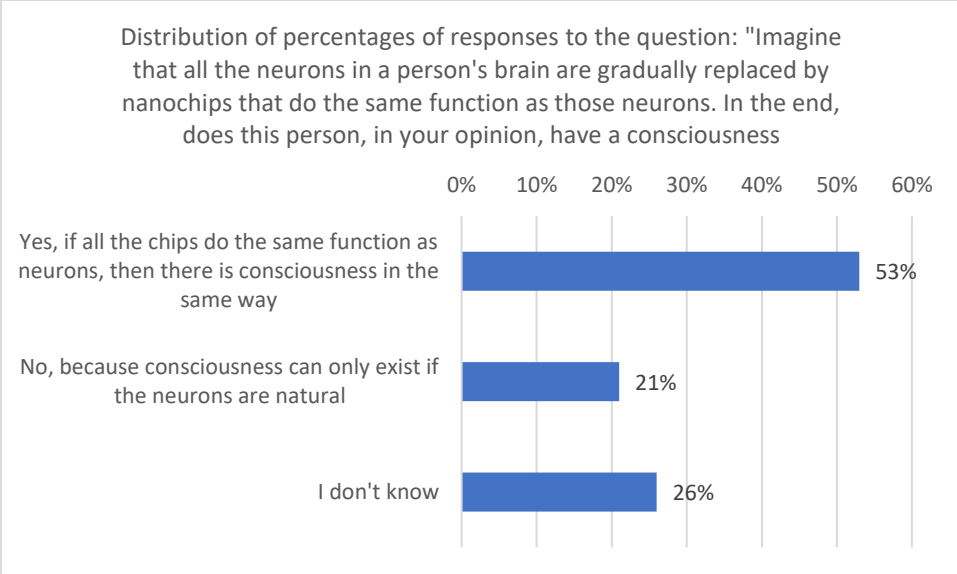

Figure 2: Distribution of percentages of responses to the question: "Imagine that all the neurons in a person's brain are gradually replaced by nanochips that do the same function as those neurons. In the end, does this person, in your opinion, have a consciousness?" (N=19).
Source: Authors (2023).

The third of these questions asked about which types of living beings would have some kind of consciousness and several alternatives were provided as possible answers. Approximately 42% of respondents stated that all living beings (including plants) are conscious, while 37% responded that only animals are conscious, 5% responded that only human beings and domestic animals are conscious and 16% responded that only human beings are conscious (Figure 3). Two alternatives were not marked by the respondents: "only vertebrate animals have some kind of consciousness" and "only mammals have some kind of consciousness". This question deals with the discussion about the so-called animal consciousness (Dennett, 1995), a theme that has been expanding in the academic world and in society in general, in line with the growth of the environmentalist movement. It is also related to the view that the closer a given living being is to humans in evolution, the greater the chance that this living being has some kind of consciousness, in the opinion of people in general.

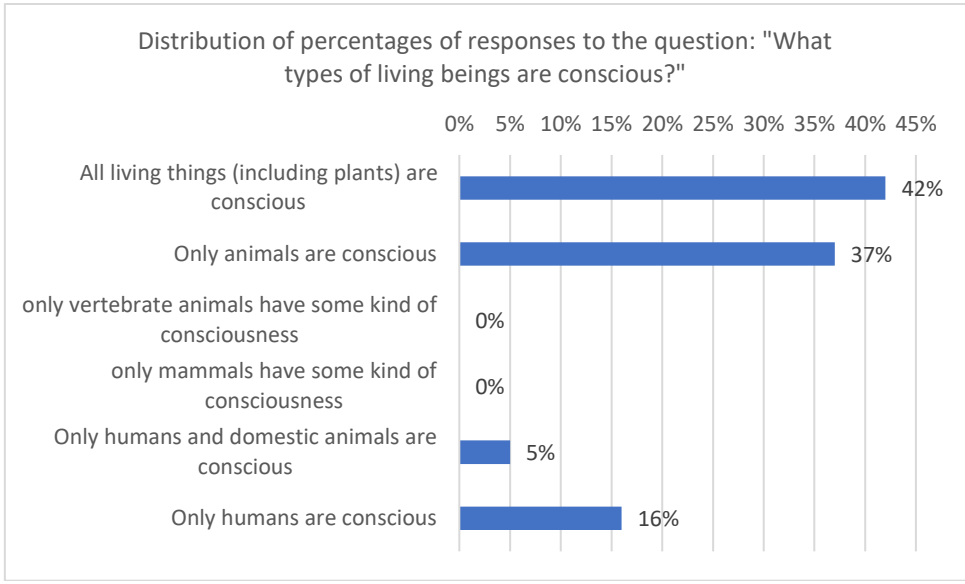

Figure 3: Distribution of percentages of responses to the question: "What types of living beings are conscious?" (N=19).
Source: Authors (2023).

The fourth of these questions asked which area (discipline) the person considered to be most related to the study of consciousness: five possible disciplines were provided as alternatives for the answers. About 47% of respondents said the discipline most related to the study of consciousness was neuroscience, while 21% said it was philosophy, 16% said it was psychology, and 16% said it was mathematics; no participant responded by ticking the computing discipline (Figure 4). In fact, in the academic environment, an appreciable number of researchers expect that both consciousness, thinking, emotion, behavior and cognition are in some way attributes resulting from brain activity and mediated by neurons, the cells of the nervous system (Mattos; Silva & Gama, 2019).

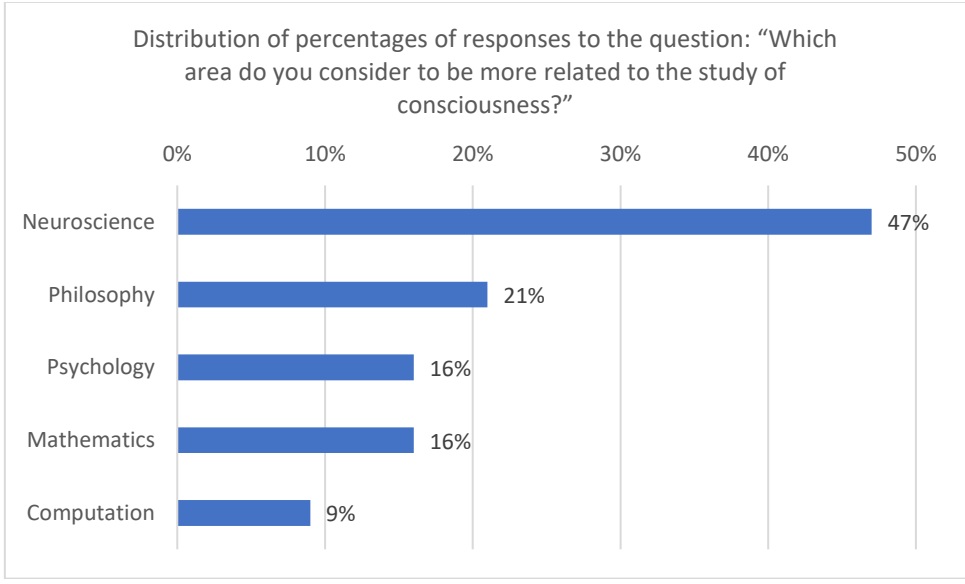

Figure 4: Distribution of percentages of responses to the question: “Which area do you consider to be more related to the study of consciousness?” (N=19).
Source: Authors (2023).

The final and open question of this form was optional and asked the participant: “Define in your own words what consciousness is”. About 42% of the participants (less than half) answered this last question. Below we will reproduce the responses that were given about how the participant defined consciousness: “Consciousness is the power of human beings to question and reason. To act with consciousness is to know the reasons for this attitude and its consequences”; “Perception of knowing what is right or wrong”; "Thought"; “It's knowing that you're alive and that death is a certainty; understanding of experiences and perception about subjects”; “These are perceptions regulated by neuronal activities mediated by physical-chemical reactions”; “Stimuli that prove my existence”; “The notion of stimuli around an individual that confirm their existence”; “It is the state of conceiving and feeling what one experiences”. It is noticed that the main arguments provided are associated with two basic perspectives: consciousness as related to the act of thinking and reasoning and consciousness as related to the act of perceiving and experiencing the world around through the senses.

As the study of consciousness is an open problem and located at the frontier of current scientific knowledge, both the web conference itself and the questions on the form sought to stimulate the participants' reflection and imagination about the topics investigated. As a result, the answers provided reflected to a certain extent the diversity of existing perspectives on consciousness that were addressed in the activity, for example, whether considering the reductionist paradigm (Sommerman, 2011), or considering the emergentist paradigm (Anderson, 1972).

So, as it is possible to see from the patterns of the answers given, a multiplicity of points of view on the phenomenon of consciousness was obtained for the questions: “What do you consider to be the best definition of consciousness?”, “What types of living beings are conscious?”, “Which area do you consider to be more related to the study of consciousness?” and “Define in your own words what consciousness is”. This shows, again, the importance of an interdisciplinary approach, linking areas as Neuroscience, Psychology and Philosophy, to study consciousness (Baars, 2003).

Final Considerations

This is an investigation work of an experience of scientific dissemination, more specifically, of a web conference held on the subject of chemophysics of consciousness, in October 2021. Carrying out this and other activities remotely with transmission on YouTube, showed that the use of technological resources like this, in the scope of teaching, extension and research, intensified by the COVID-19 pandemic, will become increasingly present in academic life.

The implementation of the web conference analyzed in this article showed that the discussion about the origin of mental states (a research topic located at the frontier of current science), within the scope of teaching activities, can effectively collaborate for a better understanding on the part of students about the methods used by science to build new knowledge. The investigation carried out on the thematic axis of the emergence of consciousness made it possible to perceive scientific and philosophical knowledge that can collaborate with the learning process, in dissemination and teaching activities on this type of subject. In particular, it was possible to notice how the use of knowledge related to the History of Science can collaborate in dissemination and teaching activities.

Professor Osvaldo Frota Pessoa Junior revealed a genuine concern about the importance of scientific dissemination. Carrying out this activity revealed the importance of leading researchers in the diverse areas of knowledge to be open to dedicating part of their time to participate in scientific dissemination activities such as these, as this helps to clarify society about the importance of science and to attract the attention of the lay public to the topics addressed, as well as motivate university

students and even high school students to consider dedicating themselves professionally to research in the areas of the knowledge in question.

Carrying out scientific dissemination activities virtually and via the Internet, such as the web conference focused on in this research, revealed two positive aspects in relation to face-to-face activities, such as seminars and colloquiums, which are common in university institutions. Firstly, web activities can be attended by people who are located in the different places, both in Brazil and abroad: this reality contrasts with what happens with a face-to-face conference of a USP professor that could only be attended by members of the USP community. Secondly, the web conference held on the chemophysics of consciousness was an extension activity that was recorded on the YouTube channel "Debate Consciência" and became an educational legacy of this research, as it can be used in its entirety or by by selecting a specific excerpt, by teachers interested in working didactically with this theme in the classroom.

This research found that the theme of the origin and nature of consciousness, which is important in scientific and philosophical terms, also has great potential to be used in educational activities, as it stimulates creativity, develops an investigative spirit and motivates students to imagine what will be the future evolution of this area of research: this opens up the possibility for scientific and historical knowledge to be worked on with students so that they have better foundations and parameters to think about possible scenarios for the development of this field of Science.

Acknowledgments

We thank Professor Osvaldo Frota Pessoa Junior for holding the web conference, which is the focus of the investigation developed in this article. We also thank CNPq and FAPESP for the support given to this research.

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