

## Investigating the Compatibility of Neuroscience and Education from the Perspective of Philosophy of Education

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### ABSTRACT

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The primary aim of this article is to critically examine the feasibility of integrating neuroscience and education from the perspective of the philosophy of education. It addresses the question of what kind of relationship between these two fields can be regarded as philosophically justifiable and educationally acceptable. This question is explored through conceptual analysis and a critical review of relevant interdisciplinary literature. Although neuroeducation has been institutionalized in several universities worldwide, it has also been criticized by philosophers of education, some of whom have dismissed it as another form of “neuromyth.” In response, this study examines major proposals for relating neuroscience and education and identifies three possible models: subservient, oppositional, and interactive. The article argues that the interactive approach provides the most defensible framework. To support this claim, it engages with key objections raised by philosophers of education concerning the epistemological and normative limits of neuroscience. Drawing on the work of Sidney Hook, Harry Broudy, and William Frankena, the study emphasizes the importance of grounding the philosophy of education in the scientific dimensions of educational practice. Through selected examples, the article illustrates how neuroscientific findings can contribute to clarifying educational aims, improving learning processes, and refining core concepts such as cognition and thought. Adopting a “soft dualism” perspective, it argues that philosophy of education necessarily involves both descriptive (“is”) and normative (“ought”) dimensions. The article concludes that neuroscience, by illuminating the descriptive aspects of learning and cognition, can meaningfully inform educational theory and practice without undermining their normative foundations.

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## Introduction

Scholars in the field of philosophy of education often face challenges when encountering new ideas, such as the application of computers and other technologies in education, or emerging concepts like educational neuroscience, neuroeducation, and brain-based learning. Conversely, they endeavor to question and critique these ideas from a philosophical-educational standpoint. Neuroscience, as an emerging discipline, is a prominent candidate for integration into the educational realm. Aided by brain-imaging technologies such as fMRI, MRI, PET, EEG, and MEG, this field has provided a wealth of data on the mechanisms and functions of the extraordinarily complex brain system (Jääskeläinen, 2012). This data has yielded fresh insights into phenomena such as thinking, learning, development, memory formation, and the nature of emotions, which has created a compelling incentive to apply them in the educational context (Goldberg, 2022; Tan, & Amiel, 2022; Goswami, 2008; Ansari & Coch, 2006; Immordino-Yang, 2017; Patten, 2011). However, as will be discussed, there is no single, unified view on the application of neuroscientific findings in education; rather, a spectrum of proponents and opponents exists (Thomas & Arslan, 2025; Thomas et al., 2024; Matta, 2021; Davis, 2004; Clark, 2015, 2017; Ansari & Coch, 2006; Bruer, 1997; Howard-Jones, 2008; Talkhabi, 2012). Although these debates have been ongoing for several years, ultimately leading to proposals for establishing disciplines like "Mind, Brain, and Education" or "Educational Neuroscience," this integration still faces significant opposition within the philosophy of education. For instance, the *Journal of Philosophy of Education*<sup>1</sup>, one of the most distinguished journals in the field, continues to publish articles arguing against neuroeducational approaches. Smeyers (2016), for example, coined the term "neurophilia" (a passion for neuroscience) to critique the utility of its findings for education.

Joldersma (2016) stated the following about the role of philosophers of education on the interconnections between neuroscience and education:

There is a need for philosophers of education to bring their expertise for an appraisal of the burgeoning educational neuroscience literature, including educational research, teacher education, and K–12 teaching (Joldersma, 2016, 2).

In this article, we examine the link between neuroscience and education through the lens of the philosophy of education, subjecting it to philosophical inquiry. The central question is: From the perspective of the philosophy of education, what justifiable link can be established between the two domains? To investigate this question, we must first articulate our definitions of "education" and "philosophy of education" to establish a clear standpoint for our critique.

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<sup>1</sup>. The *Journal of Philosophy of Education* is a leading international academic journal published by Wiley-Blackwell on behalf of the Philosophy of Education Society of Great Britain. It is a key publication for scholarly work in the field. For more information, see: <https://onlinelibrary.wiley.com/journal/14679752>

Assuming the human as an agent, we define education as the emergence of desirable cognitive and axiological transformations through an asymmetrical, interactive process between the two poles of student and teacher (Bagheri, 2013b, 2013a). In other words, education leads to the creation or becoming of desired changes in knowledge and values (Hirst & Peters, 2011). Ultimately, education must be geared towards fostering individual and social growth and transcendence, relying on non-causal methods that stem from the will and volition of the learner. Based on this, the generation of desirable and valuable actions can be considered the heart of education, and the prominent feature of these actions is the element of desirability, which is prescriptive in nature.

In addition to defining education, we must also offer a definition for the philosophy of education. As a human enterprise, education possesses a dual nature, encompassing both theory and practice. The theoretical dimension addresses the normative questions of "why"—concerning educational aims, values, and justifications. The practical dimension, conversely, deals with the descriptive and procedural questions of "how"—involving methods, curricula, and pedagogical interactions. Recognizing this dual nature, we conceive of the philosophy of education through the framework of "soft dualism" (Bagheri, 2013). According to this view, the philosophy of education is neither a purely theoretical activity of conceptual analysis (e.g., Hirst, 1993), which overlooks the practical aspects of education, nor an activity solely focused on practice, where theoretical reflection is not a fundamental component (e.g., Hirst & Carr, 2005). Rather, in this conception, any theoretical activity within the realm of education must consider its practical implications, and vice versa. This framework is crucial for navigating the relationship between a descriptive science like neuroscience (the "is") and the normative goals of education (the "ought").

In the following sections, we will focus on perspectives that have critiqued the integration of neuroscience and education, briefly discussing a selection of these views before elaborating on the viewpoint we find to be the most justifiable.

## Methodology

The present study employs a qualitative methodology, utilizing a philosophical approach grounded in conceptual analysis and a critical literature review. This approach is fundamentally non-empirical, designed to address the research question concerning the normative and logical justification for establishing a relationship between neuroscience (a descriptive science) and education (a normative practice). The aim of this research is not to generate new empirical data, but rather to analyze, critique, and synthesize existing theoretical frameworks in order to construct a coherent philosophical argument (Creswell & Poth, 2018).

The research process was conducted in three distinct yet overlapping stages:

**1. Systematic Review and Descriptive Synthesis:** The initial stage involved a systematic review of the scholarly literature at the intersection of neuroscience and education. Using

academic databases such as JSTOR, Wiley Online Library, Scopus, and Google Scholar, a corpus of key texts was compiled. Search keywords included "philosophy of education," "educational neuroscience," "neuroeducation," and "brain-based learning." The purpose of this stage was to map the existing intellectual landscape, identifying its key proponents, critics, and central debates. Based on this synthesis, the three primary approaches discussed in the article—functional (subservient), oppositional, and interactive—were identified and categorized.

**2. Critical Conceptual Analysis:** The second stage entailed a deep conceptual analysis of the foundational terms and assumptions that underpin this debate. Conceptual analysis, a cornerstone of the analytic tradition in the philosophy of education, seeks to clarify the meaning of concepts, expose ambiguities, and evaluate the logical validity of the arguments in which these concepts are employed (Hirst & Peters, 2011).

**3. Argumentative Synthesis:** The final stage moves beyond critique to the construction of an argument. Drawing upon the insights derived from the conceptual analysis, this study builds a reasoned argument in defense of the "interactive approach." This stage is not merely a summary of a preferred viewpoint but an argumentative synthesis that acknowledges the validity of certain criticisms (such as the dangers of "neuromyths" and reductive materialism) while demonstrating the philosophical viability of a synergistic relationship. The proposed framework, grounded in soft dualism, aims to reconcile the descriptive power of neuroscience with the normative commitments of education, thereby providing a robust philosophical foundation for the field of educational neuroscience.

By employing this philosophical methodology, this article seeks to provide the conceptual clarity and logical rigor necessary to evaluate the possibility of a fruitful and coherent collaboration between neuroscience and education.

### **Fundamental Approaches to the Integration of Neuroscience and Education**

It is worth noting at the outset that new fields of knowledge and technologies, in their nascent stages, often attract enthusiasts who are prone to exaggeration in their advocacy. For instance, in his article "Computers in Schools?" Scheffler (1997) examines the introduction of computers into educational settings. He challenges the taken-for-granted assumption that the computer revolution must be reflected in school curricula and that its instruction should be an integral and essential component of students' education. By questioning this axiom, Scheffler contends that the use of computers must be judged based on its alignment with educational aims.

This type of fascination is fully applicable to neuroscience. Some proponents advocate for utilizing this knowledge in education in any way possible, a trend that can even lead to the application of flawed ideas and misconceptions about the mind and brain's functions. For example, the discourse surrounding "neuromyths" in the context of neuroscientific findings points to such haste (Torrijos-Muelas, et al., 2021). These myths have been reported among teachers in various countries, including the United Kingdom, Brazil, Turkey, the Netherlands,

Latin America, Greece, and China (Grospietsch, & Lins, 2021; Gleichgerrcht, et al., 2015). In this regard, Tardif, et al., (2015) note that although "neuromyths"—which they define as false beliefs or misinterpretations of neuroscientific facts<sup>1</sup> lacking empirical support—are misleading, they have nonetheless been accepted by teachers in some contexts. As noted, this intense focus, fascination, and misuse of emerging knowledge and technologies have been reported even in developed nations. Some research has shown that neuroscientific findings possess a seductive allure for audiences; in studies where incorrect explanations for certain phenomena were presented, participants deemed the claims to be true solely on the basis that they were supported by neuroscientific evidence (Weisberg, Taylor, & Hopkins, 2015). Based on the foregoing, from the perspective of the philosophy of education, it is imperative to adopt a critical stance toward the introduction of any new technology or approach claiming applicability in education, so as to prevent an incongruous union.

Numerous studies have explored the integration of neuroscience and education. Naturally, these studies have not all spoken with one voice about the possibility or impossibility of such a link. This body of research can be categorized into three groups. The first group denies the possibility or utility of a connection between neuroscience and education. The second group considers the relationship between these two fields to be essential and indisputable. Finally, the third group maintains that establishing a connection between these two domains requires careful reflection and examination.

The first group holds that establishing a link between the two fields is impossible because neuroscience cannot justifiably influence education. For example, Nola Purdy and Hugh Morrison argue that "the entire educational-neuroscience project is misconceived and misguided" (Purdy & Morrison, 2009, as cited in Schrag, 2013, 20). Similarly, Davis (2004) calls the linkage of neuroscience and education a "category mistake." (p. 34). He critiques what has been termed "brain-based learning," arguing that placing such a monumental burden on neuroscientists and neurophysiologists alone is both unfair and incorrect. Paul Smeyers, in a strong critique of applying neuroscientific findings to education, contends that the promise of "neurophilia" is yet another neuromyth that must be judged and re-examined by philosophy and education, stating for instance:

Although there is evidence for the utility of neuroscientific insights in education, these cases are limited, and generally, we should not have high expectations for this discipline in education and educational research. (Smeyers, 2016, 62).

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<sup>1</sup>. For instance, concepts such as "differentiating curricula based on left/right brain dominance," "sensitive periods of development," "the impact of unsaturated fats and Omega-3 on reading ability," and the "Brain Gym" metaphor serve as pertinent examples. If such notions are applied without critical philosophical-educational reflection, they can lead to conclusions and educational policies with adverse and detrimental consequences.

Joldersma, in a statement similar to the view of philosophers critical of the direct connection between neuroscience and education, has said this:

point is that there seems to be a category mistake, where scholars talk about what the brain does, when it ought to be about what a person does (Joldersma, 2016, 4).

The second group, in contrast to the skeptics, considers the relationship between neuroscience and education to be essential and beyond question. Patricia Wolfe, for example, argues that just as any specialist requires knowledge of the systems involved in their field to perform optimally, educators analogously require a detailed understanding of the human brain. To foster deep and meaningful learning, she posits, they must understand and apply "brain-compatible principles" in the educational realm. She maintains that "information about the brain... is a fundamental and essential element upon which we must base our instructional decisions" (Wolfe, 2003, 208). Others have referred to findings from neuroscience about how the brain works as a "wonderful opportunity" for education (Carew & Magsamen, 2010). Figures like Jensen employ terms such as "accelerated learning," and their writings even mention the acceptable use of pills like Nimodipine or "memory pills" (a pill that helps students better commit what they have studied to memory) (Jensen, 2004).

Finally, a more balanced stance is found in the third group. Proponents of this view defend the possibility of a link between the two disciplines but oppose a unilateral and direct relationship from neuroscience to education (Thomas & Arslan, 2025; Matta, 2021; Schrag, 2011 & 2013; Clark, 2015; Howard-Jones, 2008; Nouri & Mehrmohammadi, 2010; Kraft, 2012). While affirming the possibility and necessity of establishing a connection between neuroscience and education, these researchers have articulated their educational and philosophical concerns regarding the application of neuroscience. They call for vigilance and caution in interpreting educational findings derived from brain-based research, yet they ultimately endorse this integration, even deeming it illogical not to utilize findings from neuroscience in education.

### **A Critique of the Application of Neuroscience in Education from the Perspective of the Philosophy of Education**

To determine how and in what contexts a link between neuroscience and education can be proposed and accepted, one effective approach is to examine the fundamental components of education. From the vantage point of the philosophy of education, we can then assess the extent to which neuroscience can make a justifiable contribution to these areas and, conversely, where it is incapable of doing so. This method allows for a more precise delineation of the boundaries between the two disciplines of neuroscience and education. It appears that with these boundaries established, the integration and synthesis of these two fields can proceed on a more logical

foundation. Consequently, the risk of one discipline being subsumed by the other, or of its essential character being distorted in this new synthesis, can be largely mitigated. As mentioned earlier, one school of thought deemed this integration to be essential and, at times, unilateral, obligating education to directly apply neuroscientific findings in the classroom. Another group, however, fundamentally denied the possibility of any direct or successful link. A careful examination of the core elements of education from a philosophical perspective, and an analysis of the role neuroscience might play in defining and developing them, can lead to a more nuanced judgment and a better understanding of the possible connections. Ultimately, this allows us to evaluate the proper form of this integration and the appropriate manner in which to apply neuroscientific findings in education.

The first point consistently raised by philosophers of education is that descriptive sciences cannot dictate terms to a fundamentally prescriptive discipline like education (Matta, 2021). While we will delve into the "is-ought" distinction, it must be acknowledged that educational prescriptions require scientific foundations or findings that provide an accurate description of the human being. Neuroscience offers such findings, as it has furnished novel insights into the biological and physiological aspects of human beings, particularly regarding the mind and brain (e.g., mechanisms of learning, emotion, feeling, development, thinking, and other cognitive components). With this in mind, it must be emphasized that the foundations of neuroscience and neurobiology deserve as much attention as other scientific foundations of education and should be leveraged to improve educational theory and practice (Joldersma, 2016). Therefore, the philosophy of education can accept the role of these findings in enriching the anthropological foundations and theories of education. Endorsing Sidney Hook's opposition to a purely deductive method as sufficient for all of education's needs, Bagheri, et al., (2010) states:

If someone were to claim that we can satisfy every need in the scientific domains of education through deduction from philosophical beliefs, without recourse to empirical science, they would undoubtedly be in error, because the particular and detailed aspects of scientific domains cannot be recognized without empirical investigation (Bagheri, et al., 2010, 108).

By this analogy like as Bagheri, we can argue that the philosophy of education should not preemptively exclude empirical sciences like neuroscience, which provide an understanding of objective phenomena, from the realm of education. In this vein, the philosopher of education William Frankena, in his deductive model, also took a similar approach by giving serious consideration to factual premises, the provision of which is recognized as the role of empirical findings. For Frankena, "factual premises" refer to those scientific propositions that guide us in charting a course toward achieving the fundamental aims of education (Bagheri, et al., 2010, 109-112).

In line with the role of neuroscience in providing specific, scientific details about the empirical aspects of education, it can be said that neuroscience gives us the opportunity to understand the brain's capacities and limitations in learning. Its findings even facilitate reflection on the very nature of learning. For example, contrary to the traditional view that generally considers emotions to be a disturbance and impediment to reason and sound judgment, the work of Antonio Damasio shows that emotions and feelings are central to any decision-making and reasoning we undertake regarding our social situation and the regulation of our lives<sup>1</sup>. This perspective is grounded in his "Somatic Marker Hypothesis," which posits that emotional processes are not disruptive but rather essential guides for rational decision-making. According to Damasio, emotions are tied to bodily states ("somatic markers") that provide rapid, intuitive feedback on the potential outcomes of our choices, especially in complex social and personal contexts. For education, this implies that creating emotionally engaging learning environments is not a mere motivational tool but a fundamental requirement for developing sound judgment and deep cognitive understanding. This neuroscientific insight resonates with contemporary philosophical discussions in education, such as those highlighted by thinkers like *Liz Jackson*, who re-examine the integral and constructive role of affect in learning and ethical development. From Damasio's perspective, reasoning is fundamentally dependent on the proper functioning of emotions and feelings. If, for any reason, the function of emotions and feelings is compromised, the process of reasoning and decision-making will be impaired (Damasio, 2003, 2010, 2019). Therefore, we can revise the previous attitude toward reason and rationality, recognize the positive and constructive role of emotions and feelings in the cultivation of reasoning ability, and nurture it accordingly. Immordino-Yang and Damasio also contend that for deep and meaningful learning to occur, it must be profoundly intertwined with students' emotions and feelings (Immordino-Yang & Damasio, 2007). These collective findings represent new insights added to the body of human knowledge from the perspective of neuroscience and neurobiology, and as such, they can guide the philosopher of education toward new understandings of the human being (i.e., capacities and limitations of mind and cognition). One example from Damasio's perspective is his distinction between feeling and emotion and his emphasis on their constructive role in reasoning, which holds significant potential for understanding the nature of the educational act.

Having feelings is of extraordinary value in the orchestration of survival.  
Emotions are useful in themselves, but the process of feeling begins to alert

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<sup>1</sup>. Within his theoretical framework, Damasio's "Somatic Marker Hypothesis" seeks to explain and elucidate the idea that the mind is constructed by and through the body (encapsulated in his well-known declaration from Descartes' *Error and Self Comes to Mind*: "no body, never mind"). Consequently, if the body or its somatic states are compromised, the mind will be correspondingly affected. He posits that a deficit in emotional signaling (i.e., somatic states) leads to impaired judgment in decision-making, particularly in the personal and social domains (for a more detailed discussion, see Damasio, 2010, 2003, 1999).

the organism to the problem that emotion has begun to solve. The simple process of feeling begins to give the organism incentive to heed the results of emoting (suffering begins with feelings, although it is enhanced by knowing, and the same can be said for joy). The availability of feeling is also the stepping stone for the next development—the feeling of knowing that we have feelings. In turn, knowing is the stepping stone for the process of planning specific and nonstereotyped responses which can either complement an emotion or guarantee that the immediate gains brought by emotion can be maintained over time, or both. In other words, “feeling” feelings extends the reach of emotions by facilitating the planning of novel and customized forms of adaptive response (Damasio, 1999, 363).

As stated here, Damasio believes that the role of feelings in regulating human social behavior (including in rational education and the cultivation of reason and argumentation) is highly significant. He also provides evidence showing that when “previously healthy individuals suffer damage to brain regions (such as the prefrontal cortex) necessary for the deployment and processing of a certain group of emotions and feelings, their ability to manage and regulate their social lives is severely diminished” (Damasio, 2015, 170). From this, he concludes that one of the primary functions of feelings is the regulation of social behaviors and the enhancement of rational affairs. As mentioned, this view has specific implications for education and for fostering reason and rationality in student’s life. Examples of work that have introduced Damasio's neurobiological findings into the educational realm include Immordino-Yang (2015) and Patten (2011).

However, to examine the issue more precisely, we must analyze the fundamental components of education—including the nature of learning, its aims, and the roles of the student and teacher—in order to evaluate the potential contribution of neuroscience to these areas. The first challenge raised from the perspective of the philosophy of education against the direct and unmediated application of findings from descriptive sciences is that a descriptive discipline cannot dictate terms to a fundamentally prescriptive one. This point was also raised by Harry Broudy (1954) in determining the role of a descriptive science (psychology) in a prescriptive practice (education). In his article, “How Can Philosophy of Education Be Philosophical?” he seeks to clarify the relationship of the field to norms and values. Referring to fact-based sciences like psychology and sociology, Broudy asks what connection they can establish with discussions of values and norms. To answer this, he poses questions such as: Should university education be universal, or should it be restricted to those intellectually qualified? Should religion be taught as part of public education?

By posing such questions, Broudy aims to demarcate the territory of philosophy of education from that of the fact-based sciences, thereby demonstrating that these sciences cannot resolve

the normative aspects of these issues. Ultimately, such matters must be justified by strong reasons and grounded in an epistemological, ethical, and metaphysical theory. Regarding the answers to the above questions, he believes that although these questions pertain to or involve "matters of fact," these facts can only be considered divorced from philosophical scrutiny if science were to discover facts that prove a set of value norms so definitively as to leave no room for doubt (i.e., to make them certain). For example,

psychology were to prove the fact that optimal progress—by any value standard—is directly correlated with progress based on intelligence and is achieved through university education, then this matter would fall outside the framework of a philosophical debate and would become a conflict over the means to a universally accepted end (Broudy, 1954, trans. Beheshti, 2007, 41).

What Broudy states about the empirical and fact-based sciences can also be applied to the findings of neuroscience. We can pose the challenge of how it will solve the problem of axiological and normative desirability when educational acts are inextricably linked to desirable values and knowledge. Has neuroscience advanced to the point where we can derive value and normative matters from it with certainty, telling us what the values of the educational and social system are and what cannot be a value? Can neuroscientific findings be linked to education, or even be transformed into an educational theory, without reliance on a philosophical outlook or divorced from philosophical considerations? It seems that neuroscience will be unable to answer the above questions, as its nature is descriptive; it can only provide data to educational specialists about the mechanisms of the mind and brain. Of course, this data is valuable because education can and should use both philosophical and scientific foundations, such as sociology and neurobiology, to better understand the human being. However, as discussed regarding the nature of education and educational acts, both possess a value-laden and normative dimension, the evaluation and analysis of which fall within the purview of specialists like philosophers of education, not neuroscientists.

The first example we wish to discuss here as a fundamental component of education is "learning." Proponents of linking neuroscience and education have cited the domain of learning as the most significant area where it can assist education (Tan, et al., 2022; Torrijos-Muelas, et al., 2021; Goswami, 2008; Blakemore & Frith, 2009). However, we must acknowledge that even in this area, where neuroscience appears to have a primary role, the support is not as clear or robust as it seems. A conceptual and ontological difference between the domains of neuroscience and education regarding "learning" has been noted. For instance, it has been observed that in neuroscience, whenever the term "learning" is used, it is often synonymous with "memory," where memory formation is understood as changes in the communication patterns between neurons, or synaptic plasticity (Howard-Jones, 2012). In general, from a

neuroscientific perspective, learning refers to the changes (strengthening or weakening) in neural patterns and connections that result from the formation of new synapses (synaptogenesis) or the elimination of these synapses (synaptic pruning) (Talkhabi, 2012; Nouri, 2015). Howard-Jones, however, deems such a view of learning insufficient and seeks to incorporate normative perspectives. For example, referencing the findings of the UK's "Teaching and Learning Research Programme," he notes that their principles of learning state that:

learning should equip the learner for life in its broadest sense" and "promote individuals' independence and autonomy," such that learners have "confidence and a sense of self as agents of their own learning (Howard-Jones, 2008, 366).

As is evident in these statements, a description and explanation of the mechanisms and underpinnings of learning at the neural level are not sufficient for education. We are ultimately compelled to adopt principles that imbue learning with a normative and desirable quality—the primary characteristic of educational acts. As Howard-Jones (Howard-Jones, 2008, 366). points out, none of these principles were discovered at the neuronal or neural-structural level; rather, they were derived from broad reflection and a holistic view of learning and teaching as part of education. In this context, Talkhabi (2012) argues that free will is one of the issues leading to incompatibility between neuroscience and education. Education seeks to cultivate learners to engage in learning independently and spontaneously, experiencing their free will in the process. This is while neuroscience views the existence of free will with skepticism; for example, "Wegner has called free will a trick" (Cigman & Davis, 2009, as cited in *ibid.* 16). The emergence of these challenges from the perspective of the philosophy of education makes us realize that we should not expect neuroscience to enter the practical field of education directly, even in its most foundational area (such as learning)—where even its most ardent supporters believe it has the greatest potential to help—without the involvement of philosophers and educational specialists.

Regarding the difference between descriptive and prescriptive conceptions of learning, Ribot (1968), a philosopher of education, emphasizes this point in his discussion of the difference between aims and knowledge in education versus other domains of human knowledge. Because education is always concerned with values, it cannot be devoid of value judgments; rather, education, instruction, and teaching are undertaken for something valuable. He speaks of learning in this way:

To learn is not just to acquire knowledge or durable behavioral habits, but also—rightly or wrongly—to deem these things desirable and valuable (Ribot, 1968, trans. Beheshti, 2007, 157).

If we are to use this statement from Ribot to articulate our own idea about the nature of education and the philosophy of education, we must point out that the philosophy of education cannot consider the occurrence of learning, or the provision of any kind of learning, to be an educational event or activity. Instead, it subjects it to philosophical scrutiny in at least two respects: a) its value, and b) its method. In discussing value, attention is paid to why a certain thing should be an aim of education. For example, it is asked why, from among a vast diversity of knowledge and values, specific items should be taught to the learner. Fundamentally, does such a subject or skill have a defensible aspect in terms of contributing to the desirable growth of the individual's personality system? It is only after such philosophical considerations that learning in the realm of education distinguishes itself from learning in the sphere of non-educational training.

Another matter considered a core pillar of education is educational aims. Aims in education are generally dependent on our conception of the ideal human or the educated person. Education manifests in desirable acts, and the realization of these desirable acts requires the emergence of cognition and conception, the presence and expression of emotions and feelings, and the appearance of will and volition for that act to come into being (Bagheri, 1996, 2013b, 2013a). If we were to define aims on this basis, we would have to see them as pertaining to those desirable cognitive-axiological transformations that are based on the development of cognitive, emotional, affective, and volitional infrastructures. The point here is that the element of desirability is relevant in education because education fundamentally seeks to cultivate individuals whose personal and social lives are managed in the best possible way, such that individual happiness and satisfaction, as well as social betterment, are achieved. This very goal—the optimal management of individual and social life and the pursuit of happiness and satisfaction—leads to the pursuit of various ideals and aims, and desirables are defined and interpreted within this scope. If one asks what these desirables are, in short, one can name as individual and social desirables those things that the educational system expects to be manifested in individuals' actions. But if we look at these desirables carefully, we realize they are normative matters, more related to macro-level "oughts" and desirables. The determination of such things cannot fall within the domain of a descriptive science (like neuroscience); rather, throughout the history of human thought, such matters have fallen within the domain of disciplines like philosophy, which have articulated comprehensive theories (both descriptive and prescriptive) about human beings and human social life. However, as we showed in Frankena's deductive model, a widely used pattern in education, empirical findings (including from neuroscience) can also be employed in the pursuit of fundamental aims. Therefore, regarding educational aims, in the integration of "neuroscience and education," it can be said that when philosophers of education draw upon neuroscientific and neurobiological foundations, the insights these sciences provide about the functions of the mind and brain can enable them to gain appropriate perspectives on cultivating various aspects of cognition and

increasing the capacity of executive functions. This allows for the achievement of aims and the learning of important skills like problem-solving with better approaches and methods. For example, findings from neuroscience teach us that when alertness levels are low or when an individual perceives a situation as threatening, learning cannot occur (Grospietsch, & Lins, 2021; Kharrazi & Talkhabi, 2011). This is precisely what philosophers of education like William Frankena and Sidney Hook have deemed permissible to enter the educational sphere, as a purely philosophical approach is incapable of providing the detailed knowledge about the empirical underpinnings of learning.

Another area for demonstrating the conceptual difference between neuroscience and education relates to the roles of the learner (student) and the educator (teacher/instructor). Here too, it must be added that in the realm of education, merely describing and revealing the mechanisms of learning (a valuable task that neuroscience accomplishes) will not suffice. Rather, a philosophical view of the human being as a creature (a person) who may or may not have the capacity for choice, upon which education must be based, is at the core of any educational system and directly influences the determination of educational aims and methods. For example, if our philosophical view of the human being posits agency and we believe in human agency, then all elements of education must revolve around this principle. In this case, educational aims and methods would be meaningless without conceiving of and considering the student's will and choice. For instance, in such an educational system, it is emphasized that the method of bringing about learning must not be indifferent to the individual's will. One cannot even speak of *choosing* educational aims *for* learners; rather, one must speak of aims being *chosen by* them. If this principle is fundamentally violated, not only will the aim not be educational, but the method of learning that aim will also be non-educational because it has disregarded the individual's will. Therefore, according to the definitions of education and philosophy of education provided, neuroscientific findings cannot directly lead to a conclusion about what the roles of the student or teacher will be. They can, however, provide insights that draw the philosopher of education's attention to the role of the biological and physiological aspects of the human being in the formation of the mind and the development of the self. This, in turn, can lead to conclusions about determining the positions of the teacher and student and the interaction between them. For instance, findings from affective neuroscience regarding the formation of the mind and the crucial role of emotions and feelings in social interactions can transform the interactive model and the roles of teacher-student in educational interactions. In this context, having human and social connections and interactions is even posited as a right. It is for this reason that, based on these findings and in order to secure the rights of students from different worldviews, some (Nouri, 2016) speak of a "culturally responsive curriculum." Here, drawing on findings from neuroscience about the neuro-cultural foundations of learning and development, it is argued that findings from this field support the claim that neural and behavioral differences between cultures arise from the unique interaction among various

genetic, physiological, and cultural factors. This combination of interactions causes the brain to continuously adapt itself to the cultural environment (which is the vessel for these interactions), resulting in its structure and function adapting in line with this accommodation. Thus, it is observed that the mechanisms underlying cognition and emotion are fundamentally influenced by the quality of the cultural environment, and consequently, cognitive-emotional development is affected by this environment. This has led to the discourse on a "culturally responsive curriculum," as a way to protect the rights of students and teachers to hold different worldviews, with the recommendation that it be given serious attention in school curricula (Nouri, 2016).

### **Subservience, Opposition, or Interaction Between Neuroscience and the Philosophy of Education?**

Given what has been discussed regarding the need for the philosophy of education to draw upon the empirical sciences, as well as the necessity for philosophical scrutiny of the application of their findings in the educational realm, we can conclude that the relationship between neuroscience and education cannot be subservient. That is, education cannot passively submit to the application of neuroscientific findings.

### **The Subservient Approach and Its Critique**

Given the intrinsic nature of education, in which the dualism of "is" and "ought" to be ever-present, the relationship between education and neuroscience cannot be that of a leader and a follower, where one domain completely supplants or marginalizes the other. For instance, this approach would entail accepting whatever neuroscience, as a descriptive science, reveals about learning and its mechanisms as a given, to be applied in the educational (and even instructional) realm without philosophical questioning or critique. Philosophically, this approach is rooted in a form of scientific reductionism or scientism, which assumes that complex human phenomena like learning can be fully explained at a lower level of analysis (e.g., the neural level) and that scientific description can directly prescribe normative practice. It mirrors earlier attempts, such as radical behaviorism, to make education subservient to a single descriptive science.

To demonstrate the fallacy of an approach that expects education and its philosophy to apply neuroscientific findings without careful philosophical consideration, we can use the example of selecting curriculum content—just one of many educational opportunities—to reveal how such an idea rests on an oversimplification of the role of the philosophy of education. Curriculum content, in essence, comprises the knowledge and values that, through instruction, are intended to bring about the desired transformations in students' thoughts and actions (i.e., educational aims). In selecting content, we must confront numerous philosophical questions. A philosopher's first question is: What is knowledge, and what is value? Which factual claims constitute knowledge, and which are mere belief? Supposing we identify instances of

knowledge and value, we certainly cannot impart all of them to students. We are thus compelled to make selections, choosing from the vast body of knowledge and values a subset to serve as instructional content. This, again, requires a philosophical lens. The question must then be asked: How can neuroscience possibly lead an educational system of such magnitude and complexity? A brief consideration reveals that it is a vain expectation to think that neuroscience, by claiming to uncover the underlying mechanisms of learning and memory, can make education and its methods subservient to its findings.

### **The Oppositional Approach and Its Critique**

The oppositional approach between neuroscience and education entails adopting a stance that leads to its elimination or significant marginalization in educational theory and practice. For example, the oppositional view (Davis, 2004, 2013) is also flawed because it discourages any attempt to forge a link between neuroscience and education. In essence, this approach advocates for ignoring the findings of neuroscience, deeming them unhelpful or even misleading, despite the fact that some of its insights are indeed helpful. This oppositional stance is philosophically grounded in a strict interpretation of the is-ought problem, famously articulated by David Hume, which argues that one cannot logically derive normative statements ("ought") from descriptive statements ("is"). Furthermore, it echoes Gilbert Ryle's concept of a "category mistake," suggesting that applying the language of neuroscience to the personal, normative world of education is a fundamental conceptual error.

We cannot argue that because education is intrinsically prescriptive, neuroscience, being descriptive, must be excluded from the scene. As noted, our prescriptions require consideration of reality and its underlying foundations. For instance, as we have shown, Damasio's work on the nature of the human being and the description of its biological and physiological aspects can draw the philosopher of education's attention to fundamental aspects of human development (such as the role of emotions and feelings in the formation of the mind and self) and thereby lead to more precise prescriptions regarding human beings. In his discussion of moral action and human responsibility, Damasio considers the possession of feeling and cognition as a factor that makes humans accountable for their actions. He believes that when a human possesses feeling, it means the mind becomes aware of the organism's actions; they do not simply occur in an unconscious, uncontrolled process. According to Damasio, this is what gives rise to moral responsibility.

When the mind is informed of the actions taken by our organism, the feeling associated with the information signifies that the actions were engendered by our self. Both information and authentication of ongoing actions are essential to motivate the deliberation of future actions. Without that sort of felt, validated information, we would not be able to assume moral responsibility for the actions taken by our organism (Damasio, 2010, 211).

Damasio has stated elsewhere:

We humans, conscious of the relation between certain objectives and certain emotions, can willfully strive to control our emotions, to some extent at least. We can decide which objects and situations we allow in our environment and on which objects and situations we lavish time and attention. We can, for example, decide not to watch commercial television, and advocate its eternal banishment from the households of intelligent citizens. By controlling our interaction with objects that cause emotions we are in effect exerting some control over the life process and leading the organism into greater or lesser harmony (Damasio, 2003, 46).

This statement from Damasio, alongside his emphasis on using the power of emotions for a "better" world and planning for the betterment of global culture based on a greater understanding of the underpinnings of human decisions (Damasio, 2012, 2015), indicates that he accepts a scope and range for human willpower and free choice. Thus, such a perspective, which accepts both will and "human responsibility" through the intertwining of cognition, emotion, feeling, and consciousness, has the potential to facilitate a theoretical reconciliation between a philosophical viewpoint (human agency) and neuroscience. Consequently, the notion of completely dismissing all neuroscientific approaches is subject to critique, and the oppositional and antagonistic stance should be abandoned.

### **The Interactive Approach: The Defensible Stance**

In contrast to the previous two approaches, we can speak of an interactive approach. When we speak of interaction between the two disciplines, we mean a bilateral relationship and an exchange between them. As mentioned, philosophers of education like Frankena have called for leveraging empirical sciences, delegating to them the methods and particular details of education. Therefore, far from being a threat that would displace all existing educational theories, neuroscientific findings can, by furnishing supporting empirical evidence, provide an opportunity to strengthen and reinforce certain educational theories. This interactive model aligns well with the tradition of philosophical pragmatism, particularly the work of John Dewey.

Dewey (1930) argued against sharp dualisms (such as theory vs. practice or science vs. values) and viewed scientific inquiry as a powerful tool for informing and resolving practical and social problems. In this vein, the interactive approach sees neuroscience not as a source of ultimate authority, but as a resource that, through critical philosophical reflection, can help enrich and ground educational theory and practice.

In considering an interactive approach, and contrary to those who view education as a passive consumer of data from neuroscience and who envision a one-way relationship, others

believe that it is neuroscience that should create opportunities to learn from educational thinkers. Varma et al. (2008) argue that education can, in some circumstances, play a pioneering role in the future of neuroscience. They contend that education can steer future neuroscientific research toward more complex forms of cognition. For example, by inquiring into the nature of cognition, they can signal to neuroscientists not to remain at the level of studying perception and attention, but to also prioritize the investigation of more complex dimensions such as emotions, consciousness, and so on. By posing the question, "What phenomenon should be the subject of future brain imaging studies?" they can contribute to the advancement of both neuroscience and education. In this vein, Goldberg maintains that "effective changes in teaching practices should be fed back to neuroscientists, and this exchange should be maintained continuously (Goldberg, 2022).

Key Educational Concept	Subservient Approach (Education & Philosophy follow Neuroscience unilateral)	Oppositional Approach (Antagonism between Philosophy of Education & Neuroscience)	Interactive Approach (Mutual interaction to improve theory & practice, while preserving the integrity of each discipline)
Aims of Education	<b>Reductionistic:</b> Axiological and normative aims are ignored or reduced to neural processes.	<b>Segregationist:</b> Educational aims are defined entirely within the domain of philosophy and values. Neuroscience has no role—nor can it have one—in defining or informing them. The two domains are considered entirely separate.	<b>Integrative and Realistic:</b> Aims are determined by philosophy in accordance with values, but neuroscientific findings (e.g., the role of emotions in cognition) help to enrich these aims, ground them in reality, and enhance their achievability.
Concept of Learning	<b>Mechanistic:</b> Learning is equated with changes in synaptic connections, the formation of neural circuits, and memory consolidation. The dimension of "desirability" and value is disregarded; it is seen as a purely neurobiological process.	<b>Dualistic and Unrelated:</b> The descriptive concept of learning in neuroscience has no connection to its normative and axiological concept in education. Any attempt to link the two constitutes a "category mistake."	<b>Integrated and Purposive:</b> The neural process of learning (the "is") is guided by education toward the realization of "desirable changes" (the "ought"). Education attends to the neural mechanisms of learning to better achieve its own value-based aims.
Role of the Learner	<b>Mechanistic:</b> The student is viewed as a "brain" around which educational processes and components must be optimized. Concepts like human agency and free will are downplayed or ignored.	<b>Abstract and Philosophical:</b> Human agency and the roles of teacher and learner are defined entirely within the philosophical and ethical domains. Neuroscientific data are considered irrelevant and insignificant in this context.	<b>Holistic and Contextualized:</b> Human agency is accepted as a philosophical principle, but neuroscience contributes to a deeper understanding of the roles of teacher and student by illuminating the neuro-cultural foundations of social interaction.

<p><b>Role of the Philosophy of Education</b></p>	<p><b>Minimal or Eliminative:</b> The role of philosophy is severely diminished or eliminated. Its sole function is to clear the path for the direct application of scientific findings and to avoid obstructing it.</p>	<p><b>Exclusive and Absolute:</b> Philosophy plays an exclusive and central role, answering all normative and foundational questions in education without needing empirical data from neuroscience. Conversely, neuroscientific theories are claimed to define learning and to be directly applicable in practice.</p>	<p><b>Mediating and Critical:</b> The philosophy of education acts as a mediator, critical arbiter, and synthesizer. It refines neuroscientific findings (rejecting neuromyths) and integrates them into a coherent and compatible framework aligned with foundational aims and values.</p>
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## Conclusion

As a human enterprise, education, by its dual nature encompassing both theory and practice, requires nourishment from the full spectrum of human knowledge to ensure that both its theoretical and practical domains are robustly sustained. For this reason, both scientific and philosophical foundations are considered essential, as education must draw upon them for its own coherence and development. In this context, neuroscience, as a branch of human knowledge, falls within the category of the scientific foundations of education. Education must be informed by its findings to ensure its own dynamism and sustainability. In this light, an interactive relationship with neuroscience appears essential. As we discussed knowledge about how the brain works may not in itself be enough to convince students, Therefore, it is necessary that a holistic and philosophical view of growth and learning complement the purely biological view.

Based on the view we had on the philosophy of education, this interaction, however, must be genuine. It is not a matter of education becoming a passive consumer of empirical findings. As has been noted, the philosophical ethos of the philosophy of education is incompatible with uncritical acceptance of every new finding. It cannot be like a starving wanderer, desperate for sustenance, who immediately sets off in pursuit of any rumor of a wondrous new food source. Conversely, nor should the philosophy of education become so complacent with its current state that it refuses to explore, confining itself to a fixed set of frameworks, principles, and methods. It must not ignore new discoveries about the human being and the astonishing world of the mind and brain, deeming its own findings (or perhaps, its own constructs) and those of its philosophical tradition sufficient to guide the vast enterprise of education.

To express our preferred approach in this article metaphorically: if we consider education a living organism and its foundations a stomach, we can say that the organism requires nourishment for its energy and survival. Substances must enter its stomach to be digested and absorbed, thereby providing the energy necessary for the organism's survival. Two points are critical here. First, not all substances that enter the stomach are equally nutritious or energy-producing. Second, the stomach does not react uniformly to every substance, nor can it digest

and absorb everything. This analogy can be applied, with some latitude, to education and its foundations. For education to establish itself, maintain its stability, and preserve its dynamism, it must draw sustenance from scientific and philosophical sources. However, not all foundations will have an equal capacity to influence and transform it. As shown, neuroscience, as a descriptive foundation for the mechanisms of the mind and brain, can and does make a significant contribution to our understanding of the mechanisms of learning and the physiological and genetic dimensions of human beings, as exemplified by the work of Damasio and Immordino-Yang. Consequently, it has the potential to transform teaching-learning processes. Yet, we must ensure that the sustenance it provides to this "stomach" is not toxic (such as neuromyths), nor so raw and indigestible that it proves fatal to the organism of education. The reference to neuromyths and the seductive allure of neuroscientific findings serves as a caution against this very danger.

Overall, the justifiable relationship between education and neuroscience can be summarized as follows: consistent with our definition of the philosophy of education (soft dualism), this field of knowledge, while attending to both the theoretical and practical aspects of education, understands its activity to entail a concurrent focus on both the "is" and the "ought." It must create a compatible synthesis between the two, enabling it to judge and discern what constitutes nutritious and appropriate sustenance for the organism's survival and to determine how it can be provided. Given this characteristic of the philosophy of education, one of the acceptable points of contact between neuroscience and education is in the teaching-learning process—a primary site where the "is" and the "ought" to intersect. We can take certain "is" statements from neuroscience and, through rigorous philosophical reflection, place them in a compatible synthesis with the "oughts" of education. This ensures that the teaching-learning process proceeds in a direction that does not violate core educational principles, such as respect for the student's agency and autonomy. The role of the philosophy of education is therefore essential for creating this compatible synthesis. As mentioned, neuroscientists and thinkers in that field must accept this fundamental role of philosophy. Reciprocally, the philosopher of education must accept that neuroscience is not an impediment or a disruption to the philosophy of education, but rather a potential contributor to a more holistic and comprehensive understanding of education and its core elements.

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