

The Credentials of Brain-Based Learning

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This paper discusses the current fashion for brain-based learning, in which value-laden claims about learning are grounded in neurophysiology. It argues that brain science cannot have the 'authority' about learning that some seek to give it. It goes on to discuss whether the claim that brain science is relevant to learning involves a category mistake. The heart of the paper tries to show how the contribution of brain science to our grasp of the nature of learning is limited in principle. Finally the paper explores the potential of brain science to illuminate specific learning disabilities.

I INTRODUCTION

Some people imagine that they investigate learning itself by studying brain functioning. The required techniques are highly specialised and technical, enjoying dramatically rapid development with the advent of approaches such as Positron Emission Tomography (PET) scans. Moreover, it has become fashionable recently to talk of 'brain-based learning' and to attempt to add weight to educational recommendations by appealing to supposedly relevant discoveries about brain functioning.

In the light of this it is important to ask how far brain science can contribute to our understanding of learning. A comprehensive answer would require more than a few books. This paper identifies three or four issues for discussion from the much larger number that would need to be addressed in a definitive treatment. First I discuss first some of the philosophical issues raised by appealing to brain phenomena to justify claims about good or effective ways to learn. Next I examine the contention that relating recommendations about learning to brain phenomena involves 'category mistakes'. In the most important section of the paper I show that the scope for brain science to investigate learning is limited in principle. Finally I ask whether discoveries about the brain can illuminate the understanding of specific learning disabilities.

If any additional motivation is needed for this topic, consider a selection of projects from the 'Institute of Cognitive Neuroscience' at University College London (University College London, 2003). Daniel Ansari claims to be inquiring into the brain and behavioural bases, and the development

of numerical cognition in infants. James Blair is developing a model of the ‘cognitive mechanism underpinning the development of morality’, suggesting that morality is ‘a developmental consequence of a basic emotion mechanism’; he is currently investigating the ‘neural substrate mediating this mechanism’ using Positron Emission Tomography and examining patients with acquired lesions. John O’Keefe is looking at the neural basis of cognition and memory, while David Skuse is studying the genetic influence on the development and functioning of cognitive brain systems in humans, especially those systems concerned with social cognition.

These researchers evidently think they are exploring cognition and other aspects of mental functioning. Are they correct? Or, when they outline their research subjects, are they helping themselves to contestable *philosophical* assumptions? For the descriptions of their activities hint at many unsolved philosophical and conceptual problems. What precisely is ‘neural substrate mediating this mechanism’ supposed to mean? How might a neurophysiological event or process constitute the ‘base’ of numerical cognition?

II EDUCATION, VALUES AND THE AUTHORITY OF BRAIN SCIENCE

The American journal *Educational Leadership* regularly publishes articles about the contribution of brain science to teaching and learning. The audience appears to be teachers at the chalk face. *Educational Leadership* reports brain scientists as recommending specific approaches to learning. Marian Diamond, described as a neuroscientist and professor of neuroanatomy, urges us to ‘teach children how to think for themselves’ (in, D’Arcangelo, 1998, p. 21).

Now nothing *follows* about how children should be taught to think from empirical discoveries about the brain. This point needs a little elaboration. I am ready to accept that discoveries about brain functioning could in theory have *negative* implications for learning approaches. Scientists might show that an individual is unable to learn in a particular way, or to absorb subject matter of certain kinds when her brain is in a specified state. Hence in such an eventuality the value of learning in that way could not even be considered. However, as reported, Diamond is not doing this. On the contrary, she is telling us that, because the brain functions in a given way, various educational precepts follow. Yet surely her broad claim that children should learn to think for themselves would need to be supported with moral and political arguments. The ideal of thinking for myself is closely linked to autonomy. There is a powerful liberal tradition in which human autonomy has a central value. Nevertheless, the claim that human well-being is impossible without the kind of autonomy prized within liberalism is contested (for example by Parekh, 2000). In some traditions, thinking for myself is felt to have less importance than other values sometimes dubbed ‘communitarian’. The deep and complex debate between liberals and traditional cultures of various kinds surely cannot be

advanced by referring to neurophysiology. Neurophysiology cannot tell us what *matters* in terms of human flourishing.

Moreover, there may be an even more comprehensive difficulty. Some may feel that brain characteristics are just in *the wrong category* to help justify positive recommendations for learning. Yet perhaps the thought that brain characteristics are in the wrong category is itself open to question. Shortly I return to this point in my consideration of ‘category mistake’ manoeuvres.

Similar points apply to a second example. Diamond believes that the brain’s capacity for learning is limitless, and therefore education should continue for a life time: ‘With enrichment, we grow those dendrites; with impoverishment, we lose them at any age’ (Arcangelo, 1998). Because dendrites will continue to grow in an enriched environment—for instance, the kind of environment afforded by lifelong education, on her view we should therefore pursue lifelong education. Again, we might agree with lifelong education, but this vision certainly does not follow from the possibility of ‘growing dendrites’.

III CATEGORY MISTAKES, FOLK PSYCHOLOGY AND ‘CONNECTIONS’

Consider how some protagonists for the educational relevance of brain research combine biological and educational discourse. ‘Advances in neuroscience contribute to the development of curriculums that build on the way the brain constructs knowledge’ (Lowery, 1998). Eric Jensen (1998) entitles one of his articles ‘How Julie’s brain learns’. Other writers are happy to express themselves in similar ways: ‘The brain is essentially curious, and it must be to survive’; ‘The brain is innately social and collaborative’ (Wolfe and Brandt, 1998).

Some may feel that observations such as ‘the brain is essentially curious’ and many of the other examples are literally *nonsense*, that they involve ‘category mistakes’. From this perspective they resemble claims such as ‘Grey’s headache voted for George Bush’, or ‘Whales are prime numbers’. Supporting value-laden policies about learning by appealing to brain phenomena may be held to involve similar nonsense.

Paul Ricoeur refers to the semantics of two distinct discourses, one concerning the body and brain, and the other the mental, and offers his version of the category mistake verdict as follows:

These discourses represent heterogeneous perspectives . . . they cannot be reduced to each other or derived from each other. In the one case it is a question of neurons and their connection in a system; in the other one speaks of knowledge, action, feeling-acts or states characterized by intentions, motivations and values (Changeux and Ricoeur, 2000, p. 14).

Rom Harré also makes a similar case: ‘Our brains do not understand. They do not assign or contemplate meanings. There are only electrical and chemical processes in brain activity which would have no meaning except

in so far as they are the workings of cognitive tools that *people* use to think with' (Harré, 2002, p. 121). Persuasive as the category mistake verdict seems to be, it is hard to know how it could be securely established. The idea of a category mistake itself has a history in analytical philosophy going back to Gilbert Ryle. Ryle's familiar examples include one where a foreigner visiting Oxford sees the colleges, libraries and so on, and then asks where the University is. Ryle comments that he 'was mistakenly allocating the University to the same category as that to which the other institutions belong' (Ryle, 1949). Unfortunately this example will not help us. For the absurdity of thinking of the University as yet another item in the same category as Christ Church, the Bodleian Library and the Ashmolean Museum is manifest to all.

Yet apparently at least some scientists simply fail to see their research and their claims as involving such errors. For them brain facts appropriately figure in justifications for given approaches to learning. If so, what kind of rational argument might persuade them otherwise? There seems to be nothing left to say to someone who cannot 'see' category mistakes. We can only 'show' her examples of seemingly distinct discourses of the personal/mental/intentional and the neurophysiological, and hope she comes round to our way of thinking. Vigorous expression of scepticism about the relevance of such facts as growing dendrites to what should be done about learning might prove influential. Equally it might not.

We need to ponder these themes a little longer. In doing so we shall also begin to prepare the ground for the main argument against the potential of brain science to illuminate the nature of learning. I take up this argument in the following section.

Learning involves knowledge, memory, understanding, belief, motivation and attitude. Now these ideas are key features of a discourse and a set of interconnected concepts that have been described as 'folk psychology'. We all employ folk psychology to interpret and to talk about our own thoughts and actions, and about the thoughts and actions of others. We explain people's actions in terms of reason, motive, emotion, feeling, knowledge, belief, intention and desire. We often couch our interpretations in the form of a narrative. Folk psychology is the medium in which we make sense of our own behaviour and the behaviour of our fellows.

Some philosophers have argued that the discourse of folk psychology involves a 'theory' and that this theory is mistaken. So I need to rehearse, albeit very briefly, why folk psychology can never be entirely dispensed with. I must explain why we could never by-pass the language of belief, intention, reason and motive in the vain attempt to refer directly to brain functioning when interacting with others and interpreting their actions.

Many will be familiar with radical 'eliminative materialism' claims made by Paul and Patricia Churchland (1984, 1989). Harré (2002) represents them as contending that anything we can say in the 'vernacular' (folk-psychological terminology) we can also say without loss in terms referring only to physical or material properties and things. The

Churchlands' reasons for recommending that we alter the way we speak is that the ordinary language of mental life presupposes a false ontology of mental beings, whereas a materialist vocabulary presupposes a factually true theory, namely neurophysiology (Harré, 2002). On the face of it at least the position of the Churchlands is compatible with that of Ricoeur as quoted above. Indeed, it appears to *require* a view like Ricoeur's in the sense that they acknowledge the *phenomenon* of a folk-psychology discourse. They see it as containing putative references to the 'false ontology of mental beings'. They believe this discourse should undergo a radical reform.

Harré points out one of the fundamental difficulties for eliminativist materialism here. If we try to alter the way we speak, how should we identify which brain states would be the appropriate ones to refer to? There seems no way of avoiding having first to indicate the *relevant psychological phenomena* using the traditional terminology of beliefs, desires and intentions. We can only reach the relevant brain states, so to speak, via beliefs, desires and intentions. In doing so we must draw deeply on vernacular folk psychology. Folk psychology has a kind of logical and epistemological priority that cannot be dispensed with. In saying this much, however, we are not committed to a particular ontology of beliefs, desires and other intentional states. In asserting the logical and epistemological priority of the folk-psychology conceptual scheme, we need not thereby subscribe to any particular account of how, if at all, terms within that scheme refer. Moreover, in holding on to folk psychology we are no more ruling out materialist accounts of psychological and social phenomena than we are embracing dualist alternatives.

I turn now to the idea of 'connections' which sometimes figures in the rhetoric of brain-based learning. *Educational Leadership* presents several attempts to run together ideas about connectionism in the brain with 'connectionism' at the level of knowledge and learning. For example: 'Human knowledge is stored in clusters and organized within the brain into systems that people use to interpret familiar situations and to reason about new ones' (Lowery, 1998, p. 28). On the face of it this article systematically conflates two types of connections. We have, first, connections of a neurophysiological character that obtain in the brain during learning. Second, there are connections *made by learners* between 'new' knowledge and resident knowledge. It is almost as though the writer believes there is a one-to-one correspondence between, on the one hand, 'bits' of knowledge and their interconnections, and, on the other, 'bits' of brain and their interconnections.

In another case, Pat Wolfe discusses learning something new, and speaks of the brain looking 'for an existing circuit or network into which the new information will fit' (Wolfe, 1998, p. 64). She gives as an example a young child who, having learned that a small furry animal is called a dog, on seeing a cat for the first time calls it a dog. She explains that the child's brain 'searched through its neural networks to find a place to fit this new animal and selected the closest match' (p. 64). She proceeds to compare this to reading an article involving quantum physics, suggesting

that the reader will be hampered in her understanding if she lacks previously stored information about physics.

What Wolfe has failed to notice here is that the claim that the reader will be hampered in her understanding without previous physics knowledge illustrates a *conceptual* truth about understanding, although her wording suggests that she thinks she is making an empirical point. Now, understanding may take a number of different forms and certainly there are degrees of understanding; it is not an all or nothing affair. Despite these complexities, the basic conceptual point is this. A *necessary condition* for understanding is that at least some links of an appropriate kind are made between new knowledge and resident knowledge. The reader cannot (logically) understand quantum physics without at least some links with relevant existing knowledge of physics. In the absence of 'previously stored information about physics' nothing could *count* as understanding quantum physics. This conceptual point about understanding could not possibly follow from any empirical facts about brain behaviour.

Let us now return to the 'category mistake' issue. Are people like Wolfe also committing 'category mistakes'? Are they assuming that 'links' or 'connections' between beliefs are in the same category as neurophysiological connections? Might it even be the case that they believe neurophysiological connections sometimes *actually are* connections between psychological items such as beliefs? If so, is this not a blatant example of a category mistake? Let us consider this question by means of an example.

Suppose I believe that Faraday discovered the dynamo, and that I subsequently find out that Faraday was Sir Humphry Davy's personal assistant. Imagine that before I find *that* out I already know that Davy discovered potassium. I proceed to make a 'connection' here on the basis of my discernment of a logical implication, so I come to think also that Faraday was the personal assistant of the scientist who discovered potassium. Can it now be claimed that, however neurons may behave, whether singly or in clusters, there is in principle no relationship that could obtain between them that could constitute the discerning of a link between Davy's discovery of potassium and Faraday being Davy's personal assistant? Is it not the case that to assume otherwise is to commit a category mistake?

It may be objected here that this would amount to a straightforward and unsupported *assertion* that neurons are the wrong kinds of items to be connected in a fashion that could be linked with my discernment of logical implication. We are supposed to swallow this assertion because it is supposedly self-evident that a category mistake would be involved. Yet have I not already cast doubt on the robustness of category mistake arguments? My response to this objection is to concede that there is some force in it. Although I feel that the category mistake is so obvious in the example discussed that connections between networks of neurons just *cannot* be in the same category as the connections I make between my beliefs, I have no more to say to back up my feeling.

The discussion so far is consistent with the classic view of the mind-brain relationship developed by Donald Davidson (1970), styled ‘anomalous monism’. According to this account it is not possible to claim that types of mental phenomena just are types of brain process or event. For the ‘same’ kind of mental phenomenon is associated with a range of types of brain phenomena even within a particular individual. Moreover, different individuals may undergo very different types of brain events in the course of being gripped by the same types of psychological events. However Davidson proceeds to assert that *token* mental events could be identified with *token* brain events, despite the failure of *type-type* identity theories. Anomalous monism fits the available empirical evidence about specialised functions within the brain. For instance, neurophysiologists have claimed that the neural basis of linguistic skills is located in Wernicke’s and Broca’s areas in the left temporal lobe (Harré, 2002). Evidence for this takes the form of deficiencies associated with damage to these areas. However, the brain displays significant ‘plasticity’, and some people can use different brain areas to achieve the relevant performances. Furthermore although there are ‘associations’ between types of mental phenomena and activity in specific areas of the brain, modern techniques reveal that in many cases a wide range of brain components can be active, especially in relation to higher cognitive functioning.

IV THE CAPACITY OF BRAIN SCIENCE TO EXPLAIN OR UNDERSTAND LEARNING IS LIMITED IN PRINCIPLE

I now develop an argument to show that brain science can never transcend certain fundamental limitations in its potential to cast light on the nature of learning. The argument draws on developments in the philosophy of mind since the middle of the last century. At its heart is a consideration of the *intentional* character of the psychological states involved in learning.

I use ‘intentional’ here in the technical sense familiar in philosophy of mind, namely that feature of mental states they possess in virtue of being about objects, real or imaginary. For instance, I am frightened *of ghosts*, want *a holiday in New Zealand*, or have learned that *Faraday discovered the dynamo*. When describing learning, we say that pupils come to know that . . . , understand that . . . , become curious whether . . . , interested that . . . , and so on. Propositional attitudes figure in all these states and processes, and of course they all involve intentionality. Learning arguably involves many elements over and above its ‘propositional’ components, but it is the latter on which my current argument needs to concentrate. I want to defend the following thesis in this section: the majority, and perhaps all, of the kinds of intentionality implicated in learning incorporate much more than events and processes ‘inside’ individuals. They involve events and processes ‘outside the skin’ of particular individuals.¹ These events and processes comprise elements of their social, cultural and natural environments. Yet a brain-science perspective

on learning apparently requires the associated intentional states to be confined, so to speak, to the interior of individual learners.

These complex points require some development. I first make some observations about *intentionality*. The kind of intentionality that is not confined to internal states of particular individuals takes in features of social reality. John Searle illuminates the character of social reality and its interrelationships with his account of what he calls ‘collective intentionality’. He characterises collective intentionality as ‘where I am doing something only as part of *our* doing something’. ‘If I am a violinist in an orchestra I play *my* part in *our* performance of the symphony’ (Searle, 1995, p. 23).

Searle also helps us to understand other aspects of social reality and the social environment in which the possessors of intentional states are situated. He reminds us that the existence of physical objects does not depend on the attitudes we may take towards them. The same holds good for many of their properties. Those that are not attitude-dependent are referred to as ‘intrinsic’. However, physical objects can have many other properties that are *not* intrinsic in this sense. These properties *do* depend on our attitudes. They may involve our assigning a function to them. For instance that an object is a screwdriver requires an assignment of function. Properties that are not intrinsic involve two key elements of social reality, namely collective intentionality and constitutive rules. Constitutive rules are explained as follows. Some rules operating in communities do not merely regulate (drive on the right-hand side of the road) but also create the *very possibility* of certain activities. For instance, the rules of chess are constitutive of chess. Constitutive rules crucially involve collective intentionality. That a piece of paper is a £20 note requires collective intentionality and constitutive rules. *We* follow the rules and practices concerning money, exchange, banks and so on. *I* can have beliefs about the money, and do things with the money as part of a community who follow the relevant constitutive rules.

With Searle’s observations on the nature of social reality in mind, I now continue developing the claim that many learning-related intentional states are not confined to events and processes internal to individuals. I want to make brief reference to a couple of long-standing disputes. The first is waged between *methodological individualists* and *methodological holists*. The issues between the two parties are subtle and complex, with few if any social scientists or philosophers occupying one camp or the other without qualification. In this paper I can only touch on one or two aspects linked to my theme of learning and brain research.

Harold Kincaid (2002) offers four categories of individualist claims. These are described as ontological, theory reduction, explanation and confirmation. He expresses one possible ‘explanation’ claim as follows: (A) *Individualist mechanisms are a necessary condition for social explanation*. Individualist mechanisms include brain processes, brain events and indeed any phenomena relating to the central nervous system. Even if intentional states are, or at least inextricably involve, social phenomena, he argues, brain phenomena are a necessary condition for the

explanation of intentional states. One of the main contentions of the present paper is that they are not sufficient. Under 'theory reduction' he proposes the following individualist claim: (B) *Any social theory is, in principle, reducible to a theory referring entirely to individuals.* If intentional states are at least in part social phenomena then they are appropriately dealt with by social theories. (B) as applied to intentional states involved in learning implies that collective intentionality can be reduced to individual intentionality. Optimistic views about what brain scientists can discover about learning would be consistent with this application of (B), an optimism which this paper seeks to oppose. Searle denies that collective intentionality can be reduced to individual intentionality: 'The crucial element in collective intentionality is a sense of doing (wanting, believing, etc.) something together and the individual intentionality that each person has is derived *from* the collective intentionality that they share' (Searle, 1995, p. 25).

The second debate I touch on at this point is related to the individualism/holism issue. It concerns how thought contents can be individuated and their role in explaining behaviour. Jerry Fodor (1987) argues that the contents of thought should be seen as internal psychological states that play a key role in the explanation of behaviour. If this version of 'internalism' were true, then as Michael Luntley puts it, 'it would be possible to individuate content as something that could be carried from place to place, something that was indifferent to where you were' (Luntley, 1999, p. 250). Adherents of this view, styled *methodological solipsists*, need a conception of the so-called *narrow content* of a propositional attitude. Consider the following example: Smith wants to eat the rabbit stew. The *narrow content* of Smith's propositional attitude would be content that is independent of whether rabbit-stew phenomena obtain in Smith's environment, and of the precise nature of such phenomena if they do obtain. For according to methodological solipsism it is only such narrow content that can figure in the explanation of Smith's behaviour.

Other philosophers question the very possibility of 'narrow' content. They contend that when we accurately characterise someone's intentional states we cannot avoid referring both to the individual concerned *and to aspects of their context*. Certainly there are cases where this is easy to see. For instance, Jones believes that Jupiter has more than twelve moons. The content of this belief cannot be captured without taking into account the real planet that is the focus of this propositional attitude. Lowe (2000) rules out narrow content altogether, claiming that 'a person's mental state types at any given time do not supervene upon that person's concurrent neurological state types alone. They do supervene upon the latter *in conjunction with* certain types of physical state exemplified by the person's environment at that time' (Lowe, 2000, p. 89).

The issues relating to wide and narrow content are extensive and complex. An adequate treatment cannot be attempted here. For the sake of argument, I want to assume at the minimum that there are *many* cases where only a 'wide content' reading is available. That is to say, in many

cases we cannot characterise the content of someone's intentional states without taking in aspects of their environment and of their relationship to it. I go beyond Lowe in the above quotation by making it explicit that the environment should be understood to include the cultural and social context.

Note that I make no claims to originality here. The thought that the social environment is logically implicated in what people can *mean* has been around in philosophy of mind and philosophy of language for a long time. Some may recall in particular the twentieth-century analytical philosophy version of this debate stemming from Tyler Burge's classic paper 'Individualism and the Mental', in which he offered 'some considerations that stress social factors in descriptions of an individual's mental phenomena' (Burge, 1979, p. 74). It is fair to say that the 'internalist' or individualist theories of Fodor and others have not convinced the majority of contemporary philosophers (see e.g. Wilson, 2003). This paper sides with that majority.

I now want to relate the wide/narrow construal of intentional states to the characterisations of learning. This is best done initially by considering a mundane example taken from the primary school. Suppose Jane learns to give change when taking the role of a shopkeeper. The class shop contains modestly priced sweets costing under one pound. When customers buy sweets and offer Jane £1 she can give the correct change. Now we need to spell out the point that she *intends* to give the correct change. She does not simply offer the correct money by accident. Moreover, she is not under the impression that she is doing something different from giving correct change. For example, she is not under the impression that she should pay customers to take sweets away and that coins for amounts under £1 such as ten pence pieces are somehow more desirable than the £1 coins themselves.

For Jane to give correct change while intending to do just that she needs a variety of beliefs, some of which must be true and justified. Their subject matter must include the institution of money, the appearance and value of various coins, and the practice of buying and selling. She needs to have a fair grasp of how the community deals with money and all its ramifications. Without this she cannot *mean* her act to be the giving of change.

To capture the full content of her set of relevant propositional attitudes a wide construal is essential. She can neither possess nor act on the relevant beliefs without the existence of 'external' social and cultural contextual features. Moreover, accounts of Jane's learning and related actions are true or otherwise in virtue of Jane's internal states (including states of her brain), the following of various rules and practices by her community, and Jane's relationships with these practices. Learning requires a pupil to assimilate relevant practices involving sets of constitutive rules being followed by experts in the subject concerned.

To sum up, it is my contention that much (and possibly *all*) of the knowledge and skills acquired in the classroom involves propositional attitudes that demand a 'wide' interpretation. Needless to say, *without*

brains agents could not be learners, to echo our earlier concession to Kincaid's 'individualist mechanism' claim. At the same time, an investigation of brain phenomena can only scratch the surface of learning. Looking in the head and nowhere else to investigate learning might be likened to an attempt to discover the nature of a £20 note by concentrating on a physical and chemical examination of the note itself. Clearly the colours, textures, watermarks, etc., present on the note are important, and without them the item cannot *be* a £20 note. At the same time our bizarre scientific examination is going to grind to a halt fairly quickly, and it in itself can reveal nothing of the true role, function and value of the note. Similarly, however extensively we investigate brain processes and states we will be unable thereby to make direct positive discoveries about learning. For many of the intentional states figuring in learning are not restricted to the internal states of an individual. They incorporate the complex practices and cultures in which she is embedded. These intentional states cannot be characterised without reference to crucial aspects of these social externalities.

V NEUROPHYSIOLOGICAL ABNORMALITIES AND LEARNING DISORDERS

If brain science's potential for positive insights into learning is limited in principle, does it have a role where learners have serious difficulties and where there is clear evidence of neurophysiological deficit or disorder? Cases might be thought to include pupils suffering from various inherited genetic syndromes and those with brain damage. For instance some hope to identify disorders such as autism by discovering underlying brain abnormalities. Robert Shultz *et al.* (2000) say that 'normal' people use one brain area to discriminate or identify objects and a different area to identify faces. The brains of autistic people use only the first region (inferior temporal gyri) to identify both objects and faces. In another example researchers continue to search for recognizable brain abnormalities underlying dyslexia. Kenneth Pugh *et al.* (2000) claim that the angular gyrus in the left hemisphere behind Wernicke's area malfunctions in the brains of dyslexics. The evidence comes from neuro-imaging.

In the fascinating debate between the neuroscientist Jean-Pierre Changeux and the philosopher Paul Ricoeur about what makes us think, the latter concedes most ground to science in 'medical' or deficit cases. Ricoeur remarks:

the category of material causality is applicable to the relation between the neuronal and the mental in the case of dysfunctions, because we are dealing with an immediately identifiable relation of causality *sine qua non*. Things seem to me much less clear, however, in the case of normal function or, as I like to call it, felicitous function. The underlying neuronal activity is silent in a way, and the notion of a causality *sine qua non* applies more indirectly for lack of a signalling indication by the mental in the direction of the cortical . . . (Changeux and Ricoeur, 2000, p. 49).

If scientists could provide direct methods of identifying pupils with specific learning difficulties, this arguably would be very helpful for professionals seeking to understand how such pupils learn and how to help them. Since the symptoms of such difficulties often are on a continuum with behaviours found in 'normal' pupils, diagnosis of conditions such as dyslexia can be problematic and time-consuming. So teachers might well appreciate the possibility of a more direct diagnosis. Moreover, they could adopt strategies discovered to be effective with given abnormalities or deficits without delay. The danger of *blaming* pupils for lack of effort when in fact they could not help their poor performances could be avoided.

One final caveat here is necessary, however. Without prejudice to the credentials of any particular condition, consider that pupils in our classrooms are now thought to suffer from Attention Deficit Disorder, Attention Deficit Hyperactivity Disorder, conduct disorder, dyslexia and dyscalculia, to name but a few of the currently fashionable syndromes. In addition, other 'disorders' may be held to affect classroom performance such as Post-Traumatic Stress Disorder, Asperger's Syndrome, autism, depression and obsessive-compulsive disorder. Now if we are alive to the extent to which behavioural symptoms associated with particular conditions become salient *only in relation to particular cultural beliefs and practices*, we may be sceptical about whether there is a specific and identifiable type of neurophysiological abnormality to explain each group of symptoms. We may wonder whether these abnormalities are clearly distinguishable from each other. There is a very real question about whether some of these conditions are constructed rather than discovered.² These concerns are supported by the work of some recent empirical researchers (for example, Bonnie Kaplan, Deborah Dewey, Susan Crawford and Brenda Wilson, 2001) who argue that a broad description of a brain condition such as 'atypical brain development' picks out a neurophysiological condition explaining the variety of overlapping symptom clusters associated with specific 'disabilities' and that we should adopt this approach rather than seeking specific states to explain each disability.

In addition to the general unease just rehearsed there are particular concerns about the way certain disabilities acquire the status of real and distinct conditions. For instance, dyslexia is one of several learning disabilities conceptualised as a specific deficit in cognitive functioning. Within this perspective it is held that there may be discrepancies between a pupil's cognitive functioning *in general* and her functioning in particular areas such as aspects of language processing. In the light of this tradition of thinking, Keith Stanovitch proposes a new disability called 'dysrationalia'. He suggests the following definition:

Dysrationalia is the persistent failure to think and behave rationally despite adequate intelligence. It is a general term that refers to a heterogeneous group of disorders manifested by significant difficulties in belief formation, in the assessment of belief consistency, and/or in the determination of action to achieve one's goals. Although dysrationalia may occur concomitantly with other handicapping conditions (e.g. sensory impairment), dysrationalia is not the result of these conditions.

The key diagnostic criterion for dysrationalia is a level of rationality, as demonstrated in thinking and behaviour, that is significantly below the level of the individual's intellectual capacity (as determined by an individually determined IQ test) (Stanovitch, 1993, p. 503).

In creating the putative disability of dysrationalia, Stanovitch sets up a thought experiment to test the credentials of discrepancy conceptions of disabilities. Following his lead we could invent any number of learning disabilities in which there is a discrepancy between someone's performance in a specific area and their general cognitive ability. For example, 'dystidia' might be a problem associated with tidying bedrooms. This begins to suggest that there is something seriously wrong with deficit definitions of disabilities. Stanovitch pursues his campaign by appealing to empirical evidence—for example, that in the case of dyslexia there is no evidence that poor readers with a discrepancy between their reading and their general intellectual capacity respond differently to various educational treatments from similarly performing readers whose reading performance seems to match their IQ. Yet such evidence would be expected if those with a discrepancy were suffering from a specific condition lacked by those without the discrepancy. A more philosophical criticism may be mounted against the notion of general ability, with its implication that individuals can be in possession of a comprehensive mental capacity whose nature is independent of any context in which it might be manifested. If surprise at poor performance in specific areas is to make any kind of sense, the coherence of a general context-independent mental capacity such as intelligence is required. However, I would argue that the conception of general intellectual ability is suspect on philosophical grounds. In any case the notion of intelligence-IQ has been subjected to fierce criticism by respected empirical researchers in the last few decades (for example, Ceci, 1996; Howe, 1997; Richardson, 1999). I explore this theme in 'Learning and the Social Nature of Mental Powers' (forthcoming) but cannot take it any further here. Enough has been said, I think, to cast doubt on the deficit approach as a route into real and distinct conditions underlying disability labels.

I am not, of course, questioning whether pupils actually have specific learning difficulties such as those associated with the dyslexia label. It just is a fact that some pupils often fail on tasks of certain kinds, and that, rightly or wrongly, teachers are surprised by some of these difficulties. Moreover, a selection of these failures do have labels linked to them, and there may be all sorts of different sociological and political explanations for the currency of these labels. Instead, I am expressing a reluctance to countenance the claim that there are specific and distinguishable brain abnormalities to explain each cluster of symptoms associated with a learning-disability label. The stakes here are high. For the search for effective treatment needs to appeal to the causal explanation of the symptoms. If there is no one cause, or if the alleged explanation of a cluster of symptoms in terms of a specific underlying abnormality is flawed, then hypotheses about successful treatment lack a proper scientific basis.

Further progress on the authenticity of cognitive disorders can only be made by means of detailed and specialised examination of particular cases that cannot be attempted here. The main thrust of the present paper, however, is that what we might call medical models of cognitive functioning have only a very limited role in the broader field of education and learning.

VI CONCLUDING NOTE

The upshot of this paper is that there is something peculiar about the very idea of ‘brain-based learning’. If my arguments are correct, we need the expertise of several disciplines if we are ever to make progress in our understanding of learning. Philosophy has no authority to pronounce on the credentials of neurophysiology *per se* and would rightly be ignored if it made any such attempt. However philosophy is well-placed to critique attempts to apply a scientific discipline to phenomena where that discipline on its own is incapable of dealing with such phenomena. Of course, such a critique must be supported with argument, and that is what I have tried to offer here.

We might imagine a splendid research group comprising neurophysiologists, cognitive psychologists, anthropologists and social scientists who in theory could work together on learning. If the resulting inquiries were genuinely of an interdisciplinary character and if the members of the team *really* listened to each other and understood the specialist contribution each had to make then real progress might be made. At some point such a group might wish to think about recommending approaches to learning, whether in schools or elsewhere. Dialogue with philosophers might help here too and also at earlier points where social scientists and neurophysiologists were trying to talk past each other rather than to each other. In fact, philosophy would have rather more to contribute than this limited role implies, but this limited role is crucial. All this would be very far removed from the current ‘scientistic’ fashion for brain-based learning. It would be unfair to attribute responsibility for this fashion to neurophysiologists alone.

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NOTES

1. The phrase is borrowed from Howard Gardner who uses it in the context of human competences—‘a new assessment initiative should acknowledge the effects of context on performance and provide the most appropriate contexts in which to assess competences, including ones which extend outside the skin of the individual being assessed’ (Gardner, 1999, pp. 99–100). Perhaps Gardner’s use of the term ‘extend’ is at risk of being misunderstood here, but his basic focus is the inadequacy of conceptions of human capacities where all human powers are viewed as purely individual assets. For more on this, see my ‘Learning and the Social Nature of Mental Powers’ (Davis, forthcoming).

2. For a compelling account of the social construction of ‘multiple personality disorder’, see Ian Hacking (1995).

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