

Plastic brains and the dialectics of dialectics

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Abstract This article advances the thinking of Lima, Ostermann and Rezende’s “Marxism in Vygotskian approaches to cultural studies of science education” and Mark Zuss’ response to their paper. Firstly, it introduces Catherine Malabou’s concept of plasticity, from which Hegel’s dialectic can be re-read as historical materialist self-determination in a way that embraces science but non-reductively, and which leads to the possibility of challenging theoretical rigidity as a form of transformative action. Secondly, this response article provides political analysis of scientific concepts as they reproduce and reinforce particular interests and are expropriated by policy makers and unaware teacher educators whose understanding lies within a technical-instrumentalism and diluted humanism framework. Both arguments feature the human brain as an object of research in science education. From Malabou, the emancipatory conceptualisation of the brain as material, historical and sociocultural; whilst ‘Brain Gym’ exemplifies a non-science and nonsensical misappropriation of scientific concepts for commercial gain via a para-educational intervention.

Keywords Dialectical materialism · Malabou · Science concepts · Vygotsky · Science education

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This review essay synthesizes and expands upon issues raised in Paulo Lima Junior, Fernanda Ostermann and Flavia Rezende’s paper entitled: Marxism in Vygotskian approaches to cultural studies of science education. Cultural Studies of Science Education. DOI:10.1007/s11422-013-9485-8.

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Paulo Lima Junior, Fernanda Ostermann and Flavia Rezende's paper argues that closer attention to dialectical materialism and its role in expanding sociocultural perspectives is important in advancing both theoretical commitment and methodology in science education research and practice. They discuss the main meta-theoretical categories of dialectics that inspired Vygotsky's studies (thesis, antithesis and synthesis; dialectical unity of analysis; history and process; revolution; and materialism) and how he appropriated these in his cultural historical theory of development of higher mental (psychological) function. Indeed, for Vygotsky, the concept of development itself does not include "just evolutionary but also revolutionary changes, regression, gaps, zigzags, and conflicts." (Vygotsky 1997, 221, cited in Silvonen 2010, p. 38). Lima et al. consider how Vygotsky's socio-cultural psychology has been appropriated in science education research, as the latter has shifted from a "pre/post test methodological paradigm to more developmental qualitative analysis of students learning at school..." Such a shift is consistent with David Ausubel's (1968) characterisation of 'logical' meaning (applies to the logical progression of the science under consideration) versus 'psychological' meaning (application to how students learn) in school science.

Lima et al. posit Anna Stetsenko's (2008) distinction between relational ontology and transformative activist stance as fundamental in understanding better Vygotsky's project, particularly as the distinction embraces 'revolution', an element of dialectical materialism underrepresented in most appropriations of Vygotskian theory by science education researchers. In his response to Lima et al., Mark Zuss provides a further consideration of dialectics in a sociocultural context, as emergent from dialogical relations. He considers further the "unacknowledged complicity and compatibility with current market and monetary policies..." and that some of the Vygotsky 'heirs' are actually "bearing ideological values congruent with the global market." These issues are addressed by this response article.

Plasticity

Early in their paper, Lima Junior, Ostermann and Rezende make the central claim that Cultural Historical Activity Theory (CHAT) is "sustained by Marxism, or more precisely, by dialectical materialism" and, subsequently, they provide a description of their interpretation of the dialectic. Zuss points out in his response that this description, while acknowledging that the dialectic cannot be reduced to a method of argumentation and represents an ontological stance, may not develop this theme sufficiently to support a strong *materialist* dialectic underpinning CHAT. In this regard Zuss claims that "The dialectic only becomes, or returns fully embodied with Marx. The inestimable value of the body, in its sensuous presence as labour, is made primary" (p. 2) and it is to this claim that we wish to add by considering the possible contribution of the work of Catherine Malabou to a deepening of understanding of a radically materialistic dialectic.

Malabou is an important contemporary French philosopher currently at the research centre for contemporary European philosophy at the University of Kingston in London. She taught formerly at the University of Paris-Nanterre and completed her doctorate under Jacques Derrida and this was published in English under the title: *The Future of Hegel: Plasticity, Temporality and Dialectic*. In this work, Malabou employs the term 'plastic' and 'plasticity' to open up Hegel's work on the dialectic to new readings. She points here to a number of meanings of the term 'plastic' and 'plasticity'. The word plasticity entered the English, French and German languages in the eighteenth century. It was joined two other words with the same root that had been in these languages for some time. One is the noun 'plastics' and

the other the adjective ‘plastic’. They are rooted in the Greek word ‘*plassein*’ meaning to model or to mould. Taking these origins, and the way in which the words have been used in the arts, architecture, drawing and sculpture, the meaning of plasticity, according to Malabou can be extended to signify ‘the general aptitude for development, the power to be moulded by one’s culture, by education’ (2005, p. 8) as a result of our suppleness and flexibility. On the other hand, as she also points out, plastic is not the same as polymorphic since a plastic body also resists change of shape. “Plastic thus, designates those things that lend themselves to being formed while *resisting* deformation.” (Malabou 2005, p. 9) [original italics]. The link with the dialectic of sociocultural formation is founded in Malabou’s claim that the dialectic is plastic since in the dialectic two opposing poles of concrete determinacy and the dissolution of empty transcendental self-reference are forged into the power and life of the whole of *resistance and fluidity*. Also the process of plasticity, the process of giving form, is itself dialectical because the grasping of form and at the same time the annihilation of all form in the explosive understanding of plasticity are active contradictions.

With this concept at hand, it is possible then to re-read Hegel’s dialectic as historical self-determination based on the plastic nature of human being in which human substance and the accidents and attributes that we have and encounter in the external world give form to each other. Substance, in its biological, material sense, even, has plasticity in the sense of being malleable and flexible and being susceptible to formation from external sources but it is also capable of shaping and moulding those same externals. *Both* movements are important since, as Malabou elsewhere comments, flexibility on its own is simply the capitalist ideological avatar of plasticity that masks it and distracts from its shaping power.

Teasing out the idea of plasticity as dialectical process, it offers a rich perspective on the forging and shaping of a new, transformed learner as a result of educational processes, suggesting that this transformation is at once unavoidable and impossible. On the one hand, the newness of what is to come in life and learning is not completely invisible and unanticipated, since it is the self that is shaping it in the power of its own self-differentiation. On the other hand it is not completely visible since, being dialectical, the process is occupied by the ‘other’, the external which also has the power of shaping, changing and surprising. Thus plasticity is a medium for the differentiation of opposites. But if it is this then it contains in itself the possibility of its own destruction and annihilation. The process of self-formation on the grounds of this plasticity of substance shapes its own future by dissolving bit by bit the structure of its previous self and previous world. It does this with a sense of foreboding that it cannot predict the full result of its shaping and dissolving and carries the realisation that there are unknown forces which can intervene and change the very substance of self in a flash of surprise. Plasticity, according to Malabo and her reading of Hegel, is where all birth takes place, a moment of explosion and combustion which liberates the twofold possibility of the appearance of the new and the annihilation of the present. This explosive side of subjectivity in chance has, according to Malabou, been forgotten by recent readers of Hegel.

A further engagement with Malabou’s idea reveals the notion that plasticity itself is subject to its own power, in other words that the very nature of plasticity can change in time. It obeys the law of its own power and can explode its own reserves. This suggestion requires that even at the moment when we believe to have understood the process of plasticity and the way in which it shapes the new and annihilates the old, this very understanding of the process is under threat and can collapse to be replaced with a new understanding. Here, we have a radical challenge to theoretical rigidity so that even Vygotsky’s socio-historical theory is subject itself to the very forces he invokes.

In summary, Malabou is suggesting a dialectical nature of the very materiality of brain in which the brain itself is historical and sociocultural and suggesting also that all

dialectical theory-making is itself subject to explosive plasticity. This position is a far-cry from the reductionist tendencies of many simplistic applications of the neurosciences to education but one that may indeed provide a materialist dialectic grounding for CHAT. Two particular consequences of this dialectical materialism of the brain are, first, that the brain, as an object of research, must be regarded as an historical construct and therefore a political one and, secondly, that scientific reductionism is incapable of providing an adequate model of brain function. Nevertheless, the tendency, especially in some theorising on teaching and learning, is to neglect both the dimension of politics and of the philosophy of science in science education research and practice. The next section takes up these two themes in some more detail.

Misappropriation of scientific concepts

It's a brain Jim, but not as we know it. (McCoy Circa 1968)

Positioning the plastic brain quite literally and figuratively in time and space leads into Zuss' point that a "materialist dialectic takes this (lived place of production) in which to challenge the existing contradictions" and makes it is as much a political act as a philosophical one. This is drawn out more poignantly in his further comment regarding the entwining of science education 'within neo-liberal political economies and policies'. This observation, that a dialectical engagement with the world is a critical and political act, is a line of reasoning which Lima, Ostermann and Rezende do not develop as fully as what they could have done. They note (following Wells 2008), that concepts are cultural artefacts produced under special conditions, however they do not extend this line of argument into domain of capitalist social relations and the role of scientific concepts in particular, and how they reproduce and reinforce particular interests. This stance of wrapping science or more specifically the products of scientific practice in a cosy blanket of naive realism, acts as a way of hiding these interests (however defined or manifest). Indeed, the very notion of naive realism as a mode of discursive practice is woven very tightly into the populist doxa of science. By locating these concepts in the world of nature and given further credence by a recourse to a vulgar ontological realism, these concepts are legitimised by an attempt to (1) universalise them and (2), render them impervious to social and political critique by placing them outside the realm of values. However, Lima, Ostermann and Rezende with their focus on the dialectics of pedagogy, have inadvertently emptied out such considerations. Furthermore, there is also the sense that within this pedagogy, whilst seen as being bound up in a dialectical relationship with their students, teachers are somehow immune from contamination from the outside world. Although we should be careful not to equate social critique via a dialectic approach with trite (or crass?) vanguardism, teachers themselves are as much cultural 'products' as the concepts they wish to subject to critique. That they are as capable of understanding the contradictions which form part of their practice, as they are with their relations with others. Following on from this we need to be careful that radical and transformative work of Vygotsky and/or dialectics does not become another form of pedagogical practice to be expropriated by policy makers and teacher educators whose understanding of education is premised largely on technical-instrumentalism and a diluted humanism. That it becomes colonised and then via a process of ritual cleansing (usually by academics and teacher educators), neutered and domesticated, and then finally placed in the 'skills' tool-box along with all other once proud radical theories full of transformative promise.

The commodification of knowledge, whether embodied in the form of products or codified in the form of patents or licenses, is an integral part of the development of industrial (Ben-David 1969) (Ashby 1958) and (Western) post-industrial capitalism (Nelson and Nelson 2002). In the realms of education, the conversion of commons (i.e. knowledge within the public domain) into text books and produced for commercial gain, is as old as the institution of schooling. Much has been made about the commodification of education (at least in the public variety) and its transformation into a positional good. But this is only part of the narrative, as the internal processes of schooling (pedagogical, organisational, curricula and so on) have also been subject to neoliberal annexation. To paraphrase Foucault (1975/1991) the capillary action of neoliberal values has permeated and increasingly colonised the social spaces *within* schools. As suggested by Alex Molnar (2004) schools can be subject to a range of commercial activities (1) sponsorship of activities or programmes, (2) exclusive agreements, (3) incentive programmes, (4) appropriation of space for advertising, (5) sponsored educational materials, (6) electronic marketing via the provision of software or equipment and (7) privatisation via the management of schools or programmes by for-profit concerns. In one of the more surreal examples of this process of commercial entrapment, the consumer magazine *Which?* (2001) calculated that for a school to buy a personal computer costing around £1,000 via the supermarket chain Tesco's 'Computers for Schools' voucher scheme, would require parents would have 'to spend nearly £250,000 to obtain the necessary 21,990 vouchers'.

Entwined within this 'market as redeemer' narrative, has been since the mid-1970s in the UK an escalating discourse of derision (Ball 1994) aimed at teachers' professionalism and competence. This is usually manifest around a moral panic concerning 'standards of schooling' and 'professional accountability'. The twin effects of 'league tables' to supposedly act as a proxy for price information (as per the 'real market') and the strong centralising tendency of the state to prescribe the contours of various facets of schooling, was for the New Right of the 1980s (and unashamedly continued with great aplomb by New Labour during the late 1990s and the 'noughties'), seen as the solution of how to inject market discipline into overcoming the problem of producer capture whilst minimising the risk of market failure.

Schools in search of solutions to the problems of 'standards and accountability' may find solace in the acquisition of pre-digested commercial educational programmes. The correct application of these schemes takes away the variability and alleged unreliability of professional judgement. One such example of this kind of programme is 'Brain Gym', which is owned and marketed by the Orwellian sounding 'Educational Kinesiology Foundation' (or the even creepier Edu-K as it refers to itself) based in California. Although Brain Gym is not an educational programme per se, it is as the originators Paul and Gail Dennison describe it as 'unique learning readiness program'. In short it functions as a series of physical exercises which are intended to influence a student's capacity to learn. As described in one of the Foundation's publications:

Brain Gym activities contain three categories of movements: The Energy Exercises to develop awareness of the body as the central reference for all directional movements; The Lengthening Activities to facilitate skills of focus and attention; and The Midline Movements for physical coordination as well as accessing of both analytical and spatial information...

Educational Kinesiology (Edu-K) - the study of movement and its relationship to whole-brain learning; a process for drawing out innate learning abilities through the understanding of movement and its relationship to whole-brain learning patterns; the

application of kinesthetics (movement) to the study of whole-brain integration for purposes of alleviating stress and maximizing the full learning potential. (Scott Studebaker 2010, p. 21)

As a commodity, Brain Gym is a curious hybrid as it is both a commercial product and intended to function as a para-educational intervention. We would argue that what gives Brain Gym and other pedagogical ‘knowledge in the can’ programmes their legitimacy, is at best their association with and at worst the colonisation of scientific modes of discourse and concepts. Brain Gym in particular has been subject to a number of critiques which function on two levels. The first are critiques which are levelled at Ed-K’s own pretensions to scientific legitimacy paraded within its own literature and the second, from the educational and scientific community. Colin Blakemore, renowned UK neuroscientist, was “amused” by the idea that massaging areas of the body could improve performance (interview on UK flagship TV news programme, *Newsnight* 2008). He suggested it was “a bit like trying to regulate your central heating system by pressing on the wall of your house because the pipes are behind them.” More seriously, in the same interview, Blakemore commented:

By dressing up what might be very useful distracting little classroom exercises with this almost cult-like, ritual-like dogma of pseudo-science is a great pity and the residual misperception that that will leave young children and teachers with is much more damaging than the consequences of the exercises themselves.

Developing science education theory

In conclusion, then, we might draw together ideas from the forum, which suggest that science education research requires development from Lima et al.’s “developmental qualitative analysis of students learning science at school” towards a new theoretical and methodological framework; one which would embrace a critical, political, sociocultural stance that helps to ‘free’ school science from the 1950s curriculum base to one which develops the agency of the learner to question, critique, improve and transform school and undergraduate science courses from their present out-dated, masculine, essentialist, scientific conceptual framework—from a relational ontology towards a transformative activist stance. Zuss emphasises a need to consider “how cultural studies in the sciences today are prepared for such transformative ferment.” We suggest that without such transformation, the rate of science progress is in danger of slowing down. Although becoming somewhat of a cliché, the commodification of schooling both as a process via the incursion of commercial interests and as a product that is a positional good, it is urgently in need of a form of critique which returns to Marx’s material dialectic as evidenced in Vygotsky. The apolitical poetics of postmodernism with its authorless texts and multiarbitrary discourses are incapable of illuminating the real forces of neoliberal power.

We argue that deeper interrogation of theory underpinning what and how science is taught at all levels is promoted by articles such as those in this forum, which attempt to make sense of and question how science education theory is developed and appropriated in learning and teaching contexts. Lima et al.’s study provides an excellent stimulus for such a process which is directed ultimately towards improving the quality of science education.

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