Neoliberalism and STEM Education

LYN CARTER

*Australian Catholic University, Melbourne, Australia; Email: Lyn.Carter@acu.edu.au

Responses
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ABSTRACT

This paper summarise some of the more salient points of neoliberalism as the ideological space driving much of contemporaneity including that of STEM (science, technology, engineering and mathematics) and STEM education. It describes the neoliberal underpinnings of STEM silencing other perspectives of science education, effectively narrowing its possibilities. This paper also reviews the Australian discourse on STEM and STEM education as expressed by the selected sections of the Australian Government and the Australian Chief Scientist. Like the GERM (global education reform movement) contagion that it is, STEM only really officially reached the shores of Australia when in 2012 our Chief Scientist began a series of utterances (speeches, media interviews, reports, position papers and the like) that purposefully included this acronym. The paper also describes the appointment of Australia’s most recent Chief Scientist whose biography sees him well suited to the enterprise society.

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ANTECEDENTS

This paper springs from a seminar entitled *The STEM-ification of Science Education: Challenges for Policy and Practice in Neoliberal Times* presented in Helsinki at the biannual European Science Education Research Association (ESERA) meeting in September 2015. The seminar was preceded by one given on a similar theme at the National Association of Research in Science Teaching (NARST) conference in Chicago in April of the same year. The genesis for both seminars lay within the Cultural Studies of Science Education special meeting held in Luxemburg in June 2014. The three day Luxemburg workshops enabled some deep conversations about the neoliberal ideological moorings, and the normative meanings and enaction of STEM (science, technology, engineering and mathematics) as well as the possibilities for rogue readings and disruption. Attendant scholars including Michael Reiss, Chantal Pouliot, Larry Bencze, Deborah Tippins and Ajay Sharma decided that presentations at the NARST and ESERA meetings the following year would provide excellent opportunities for the wider dissemination and extension of our conversations, ideas and research. Some of these discussions are featured in the other papers in this edition of JASTE.

My role as first speaker in both seminars was to introduce our theme, summarise some of the more salient points of neoliberalism as the ideological space driving much of contemporaneity, and establish the linkage between neoliberalism and STEM. If time permitted, I could also explore some STEM issues in my own country of Australia. My resultant presentation *Neoliberalism and STEM Education: What’s in a Name? Narrowing Science Education’s Possibilities* hopefully managed to complete that task. Both seminars at NARST and ESERA were very well attended and provoked interesting discussions with one eminent scholar noting that our work was essential as ‘too few sessions address the important and common policy issues that face us in science education.’

This paper responds to Larry Bencze’s request that I develop an article from my seminar presentations. But somehow, such is the act of writing down a paper (or in reality typing on a screen) rather than speaking that suggests the need for a more thoughtful and rigorous framework. And so this paper is definitely still a work in progress as I make my way through the intricacies of more fully elaborating the ideas with which I am working and ‘trying out’ a theoretical lens. Its first aim then, in parallel with my presentation, is to describe the neoliberal underpinnings of STEM that work to silence other perspectives of science education, effectively narrowing its possibilities. The second aim is to more thoroughly review the Australian discourse on STEM as expressed by the Australian Chief Scientist. Like the GERM (global education reform movement) contagion that it is, STEM only really officially reached the shores of Australia when in 2012 our Chief Scientist Professor Ian Chubb began a series of utterances (speeches, media interviews, reports, position papers and the like) that purposefully included this acronym. Thirdly, I explore the Deleuze-Guattarian concept of nomadology as I believe it could provide a useful lens with which to interrogate STEM (Deleuze & Guattari, 1987).

Before I begin though, it is worth taking a minute to probe the term/acronym STEM in its many guises. There is some dispute about the origins of the acronym STEM with Mohr-Schroeder, Cavalcanti and Blyman (2015) suggesting it was coined in 2001 by Judith Ramaley, a then director at the US National Science Foundation as a reordering of SMET (science, mathematics, engineering and technology). Somehow, rearranging the letters was meant to convey a more interdisciplinary focus, Ramaley is reported as saying. Sue Dale Tunnicliffe from the Institute of Education at the University of London in a personal communication last year however, stated that she and her colleagues were using STEM in the 1980s and 1990s. I personally came across the term for the first time in 2007 on a visit to Virginia Tech in the US. In meeting with the Department Chair, STEM it was explained was the direction in which they were all moving. As it is an acronym – its also a word. More interesting perhaps are the definitions, homonyms and etymology of the word *Stem*. Thought to be of Germanic in origin meaning prow of a ship, and of old Norse for damming and stopping, the everyday Oxford Dictionary English usage includes to ‘originate in,’ ‘be rooted in,’ ‘proceed from,’ as a ‘trunk’, ‘stalk,’ ‘stock,’ and ‘to staunch,’ ‘halt,’ ‘restrict,’ ‘control,’ and ‘contain.’ There is much here with which to play if one is seeking rogue readings of STEM!
NEOLIBERALISM

Peck (2010) is but one scholar who provides a lucid overview of neoliberalism, about the lack of consensus on it as a messy, diverse and hybrid hegemon, and about the increasing reams of scholarship it commands particularly after it was declared dead in the wake of the Global Financial Crisis. Rather than gone, it is now viewed as having increased its grip on the contemporaneous world. I have frequently written about neoliberalism and its shaping of science education, and readers wishing to know more are directed to Carter (2005; 2008; 2010; 2014; 2015). Some of my favourite thinkers on neoliberalism include Lazzarato (2011; 2009), Venn (2009) and Hall (2011) but I can really do no better than to refer those wishing for extra to the 2013 special double edition of the journal New Formations on Neoliberal Culture. The excellent New Formations uses cultural theory for the analysis of political and social issues from an interdisciplinary perspective. Here, as this paper is one in process, rather than rehearsing much of this material, it is sufficient to make a few salient points about neoliberalism so as to animate the ensuing discussion.

In his editorial for New Formations, Gilbert (2013 p. 7) describes neoliberalism as a “discursive formation, a governmental programme, an ideology, a hegemonic project, (and) a technical assemblage,” while elsewhere Gane (2015 p. 133) declares it “an intellectual project and a set of governmental practices.” The governmental dimension in these two views comes from Foucauldian thinking that sees all government (power) as promoting certain modes of subjectivity and civility (Foucault, 2008). Neoliberalism then, is the deliberate intervention by government to encourage particular types of entrepreneurial, competitive and commercial behaviour in its citizens with the market as the regulatory mechanism. It is also the management of populations to cultivate individualistic, competitive, acquisitive and entrepreneurial behaviour. In classical liberalism, market regulation is regarded as the natural condition of civilised humanity and presumes that, left to their own devices, humans will naturally tend to behave in the desired fashion. Neoliberalism by contrast, assumes that humans must be compelled to do so by a directive state to overcome humanity’s (“unfortunate”) tendency towards collectivism.

McNay (2009) argues that Foucault, in his famous 1978–79 lectures The Birth of Biopolitics (translated 2008), remarkably “predict(ed) crucial aspects of the marketization of social relations” (p. 56) even though his lectures were delivered several years before the emergence of the New Right in the early 1980s. Under neoliberalism, the focus becomes not only on supply and demand of goods and services but on the individual as Homo oeconomicus or enterprise man, an active economic subject who “allocates their time and resources between consumption … and investment in the self … (S)uch an individual is … an investor, an innovator, and an entrepreneur” (Flew 2010, p. 29). For Foucault, the required Homo oeconomicus is not the man of exchange or man the consumer; he is the man of enterprise and production within an enterprise society. The contemporary mission of neoliberal government is that “one must govern for the market” (Foucault 2008, p. 125).

That is, one must govern according to the rules of the market, by drafting laws, by instituting (fiscal and other) regulatory apparatuses, recalibrating the functions of socio-cultural institutions to bring them into line with the new language and new objectives of the enterprise state, and by constituting appropriate subjectivities, notably Homo oeconomicus as ‘enterprise man.’ (Venn 2009, p. 212, italics in original)

Neoliberalism has various histories and locations which while different (for example Ordoliberalism from Germany in the 1930s, the Chicago School in the US, and implementation in Chile in the 1970s), can tend to morph, but for my purposes in this paper, I do privilege the economic. Davies’s (2014) bibliographic review of neoliberalism though, maps out and distinguishes between its different arrays and trajectories allowing for a more nuanced sociological reading. Some of the scholarship on neoliberalism variously describes it as an affective regime where the ‘affect’ makes us act, exceeding or preceding rationality (Fisher & Glibert, 2013), as contrary/contradictory (Birch, 2015; Harvey, 2005) and of promoting a constant state of anxiety (Castree, 2009; Massumi, 2009). Constant crisis discourses work to make populations malleable as we have seen in the relentless swirl of terrorism rhetoric for example,
Neoliberalism is of course, not referred to as such by its proponents. It has become such an impossibly wide term, it includes everything and means nothing and is as flexible as it is pervasive. For its interlocutors, it has become a pejorative term which needs to be constantly named so as it can be called out and interrogated.

**NEOLIBERALISM AND SCIENCE**

As the naturalised way of being on the contemporaneous world, science itself is shaped by neoliberalism. There has always been a reciprocal and mutually productive relationship between the economy and science as Max Weber noted in a lecture he gave in 1918 at Munich University entitled *Science as a Vocation*. While discussing the benefits and disadvantages of choosing a career in the sciences, not only does Weber ponder the value of science arguing it is never free from supposition, he also portrays the hard realities of the science academic vocation that include the ‘bureaucratic hoops, employment lotteries, and the dominance of a capitalistic agenda, which prioritizes financial accumulation over the cultivation of scholarship’ (Fantuzzo 2012 np). What is different now, is the intensification of this agenda to the exclusion of all else. Krishna (2014) for example, describes the shift from science as an autonomous open knowledge and social/cultural object to progress the public good, to a closed and privatised form of applied knowledge production where patents and industrial secrecy impede the progression of scientific knowledge and economic interests determine research priorities. Hence, within a neoliberal sensibility, what counts as scientific research becomes a consequence of national economic interests, linking the demand for skilled scientific workers to global competitiveness (see also Ancarani, 1995; Carter, 2008 for a more developed discussion; Fuller, 2000).

Paula Stephan’s book *How Economics Shapes Science* is relevant here. It is worth repeating a number of points I made in a review of Stephan’s (2012) solid book for the journal *Science Education* (Carter, 2013). Stephan (2012), an economist, makes her justification clear: “I have been amazed at the number of people who venture to write about science and science policy without understanding the environment in which research takes place” (p. xii). Stephan (2012) probes questions of productivity, the allocation of resources, impact of policy on outcomes, the public good, efficiency, incentives and costs, utilising methodologies she describes as naturalistic study. In some ways, the work is not new, as much of the content itself has already been published extensively elsewhere by Etzkowitz (2002), Fuller (2000) and others and is in a way, tacit knowledge. Stephan’s (2012) arguments are backed by a plethora of facts and figures, largely from the most recent available data c.2009-2010. For example, Stephan tells us that while around 56-58% of all scientific and engineering research in US occurs within universities, they publish around 75% of the journal research. Only 6% of the scientists write as many as 50% of the articles. The clear corollary here is that more than 40% of the research is produced by the private sector, which contributes only 25% to the publicly available pool of scientific knowledge. This is not surprising in the neoliberal world as trading in knowledge now as well as goods and services, requires that it is not given away for free. Rather to be commercially viable, knowledge must be scarce, competitive, and excludable or it undermines the very system by which it is produced.

It would be an error however, to suggest that the science knowledge-as-commerce is restricted to private enterprise. To the contrary, Stephan (2012) outlines at length how the laws of competition and increasing returns sees fewer ‘top performing’ scientists and engineers get the largest share of resources, in addition to the plumb jobs at negotiated salaries with their accompanying security, in the public sector including Universities. Scientists such as these can reap significant additional financial gain as their research is sold onto the corporations. At the same time, itinerant and casualised PhD students, Postdocs and other service labour staff their labs to reduce costs as they are ‘cheap – and temporary’ (p. 162).
It is within this context that the STEM discourse has become increasingly prominent. For example, Coble and Allen (2005 p. 2) reporting on a think tank on U.S. global competitiveness and the role of education begin with the statement:

Improving mathematics and science education in the United States belongs near the top of the policymaking agenda. America’s role as a leader in the world’s economy and its capacity to produce wealth and quality jobs for its future citizens depend directly on the ability of our education system to produce students who can compete in the math- and science- dominated industries of the future.

Sometime later, Engberg and Wolniak (2013 p. 1) reiterate the same rhetoric without there apparently having been much improvement in the intervening eight years:

As concerns mount about the shortage of students entering science, technology, engineering, and math (STEM) careers, policy makers throughout the United States are contemplating strategies to maintain and enhance our nation’s economic vitality and international competitiveness. Preparing young adults for careers in STEM fields has received considerable attention in recent years, fueled by apprehension about producing enough students to keep up with the growing demand … The prevailing concern is that a failure to meet workforce demands will ultimately impede America’s ability to compete in an increasingly global and technologically advanced economy.

The conflation of science and science education with a nation’s global economic competitiveness is clear. While it is important for science education to prepare students for future work opportunities, the neoliberal drive to STEM as the new orthodoxy in science education risks not only limiting the goals of the science education but possibly preparing students for jobs that under globalisation have probably already migrated offshore.

Although the neoliberal moorings are apparent in the policy literature for STEM, they are less obvious in the STEM education discourse. In casting around for a definition of STEM education for their recent book on STEM teaching, Mohr-Schroeder, Cavalcanti and Blyman (2015) choose this one from Tsupros, Kohler, and Hallinen’s (2009) that softens the economic emphasis within local community connections:

STEM education is an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply science, technology, engineering, and mathematics in contexts that make connections between school, community, work, and the global enterprise enabling the development of STEM literacy and with it the ability to compete in the new economy.

Neoliberal reform of education has been discussed at length in educational policy literatures but is very sparse within science education scholarship (exceptions include Bencze 2010, 2008: Carr & Thésée 2008; Tobin, 2011). This is an oversight given the increasing emphasis on STEM education which is usually portrayed as important common sense, or at worst, as benign.

STEM AND STEM EDUCATION IN AUSTRALIA

Reviewing the Office of the Chief Scientist of Australia is one way of gaining a sense of Australia’s direction in science and science education. Located within the government Department of Industry, Innovation and Science, the Chief Scientist’s website describes the role as providing:

high-level independent advice to the Prime Minister and other Ministers on matters relating to science, technology and innovation … advocate(ing) for Australian science internationally … (acting as a) … champion of science, research and the role of evidence in the community and in government. (Australia’s Chief Scientist, 2016).

As I write, one incumbent is making room for another with the outgoing Chief Scientist Professor Ian Chubb (2011–2015) being replaced by Dr Alan Finkel (2016–2020). Ian Chubb is an academic and neuroscientist, and a former university Vice Chancellor (President) of both the Australian National
University (ranked 19th on QS World University Rankings) and Flinders University. With a different trajectory, Dr Finkel, the website tells us:

has an extensive science background as an entrepreneur, engineer, neuroscientist and educator. In 1983 he founded Axon Instruments, a California-based, ASX-listed (Australian Securities Exchange) company that made precision scientific instruments … In 2004, Dr Finkel became a director of the acquiring company, NASDAQ-listed Molecular Devices. In 2006, he returned to Australia and undertook a wide range of activities. He … was a director of the ASX-listed diagnostics company Cogstate Limited. He was Executive Chair of the educational software company Stile Education, Chair of Manhattan Investment Group, Chief Technology Officer of Better Place Australia (electric vehicles) and Chair of Speedpanel Australia (recycled building panels) (Australia’s Chief Scientist, 2016 my italics).

In fact, much was made of Dr Finkel’s entrepreneurial credentials when his appointment was announced by our Prime Minister Malcolm Turnbull. In a statement from Prime Minister’s website, Mr Turnbull together with the Minister for Industry, Innovation and Science Christopher Pyne, are reported as confirming that

science and innovation are at the centre of the Government’s agenda and key to Australia remaining a prosperous, first world economy with a generous social welfare safety net. "The Australian Government recognises the importance of science, innovation and technology to our future prosperity and economic security as a nation in a rapidly expanding and diversifying global economy,” the Prime Minister said. … the Hon Christopher Pyne MP congratulated Dr Finkel … "Dr Finkel is renowned for his outstanding research, industrial and entrepreneurial achievements in Australia and overseas … His will be a vital role in shaping Australia’s economic future and leading our national conversation on science, innovation and commercialisation across the research, industry and education sectors and with the wider community," he said. (Office of the Prime Minister, 2015).

It would seem from this description that that Dr Finkel is a perfect example of Foucault’s Homo oeconomicus, well suited to enterprise society and its demands of constant innovation. That Dr Finkel is comfortable in the role is apparent from his comments upon accepting his new commission reported in the Sydney Morning Herald newspaper:

My personal experience across research, business and STEM education will guide my ability to formulate relevant advice …. We exist in a competitive international environment and to compete effectively, business needs science, science needs business, Australia needs both.

Originally I had thought to complete a critical reading of the communiques from Ian Chubb to interrogate his use of STEM as it was not common Australian parlance prior to his appointment in 2011. As he is now the past Chief Scientist, it seems more sensible to follow Alan Frankel’s residency. It is sufficient to note that under Professor Chubb’s tenure the prolific communicator oversaw a plethora of reports, media statement, interviews, public appearances, and policy papers advocating for STEM and STEM education. Some of the major reports include:

• July 2013: Science, Technology, Engineering and Mathematics (STEM) in the National Interest: A Strategic Approach

(A position paper for a whole of government approach to investment in STEM. The Business Council of Australia’s Action Plan for Enduring Prosperity endorsed the approach and recommended its swift adoption).

• September 2014: Science, Technology, Engineering and Mathematics: Australia’s Future

(Four areas identified and recommendations for improvements of which education was one. Education is to provide a secure pipeline for a skilled workforce in STEM to secure Australia’s future).

• November 2014: Benchmarking Australian Science, Technology, Engineering and Mathematics.
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March 2015: *The Importance of Advanced Physical and Mathematical Sciences to the Australian Economy*

(Underlines the point of STEM to the economy. A further report on the Biological Sciences to the Australian economy was released in January 2016).

Gough (2015) writes about several of Ian Chubb’s earlier reports and their implication for science education. However, in viewing these reports in tandem with the comments in the US context noted earlier, (with those more generally abroad in the literature, media and elsewhere), one cannot help but think that as one nation perfects its STEM and STEM education, so too does the next. This puts me in mind of the absurdity of a system Gee, Hull, and Lankshear (1996) identified which desires “ever more creative and perfect products and services (being) created and re-created at ever faster rates” (p. 27), to be ever more economically competitive.

In his first media release on his new website in February 2016, Alan Finkel tells us he hopes to start a ‘new conversation’ and he looks for ‘forward to the new responsibilities that the National Innovation and Science Agenda brings to the role of Chief Scientist … and serving as Deputy Chair of Science and Innovation Australia as it develops its critical 10 to 15-year plan.’ (my italics). The National Innovation and Science Agenda (also known as the somewhat inanely as the Ideas Boom) is the policy centerpiece of the Turnbull government. Its website describes the agenda thus:

Innovation and science are critical for Australia to deliver new sources of growth, maintain high-wage jobs and seize the next wave of economic prosperity.

Innovation is about new and existing businesses creating new products, processes and business models.

**Innovation is important to every sector of the economy** – from ICT to healthcare, education to agriculture, and defence to transport.

Innovation keeps us competitive. It keeps us at the cutting edge. It creates jobs. And it will keep our standard of living high (emphasis in the original). (National Innovation and Science Agenda, 2016)

The role of STEM and STEM education in this national agenda was reiterated by Christopher Pyne in a media release on his website in January this year:

“Australia needs to grasp new ideas in innovation and science, identify and capitalise on new opportunities and create new sources of growth to secure our nation’s future,” Mr Pyne said.

“The agenda heralds a critical and exciting time for the Australian economy. Its measures support innovative businesses, boost private investment in research commercialisation, fund critical research infrastructure and STEM skills and increase access to capital for high potential startups.”

And it shows a need to ‘open the eyes’ of students and parents how science, technology, engineering and mathematics will open doors to new and different career opportunities into the future. (Office of the Industry, Innovation and Science, 2016).

I hope to be forgiven for quoting at length from these websites. Their choice of words though, so clearly conveys the ideological positioning better than my paraphrasing. So it seems that in spite of Gee et al.’s (1996) warning, in a neoliberal globalised world, like many other nations, Australia is on a course of economic innovation heavily reliant on STEM and STEM education. Venn’s (2009) paraphrasing Foucault noted earlier and repeated again here is readily apparent:

That is, one must govern according to the rules of the market, by drafting laws, by instituting (fiscal and other) regulatory apparatuses, recalibrating the functions of socio-cultural institutions to bring them into line with the new language and new objectives of the enterprising state, and by constituting appropriate subjectivities, notably Homo oeconomicus as ‘enterprise man.’ (Venn 2009, p. 212, italics in original).

Not all Australians however, seem to be that impressed with the new innovation obsession. While
speaking at the National Press Club as recently as January 27th of this year on what he regards as a deep crisis in Indigenous affairs, Noel Pearson, possibly Australia’s most prominent Indigenous leader and activist, argued that the Turnbull government’s catch cry of ‘Australia as a culture of innovation’ is too narrow a conversation. “Every galah in every pet shop is talking innovation … (that is) … largely focused on business and product innovation and venture capital mobilisation rather than social and policy innovation” (Pearson, 2016). A galah is an Australian bird, a rose-breasted cockatoo or parrot with distinction pink and grey plumage and bold and loud behaviour. Not surprising, it is often used colloquially to describe a person who is a bit of a fool. Astutely, Pearson points out that the “lack of imagination” shown by the obsession with economics needs to be replaced by political and social innovation of a radial center as a way of progressing Australia’s commitment to justice and equality. Our mania with economic competitiveness (through STEM and STEM education) will not make for a happy nation. Moreover, as Triffitt (2016) argues in an opinion piece in The Age newspaper on January 28th alongside Pearson’s widely reported speech, our current trajectory is flawed as “the world is waking up to the reality that in 2016 it is shackled to an increasingly incoherent and stagnating economic system.” Commenting on the recent Oxfam report that just 62 individuals now hold as much wealth as almost half the world’s population, Triffitt (2016) suggests that our economic system may proceed for the short term. “But the one certainty we have is that stagnation, inequality and crisis will worsen, because nothing and no one can fix them. Something will have to give.”

WHERE TO FROM HERE: STEM AS DELEUZE & GUATTARI’S ROYAL SCIENCE

While I had intended to explore the Deleuzo-Guattarian concept of nomadology in this paper as a useful lens with which to interrogate STEM, it is a task that remains largely undone (Deleuze & Guattari, 1987). I have in the end, spent too much time on my first two tasks. But such is the joy of a paper in progress that this is concedable. (I also follow Foucault here in his 1978-79 Biopolitics lectures where he famously set out to achieve one thing only to do another). I will just make a few comments about nomadology and how it may function in a reading of STEM outside of the conventional scientism. It is worth noting though, that it is a difficult task to select just one of Deleuze and Guattari’s many concepts as each naturally “leads into many others and connects with another and another” (Blaise, 2013 p. 185). In Dialogues (Deleuze & Parnet 2002), Deleuze describes his use of ‘and’ rather than either/or logic as it produces for him, a more expansive way of thinking. So the concept of nomadology or nomadism, is but one from their self proclaimed ‘toolbox.’

Elaborated in A Thousand Plateaus, nomadology or ‘nomadic inquiry’ refers to states of being that resists hierarchical centralisation and control (of for example, ‘the state’ or under globalisation, the corporation) that aims to tame and control life. By contrast, the nomad - modelled on the life of the outsider - is not bound by territory (that is, remains in motion), is non-hierarchical, local and close range, values experience and seeks to exist outside state/corporate power. The nomad is a useful trope as it enables the decoding of the dominant (‘modern’) fixed and static political and social structures. Also referred to as ‘nomadic science,’ nomadology is the art and technique concerned with connections and the flow of ideas, things, and people, such that spaces for possibilities and creativities are in the becoming, spaces that are capable of inventing themselves. Within nomadology, ‘royal science’ is a state science that is official, proceeds from universals, and is heavily codified in terms of its processes, practices and concepts. It is clear that the STEM in the Australian Government’s and Chief Scientist’s views is a royal science whose “legislative and constituent …. primacy is taken for granted” (Deleuze & Guattari, 1987 p. 367) and has at its disposal “a metric power that can define a conceptual apparatus or an autonomy of science” (Deleuze & Guattari, 1987 p. 374). Drawing from Deleuze and Guattari (1987), Svirsky (2010 p. 4) goes on to argues that

the interaction between royal and nomad science produces a ‘constantly shifting borderline’, meaning that there is always some element that escapes containment by the ‘iron collars’ of representation … This occurs when ... a nomad element inserts itself in political struggles in which
for instance, the boundaries of citizenship are challenged and reopened … or the barriers of ethnic segregation are challenged by new form of interculturalism (as occurs with bilingual forms of education). It is through these ‘smallest deviations’ that smooth types of political activity dwell within the striated forms of state politics.

There is a resonance here in Svirsky (2010) words with a recent call for papers bought to my attention by Annette Gough. The journal Educational Studies is intending a special edition on Rethinking the Role of STEM in the Philosophy of Education: Implications for Education Research. The call ‘aims to put philosophy to work as a pragmatic intervention into the concrete STEM practices that saturate the field, and also as a creative platform for tapping and formulating subversive STEM practices that might open up a radically different imaginary.’ The ‘smallest deviations’ in nomad science mean it is an exciting time to be writing about STEM.

REFERENCES


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