FORUM

Exposing and deposing hyper-economized school science**John Lawrence Bencze****Abstract**

Despite indications of the problematic nature of *laissez-faire* capitalism, such as the convictions of corporate leaders and the global financial crisis that appeared to largely stem from a de-regulated financial services industry, it seems clear that societies and environments continue to be strongly influenced by hyper-economized worldviews and practices. Given the importance of societal acceptance of a potentially dominant ideological perspective, it is logical to assume that it would be critical for students to be prepared to function in niches prioritizing unrestricted for-profit commodity exchanges. Indeed, in their article in this issue, Lyn Carter and Ranjith Dediwalage appear to support this claim in their analyses of the large-scale and expensive Australian curriculum and instruction project, *Sustainable Living by the Bay*. More specifically, they effectively demonstrate that this project manifests several characteristics that would suggest *neoliberal* and *neoconservative* influences — ideological perspectives that they argue are largely fundamental to the functioning of the global economic system. In this forum article, possible adverse effects of neoliberalism and neoconservatism on school science are discussed — with further justification for Carter and Dediwalage's concerns. Additionally, however, this article raises the possibility to subverting neoliberalism and neoconservatism in science education through application of communitarian ideals.

Keywords Two-four key words • separated by • bullets • Science education • economization • social justice • environmental sustainability

As Carter and Dediwalage suggest in their article *Globalisation and science education: The case of Sustainability by the bay*, science education does not exist in a veritable ‘bubble.’ Rather, it functions, essentially, within a dynamic system involving larger societal and environmental contexts. Also as they suggest, science education — like so many other entities in societies — appears to be dominated by globalized economic ideologies. More specifically, despite an apparent ‘crack in their façade’ (in the form of the recent global economic crisis), science education seems to be under the influence of the mutualistic ideological perspectives of *neoconservatism* and *neoliberalism*. Under neoliberalism, capitalists accumulate wealth with minimum opposition to, and responsibilities for negative side effects of, their activities. Meanwhile, under neoconservatism, traditional elites maintain and perhaps augment their social status. Through analyses of documentary evidence and observations of school science practices associated with the ambitious and costly Australian curriculum programme, ‘*Sustainable Living by the Bay*’ (SLB), Carter and Dediwalage demonstrate how neoconservatism is manifested, for example, through an orientation towards Western Canonical knowledge and how neoliberalism is manifested, for example, through inculcation of habits of competitive consumption. Such effects seem incongruent with sustainable living. Nevertheless, that they appeared to be manifested in SLB seems to indicate the intensity of neoconservative and neoliberal perspectives. In this review article, claims made by Carter and Dediwalage are supported and extended. However, this article also offers a paradigmatic re-orientation that may undermine effects of neoconservatism and neoliberalism on school science.

Global Economization

The wellbeing of individuals, societies and environments (WISE) appears to be threatened in ways that often relate to science education. Arguably, our greatest concerns should relate to potentially catastrophic global climate change (Lynas 2008). There are many other problems, however, including health and social justice issues associated with: fast foods and other processed foods, pharmaceuticals, various biotechnologies and toxic chemicals in seemingly everything from shampoo to cell phones.

There are, undoubtedly, complex and diverse factors that could help explain associations among WISE problems and science education. However, a factor that seems to permeate such issues is the current state of capitalist economic systems. Weinstein (2000) suggests that “all other educational ideologies are marginal to [capitalist perspectives]” (p. 100). Although capitalism has existed for centuries, it has, apparently, come to dominate the zeitgeist of many societies. A key version of capitalism is *economic liberalism*, a view that societies must take steps to reduce impediments to market-based decisions about the nature of for-profit production and consumption of goods and services. In recent years, however, after a period of intensive government social spending following World War II and the Great Depression, this ideology was renewed — becoming known as *neoliberalism*. Under *neo-liberalism*, profit-oriented government intervention has been encouraged — often in the form of: tax reductions and, related to that, reduced social spending (e.g., health and education); more emphasis on individual responsibility, rather than the public good; reduced regulations on business activities, such as transnational trade and environmental and labour standards; and, privatization of some government services (e.g., forms of transportation). High business profits often are justified through suggestions that some benefits will ‘trickle down’ to lower classes in societies (McMurtry 1999). In this ethic, responsibility to others is a passive, rather than a pro-active, phenomenon.

Neoliberalism does not, necessarily, benefit all the people of the globe. It appears, instead, to be a project — likely subconsciously — of the global *elite*. People in power worldwide often take steps to ensure their continued power status and this often appears to translate into efforts to preserve traditional social interactions and stratification. This is said to be the neo-*conservative* agenda of globalization; that is, an orientation towards conserving (and augmenting) global social-economic stratification, which implies — among other things — that wealth will continue to be funneled towards the traditional elite (Gabbard 2000a). Carter and Dediwalage's case study of the expensive and heavily-promoted *Sustainable Living by the Bay* project is an excellent example of the pervasiveness of neoconservative and neoliberal ideals.

Economized School Science

In order to maintain and, perhaps, augment economic thinking and associated neoliberal and neoconservative ideological perspectives, economic elite may benefit if succeeding generations of children are enculturated along economic lines. Gabbard (2000b) referred to this project as *economization*, a process that he suggests “subordinates all ... forms of social interaction to economic logic and transforms nonmaterial needs, such as education, into commodities” (p. xvii). Effects of economization on education seem clear when examining various government policy and curriculum documents, in which it is common to read statements urging school systems to prepare students for an orientation towards economic transactions, so that ‘countries’ (particularly in terms of their businesses) can compete successfully in local and global markets (Henry *et al.* 1999). For example, the US National Science Education Standards document (NRC 1996) states that one of the purposes of science education is to “increase economic productivity through the use of knowledge, understanding, and skills of the scientifically literate person in their careers” (p. 13). Carter and Dediwalage claim that *Sustainable Living by the Bay* also manifests such an orientation. Authors of such documents seem comfortable recommending, in

effect, that jurisdictions use children as “human capital” (Apple 2001, p. 38) in their global economic conflicts.

Given the importance of science and technology to for-profit production and consumption (involving significant marketing) of goods and services, a major contributor to such social engineering appears to be school science. To understand its role, it is helpful to think of perspectives and practices of the for-profit *corporation*. Legally, corporations are mandated to emphasize profit-generation — often by minimizing costs, including through *externalization*; that is, getting others to pay for costs (Bakan 2004). Such an orientation appears broadly evident in school science. Profit for school science may refer to workers, such as engineers and scientists, who can develop and manage mechanisms of production and consumption, often at the expense of the wellbeing of many individuals, societies and environments. To understand such effects, it is helpful to think of them — as Carter and Dediwalage urge — in terms of *neoconservative* and *neoliberal* capitalist agendas. Each of these influences is described, with examples, in the sub-sections below.

Neoconservatism and Science Education

Lyn Carter (2005) suggested that “neoconservatism works to preserve traditional forms of privilege and marginalize authentic democratic and social justice agendas ... (p. 571). In economized societies, it follows that ‘privilege’ would relate to one’s control of economic exchanges. Although there may be many ways to analyze such control, Carter and Dediwalage, and others, emphasize that economic systems have recently shifted from a focus on production and consumption of *physical* products to that based on knowledge. In *knowledge economies*, emphasis is increasingly placed on ideas, images and concepts for development and marketing of products for repeated cycles of consumption (Lash 2002). Apparently, such a system requires relatively few people to *create* knowledge. These people — who may work as scientists, engineers, accountants, lawyers, management consultants, investment bankers, authors, art

directors, etc. — are said to be *symbolic analyzers*; those with abilities to analyze and manipulate symbols, including words, concepts, numbers and graphics (Reich 1991). These workers are said to comprise a “managerial class” (Apple 2001, p. 30); those who develop and manage knowledge production and distribution (e.g., marketing). Most of the labour, however, is carried out by much larger classes of workers; those who are said to provide routine production and in-person services — such as factory workers, store clerks, call centre operators, security guards, etc.

Science education appears to assist with this sorting of students in a number of ways. Given neoconservatives’ priority for maintaining their status, an artificial selection process appears to occur — in which ‘success’ in school science is largely based on a student’s inherited wealth and wellbeing. Pierre Bourdieu (1986) discussed this concept in terms of *capital*; entities of exchange value. Survival in terms of *cultural capital*, including knowledge, skills and attitudes that enables a person to acquire status in a particular culture, appears to operate in education. Lemke (2001), for example, suggested “curricula and teaching methods are ... most closely adapted to the needs of middle- and upper-middle-class ... fluent speakers of prestige dialects of English” (p. 306). With regards to science education more specifically, a key form of capital enabling survival relates to students’ abilities to demonstrate their potential for serving economic elite as their symbolic analyzers. Students often must be able, for example, to quickly comprehend large amounts of abstract, decontextualized knowledge (e.g., as laws, theories and functions of inventions) that often are rapidly transmitted to them in school science. Another pervasive and powerful technique in this process appears to be use of *learner-centred pedagogies* — as Carter and Dediwalage emphasize. In so-called inquiry-based learning, through ‘scientific’ interactions (e.g., experiments) with phenomena, students are expected to self-determine, with some teacher prompting, questions/problems, data-collection and analyses methods, approaches to knowledge dissemination, etc. Many students, however, tend to have considerable difficulty ‘discovering’ abstractions, such as forms of energy — like potential and kinetic states — without *already* having conceptions of them (Hodson 1996). Assuming that access to conceptions enabling

students to ‘discover’ appropriate abstractions is related to the extent of a person’s cultural capital, such guided inquiries appear to be discriminatory (Bencze and Alsop 2009).

Expecting students to take individual control over their learning seems, as Carter and Dediwalage suggest, disempowering for many students. It is as if school science was like a protracted *test* to determine which students have and can gain further access to scarce cultural capital. In a hyper-economized world, it is apparent that “[P]ersonal struggle, competitiveness, atomization, and scarcity of success or well-being are the constitutive elements of both the social[-economic] and the educational world” (Shapiro 2000, p. 104). However, such an exclusionary approach seems to have contributed to the well-documented severe and increasing global differences between rich and poor — which McLaren and Baltodano (2000) call “global economic apartheid” (p. 56). Where this is occurring, there is a need for dramatic school science reform in ways that would help lead to more socio-economic equity.

Neoliberalism and Science Education

It is apparent that the neoconservative agenda is largely facilitated by *neoliberal* perspectives and preferred practices. As described above, this agenda emphasizes relatively unregulated for-profit production and consumption of goods and services — often with minimal regard for possible adverse effects on individuals, societies and environments. Carter and Dediwalage’s analysis of the *Sustainable Living by the Bay* project suggests that it greatly enacted neoliberalism. In particular, they emphasize its influences on students’ *conceptions of self and others*. Other research, however, indicates the role of at least two additional factors associated with enactment and promotion of neoliberalism; that is, students’ *conceptions of science and technology* (the subject of their study) and their *level of capital*. Each of these themes is addressed, with examples, in the sub-sections below.

Conceptions of Self and Others

In essence, Carter and Dediwalage seemed to stress that *Sustainable Living by the Bay* was oriented towards assimilating students into a kind-of *personal* zeitgeist that prioritizes unregulated for-profit commodity exchanges. This aligns well with Weinstein's (2000) claim, for example, that individuals in a capitalist society "find their meaning in life by transforming the demands that the system makes of them into values that form the core of their identities" (p. 98). More precisely, as Carter (2005) noted, "[n]eoliberalism 'marketizes' everything, even notions of subjectivity, desire, success, democracy, and citizenship, in economic terms ..." (p. 571). Perhaps fundamental to neoliberal ideals, Carter and Dediwalage suggest that *Sustainable Living by the Bay* orients individuals towards thinking of themselves as economic *consumers* in their private life worlds. There is, indeed, considerable support for this claim in refereed literature. With repeated instances of individualized competition for assessment/evaluation success, and due to the excessive emphasis in school science on student learning of professionals' achievements (e.g., scientists' laws and theories) (Hodson 2003), students may identify themselves as *consumers* of knowledge much more so than producers of it. Apparently, a steady diet of conclusions can stifle students' desire to: ask questions, critique claims, criticize those who control knowledge and develop conclusions. Saturating people with 'consumer goods' (including 'achievements' of professionals in science and technology) has, apparently, served as an excellent pacifying technique. Murray Dobbin (1998), for instance, suggested that people tend to be less critical of public affairs when they have ready access to consumer goods. This may be good for business, as such passivity can ensure workers follow labour instructions (e.g., from the aforementioned symbolic analyzers) and people may think of themselves primarily as purchasers of products and services (Giroux and Giroux 2006).

A consumer orientation should not be conceived completely as an *individual* phenomenon, however. The nature of students' identities with respect to others also is an important factor in implementation of neoliberalism in schooling. As Carter and Dediwalage note, a neoliberal

orientation may result in students/citizens thinking of themselves as individuals in competition with others for access to limited wealth/capital. However, such *possessive individualism* cannot be fully understood without assuming that students/citizens may see themselves fitting into *hierarchies*, and doing so with perhaps reduced empathy for those less ‘fortunate’ than them. Barlow and Robertson (1994) claimed, for example, that, in competitive school environments, “a student learns that when the boy seated next to her drops out of school, he is solely responsible for the decision. ... What happens to him is of no concern to her. She is learning to blame the unemployed for their condition ...” (p. 82). Such a view discourages support for the common good and, related to that, promotes the neoliberal priority for privatization. In a competitive world, this inevitably generates ‘losers’ — often judged on narrow, economic bases — and, given the scarcity of capital of various sorts, promotes oppressor-oppressed social relations. As Freire (1997) has said,

[t]he oppressor consciousness tends to transform everything surrounding it into an object of its domination. The earth, property, production, the creations of people, people themselves, time — everything is reduced to the status of objects at its disposal (p. 40).

Such oppression needs to be opposed at every turn in democratic societies (and otherwise).

Conceptions of Science and Technology

It seems logical to assume that the neoliberal agenda would be supported if professional science and, by association, business and industry (and their products and services) were portrayed in ways conducive to for-profit production and consumption cycles that minimize concern for possible adverse effects on individuals, societies and environments. There is, indeed, considerable evidence in educational research literature to support this possibility. In various ways, it seems that school science can serve as an ‘infomercial’ for neoliberal capitalist

activities. A convenient way of thinking of such a portrayal is in terms of Cathleen Loving's (1991) *Scientific Theory Profile* (STP)¹, illustrated in Figure 1.

Figure 1: Scientific Theory Profile (Loving, 1991).

Arguably, portraying science as Rationalist-Realist would be supportive of neoliberal capitalism. Scientists would be portrayed as using highly logical and systematic approaches to knowledge development, and little or no reference would be made to adverse effects on science of particular social groups, ideologies, etc. (which would indicate a Nationalist-Antirealist stance). To a great extent, this does, indeed, appear to be the case. Derek Hodson (2008), for example, in a general review of school science, suggests that the following *ideological pivots* seem to apply to school science:

Naïve realism: science gives access to truth about the universe; *Blissful empiricism*: science is the meticulous, orderly and exhaustive gathering of data; *Credulous experimentation*: experiments can conclusively verify hypotheses; *Excessive rationalism*: science proceeds solely by logic and rational appraisal; and, *Blind idealism*: scientists are completely disinterested, objective beings (p. 31)

¹The horizontal axis in this framework spans a continuum ranging from Rationalist through Naturalist positions regarding the nature of theory negotiation in the sciences. Rationalists tend to believe in highly systematic methods of science, including rational judgments about theory. Naturalists, by contrast, assume that the conduct of science is highly situational and idiosyncratic, depending on various factors, including psychological, social, cultural and political influences. The vertical axis, meanwhile, depicts a continuum reflecting the truth-value of knowledge, with Realist through Antirealist positions. Realists believe that scientific knowledge corresponds to reality, while (extreme) Antirealists claim that each person's constructions are valid.

Rationalist-Realist perspectives about science also can be ‘portrayed,’ in a sense, through *omission* of problematic aspects of science. Although Bruno Latour and Steve Woolgar (1986), in their study of scientists in action, found that hoarding of information, cultural variations in science practices, personal and group biases, plagiarism, and blind trust in data, are often found in authentic science practices, such practices are rarely addressed in school science. Beyond such *internalist*² misconceptions, however, it also is apparent that common school science practices ignore or unrealistically portray relationships among fields of science and technology and societies and environments. Allchin (2004) claims, for instance, that school science often portrays professional science as “pure and isolated from culture” (p. 939). Often omitted from instruction, for example, are references to problematic aspects of business-science partnerships that can compromise the integrity of practices in fields of science and technology (e.g., Carter 2005).

With relatively naïve views about professional science, students may be dependent on authority figures, ill-prepared to make informed judgments about scientific products and practices. Consequently, because of increased advertizing in our society, students may be “prey to dogmatists, flimflam artists, and purveyors of simple solutions to complex problems” (AAAS 1989, p. 13).

Perhaps one of the few allusions in school science to potential problematic aspects of professional science and technology is to imply that products of these fields can and should be *owned* by individuals. This may arise, in part, from the individualistic nature of assessment and evaluation of students’ development of understanding of science knowledge. In a sense, in using their newly acquired/developed knowledge to answer test questions, for example, it is like they are ‘trading’ their knowledge for marks — as if it were a commodity to be ‘bought’ and ‘sold’. This seems to be paralleled by the apparent common practice of attributing science knowledge

² *Internalist* conceptions about science refer to characteristics (e.g., psychological) involving individual scientists, along with those relating to their social interactions amongst colleagues *within* their fields (Ziman 1984). They ignore *externalist* conceptions, such as relationships among practitioners in fields of science and technology and societies and environments.

claims to individuals, by holding up particular scientists, such as Nobel Prize winners, as owners of particular ideas (e.g., Hodson 2008). Also supporting the idea of individual ownership may be the practice of encouraging students to arrive at conclusions based on data from their (likely guided) ‘critical’ inquiries (Hodson 1996). They may assume (if only subconsciously) that, like ‘science celebrities’ (those whose names are attached to particular knowledge claims), their conclusions *belong* to them. This starkly contrasts with suggestions that knowledge is historically and socially constructed and, to a great extent, belongs to everyone — past, present, and future. In a wide-ranging and deep analysis of knowledge development in various fields of science and engineering, for example, Gar Alperovitz and Lew Daly (2008) demonstrate ‘discoveries’ and inventions would not have occurred without prior development, usually by others, of necessary knowledge, techniques, infrastructure and so forth. Consequently, they concluded that we must think of most knowledge, inventions, etc. as part of our common heritage.

Capital

Finally, while conditioning students, effectively, towards acceptance of often-irresponsible for-profit production and consumption of goods and services, neoliberal science education also appears to limit their access to and use of various cultural and social resources. Pierre Bourdieu (1986) spoke of these in terms of ‘capital’. For success, people need access to knowledge, skills, attitudes and other cultural resources, along with appropriate social networks, associated with the dominant classes in a society. In an educational system greatly influenced by neoliberalism and neoconservatism, few gain access to such capital. There appear to be at least four aspects to this ‘disempowerment’, which I address in the following subsections.

Confusion:

Rapid-fire instruction in ‘products’ (e.g., laws and theories) of science and technology, which appears to be very common in schools, tends to leave many students — particularly those lacking useful cultural capital — relatively illiterate. Millar (1996) claimed, for example, that most studies of students’ (by the age 16) understandings of fundamental laws and principles of science — including the particle theory of matter, the model of the solar system, and ideas about animal and plant gas exchange — are either simplistic or quite different from those of scientists. Similar results are obtained for lay adults. Such illiteracy may, however, be good for business. Citizens would be less able to contribute to public decision-making on matters pertaining to professional science. Also, with poorer understandings of science concepts, they may be more inclined to consume those supplied by others — including by businesses, which control much of professional science.

De-skilled:

Paradoxically, students rarely, if ever, have opportunities to *do* science in school science. In other words, texts or teachers invariably control decisions about areas of exploration, questions or problems to solve, methods of data collection, analysis and critique and decisions about conclusions from investigations (Hodson 1996). Even with constructivism-informed pedagogical approaches, including learner-centred pedagogies discussed by Carter and Dediwalage, students’ thoughts and actions often are, more or less, ‘attacked’ in ways ensuring their conclusions match those of Western science, including by: i) maligning their pre-instructional conceptions, ii) engineering their empirical inquiries and iii) regulating their conclusions (Bencze 2000). Without full control over at least some of their learning, students may not develop deep and personal expertise that they might use in problem solving/knowledge-building situations important to them. Etienne Wenger (1998) suggests that deep and committed learning is most likely to arise

when there is a close reciprocal relationship between phenomena of the world with which a person interacts and representations of those phenomena that the person has a role in creating. Without such deep learning, students may be dependent on those controlling knowledge generation and dissemination.

Homogenization:

Something that Carter and Dediwalage did emphasize was that expectations for student achievement in science have been highly standardized and kept under tight surveillance by governments (e.g., through testing). Governments claim such uniformity in curriculum and instruction will guarantee equal opportunities for all learners, regardless of their learning contexts. However, such standardization is likely to place pressure on members of distinct sub-cultures to conform to the dominant culture. For example, “around the world, ... science students are expected to construct scientific concepts meaningfully even when those concepts conflict with indigenous norms, values, beliefs, expectations, and conventional actions of students’ life-worlds” (Aikenhead and Jegede 1999, p. 270). Such societal conformity may be tolerated, nevertheless, because it can be good for business. As Michael Apple (2001) claimed in his analyses of effects of curriculum standardization and assessment, cultural homogenization can make it easier for companies to market to citizens who generally think and act alike.

Isolation:

As argued above, extreme emphasis on individualized assessment and evaluation tends to isolate students from one another. Because isolated individuals may be more dependent on producers of goods and services than would be members of collaborative teams, ideas, motivation and other factors in knowledge building are made *scarce*. “Economization insists on scarcity as the defining characteristic of the human condition” (Gabbard 2000a, p. xx). Indeed, in

Bowling Alone, Robert Putnam (2000) documents numerous instances in which people are losing social capital as their participation in myriad life activities has been individualized in recent years. A sense of scarcity is, thus, created in the minds of the public — which can, then, be filled by business and industry.

Overall, the contribution of much of school science to societies and environments may be highly problematic. Although it generates professionals, such as scientists, engineers, lawyers, etc., it is apparent that the overwhelming effect of school science is to orient (or re-orient) children towards *egoism*. Students often have been encouraged to desire and compete for scarce cultural capital and, in doing so, suppress concerns for others' exclusion from it. Dobbin (1998), for example, finds this *barbaric*:

[O]ur collective will is declared meaningless compared to the values of the marketplace, and communitarian values are rejected in favour of the survival of the fittest. A thinly disguised barbarism now passes for, is in fact promoted as, a global human objective (pp. 1-2).

To the extent that neoliberal capitalism is having effects on students such as those discussed above, it needs to be abandoned and replaced with more democratic forms of science education.

Towards a re-visioning of science education

Suggesting that hyper-economized school science is barbaric and analogous to a ruthless 'animal-world' *survival-of-the-fittest*, as found in Charles Darwin's (1871/2004) writing, may seem appropriate — given its emphasis on competitive and unequal distribution of capital and its consequent disempowerment of the masses and environmental compromises. Further reading of Darwin's works suggests, however, that he did not recommend a 'dog-eat-dog' mentality for *human* progress. Rather, he urged adoption of a more 'civil' form of evolution; that is, one that promotes caring, love, moral evolution, and education as the prime drivers for human evolution (Loye 2004). In this conception of knowledge and learning, each of us finds our niche partly

guided by ways in which we can contribute to a *sustainable* evolution. This is comparable to a *communitarian* epistemology and ideology; that is, that individuals are socially (historically and temporally) constituted and, consequently, albeit not necessarily for altruistic reasons, need to act responsibly towards each other and to their environments (Eiglad and Bookchin 2007). Through the lens of communitarianism, one can imagine a science education that, for example, ensures that all students: are educated to the best of their abilities, develop more realistic conceptions of the nature of science and technology and their relationships with societies and environments, have the expertise and motivation to develop their own knowledge and are motivated and able to use their education for the benefit of the common good.

Although the power and reach of global economization seems immense, and even unstoppable, it does not stop us from seeking to envisage a more socially just and environmentally sustainable science education — perhaps based on communitarian principles.

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Bios

John Lawrence Bencze is an Associate Professor, science education, at the Ontario Institute for Studies in Education, University of Toronto. His teaching, research and scholarly writing are focused on issues pertaining to history, philosophy and sociology of science and technology and citizens' possible actions to address them.