ABSTRACT

STEM reform efforts are profoundly reshaping the nature of public education in many developed nations. Taking inspiration from Ulrich Beck’s notion of zombie categories in political theory, in this paper I make the case that the current STEM education bandwagon is a zombie reform that has been coming back in different garbs to haunt public education with disheartening consistency for more than a century. I explain the endurance and success of STEM and STEM-like initiatives of the past as an outcome of the discursive legitimacy afforded by the hegemonic discourse of neoliberalism and the material power of powerful actor-networks that fuel these initiatives. In the end I explore if overcoming this zombie attack is indeed a ‘mission impossible’.

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If one were to survey the public education landscape of the recent times, it would be hard to miss the prominence of STEM education initiatives in the United States (Zeidler, 2014) as well as in many other developed nations (Carter, 2015; Bencze, 2015). It is also unmistakable that the goals of these initiatives are anything but modest. For instance, under the impact of these initiatives, science standards in the United States appear to be shifting in directions that limit the scope of democratic engagement and privilege neoliberal ideas in science education (Satchithananthamamoorthy, 2015). Further, “technological literacy for all” has become the dominant educational goal in STEM education (Sanders, 2009). Clearly, as the National Research Council’s (2012) report articulates, the focus on STEM education is directed towards meeting the goals of “continued scientific leadership and economic growth in the United States” (p. 3).

Based on the premise that though STEM initiatives may lead to some beneficial outcomes, overall they bode ill for public education in the United States, and taking inspiration from Ulrich Beck’s notion of zombie categories in political theory, in this paper I make the case that the current STEM education bandwagon is a zombie reform that keeps coming back in different garbs to haunt science education with depressing regularity no matter how hard we try to quash them. I explain the endurance and success of STEM and STEM-like initiatives of the past as an outcome of the discursive legitimacy that such initiatives are able to acquire because of their close alignment with the dominant discourse of neoliberalism and the material power that fuels these initiatives. Further, I find that these efforts emanate from a vast and powerful actor-network in action whose material and ideological interests lay in fully embedding public education in the global market economy. In the end I explore if overcoming this zombie attack is indeed a ‘mission impossible.’

**THE (UN)DEAD RATIONALE FOR STEM EDUCATION**

The current push to integrate science, technology, engineering and mathematics together as STEM in the context of PK-12 education is legitimized on the basis of the claim that there exists a ‘skills gap’ in the US industry that is assumed to be hobbling it down and preventing it to offer employment opportunities to the working class (Dimon and Seltzer, 2014). It is said that industry is not getting the kind of skilled workers it needs. In an attempt to convey this sentiment, a National Research Council’s (2011) report asserted that “‘Employers in many industries lament that job applicants lack the needed mathematics, computer, and problem-solving skills to succeed, and international students fill an increasing portion of elite STEM positions in the United States’” (p. 3). Similarly, the Business Roundtable (2014), an association of chief executive officers of leading U.S. companies, in their recent report *Closing America’s Skills Gap* argued that this is because of a ‘core skills’ problem. That is, workers seeking employment are not well prepared and lack ‘employability skills’. The Business Roundtable clearly lays the blame on “the K–12 education system, which lacks high academic standards in many states, allowing students to graduate from high school without mastering these competencies” (p. 2). Of course, the Business Roundtable is not the only business group making such a claim. A few years earlier, the President’s Council on Jobs and Competitiveness (2011), a committee dominated by corporations, had also sounded an alarm over this ‘skills gap’ through its declaration that “the gap between employer needs and workforce skills is starkest in the critical areas of STEM education” and “improving STEM education throughout our educational system is critical in an increasingly technical world” (p.12). With the problem being so framed, the President’s Council argued that what we need are “a series of actions that could realign our higher education systems and lifelong learning programs to better meet workforce and student needs, even as we transform our education system from preschool to high school” (p. 11).

Clearly, these are powerful voices, and when they urge in unison that there exists a ‘skills gap’ crisis, the state not only listens but also tends to get swayed. However, given the private sector’s long standing interest and interventions in public education (Cuban, 2004; Engel, 2000), a conflict of interest cannot be denied and any claims coming from them regarding the nature or quality of education being offered in public schools
deserves a close scrutiny. When one does that, and clearly a number of researchers, such as Capelli (2015) and Salzman, Kuehn and Lowell (2013), have looked into the merits of this claim, one finds that this crisis exists only on the pages of reports and position papers emanating from groups and organizations connected with big business. We also find that public schools are being unfairly blamed for any difficulties that employers maybe facing in getting the workforce they need. This is not to say that public schools in the United States do not face serious challenges. They do, and there is a lot that can be done to improve public education. However, as I show ahead there is little evidence to suggest that the current quality of science or math education poses any threat to American economy.

Our schools are showing solid improvements in math, reading and science learning, and U.S. is not in an adverse position in this regard with most nations, and certainly not with nations commonly perceived as a threat to our industrial and technological prowess, such as India and China (Ravitch, 2013). In fact, researchers now raise serious questions about comparisons that groups like Business Roundtable make between nations on the quality of their education system based on scores on international tests, such as TIMSS and PISA. A review of research has this to say on this issue: “Our review of the critiques of the claims surrounding international tests and the future prospects for countries that do well or poorly on these tests suggests that much of the international testing enterprise and its ideological influence has the substance of a house of cards” (Carnoy, 2015; p. 15). For instance, the report concludes that the results of such tests are a poor predictor of future economic growth rate, especially in the case of the United States and Japan. Thus, according to the report, “the use of data from international tests and their accompanying surveys have limited use for drawing educational policy lessons” (pp. 15-16).

In fact, even if we do not rely on international comparisons and just focus on the workforce requirements for the U.S. economy, it is clear that the fears of a “skills gap” are overblown and without much basis. First, quality wise science and engineering graduates from universities in the United States rank better than graduates from nations, such as China and India, that are supposedly threatening its economic and industrial superiority (Gereffi, et. al., 2008; Loyalka, et. al., 2014). Second, the supply of science and engineering graduates is more than enough for what the United States economy needs. In fact, U.S schools and colleges supply qualified science and engineering graduates far in excess of the demand (Xie & Killewald, 2012). For instance, only one out of every two STEM graduates are employed in a STEM job, and computer science and engineering departments in US universities produce 50% more graduates than are hired (Salzman, Kuehn, & Lowell, 2013). Similarly, researchers find that the real reasons behind recruitment of foreign workers in the tech industry have little to do with labor shortages but with the capitalist imperative to reduce labor costs and get “indentured” workers (Matloff, 2013). A well regarded review of research on the “skills gap” issue from the National Bureau of Economic Research, therefore, concluded:

Overall, the available evidence does not support the idea that there are serious skill gaps or skill shortages in the US labor force. The prevailing situation in the US labor market, as in most developed economies, continues to be skill mismatches where the average worker and job candidate has more education than their current job requires. Persistent, high levels of unemployment reflect the fact that job seekers still outnumber available job openings. While it is certainly true that a bigger supply of cheaper labor would be useful to employers, it is not clear that such a situation would be useful for the country as a whole, and any claims to that effect should be examined carefully. (Capelli, 2014; pp. 46-47).

Thus, it is evident that the rationale of “skills gap” for the current push for STEM education in United States public education has no life to it. And yet, it continues to animate the public discourse and provide legitimacy to current STEM initiatives. What gives? In the next section, using the trope of zombies I present a historical context to the recurrence of the “skills gap” threat in different garbs over the decades in the United States, and in the section that follows, with the help of conceptual ideas borrowed from post-structuralism and actor-network research, I offer an explanation for the “skills gap” ‘crisis’ and its recurrence in different garbs over the decades in the United States.
STEM-FICATION OF EDUCATION AS A ZOMBIE REFORM

Once in an interview Ulrich Beck used the term ‘zombie concepts’ or ‘zombie categories’ to refer to “living dead” ideas, such as nation-state, which govern our thinking but are not really able to capture the contemporary milieu” (Beck and Beck-Gernsheim, 2002). Ever since, the use of this term has been broadened by social scientists to include theories that appear alive and important to supporters but in fact fail when matched with available evidence and current scholarship. For instance, John Quiggin (2012) has written extensively about ‘zombie economics’ – the dead ideas, such as market liberalism, the great moderation and the efficient markets hypothesis, that the great recession of 2008 was supposed to have disproved and killed for all times to come, but we find that they somehow continue to dominate the policy world. Scholars have also found zombie ideas in other disciplinary fields, such as sciences (Moles and Ollerton, 2016) and education (Kern, 2013). The idea that public education is not living up to its core purpose to support the demands of the nation’s economy also qualifies as a zombie idea that resurrects itself to haunt public education every few years with unnerving regularity.

As we saw in last section, the notion that the U.S industry is being harmed because of the existence of a “skills gap” for which public education is to be blamed has little merit, and yet it not only survives but also dominates the thinking of nation’s economic, political and policymaking elite. Just a few years earlier, the putative failure of the public education system was seen reincarnated as the reason why the U.S was facing a ‘gathering storm’ in terms of competition to its industrial prowess from rising nations like China and India. These fears were given a concrete, actionable shape by the publication of a very influential report, Rising above the gathering storm, from the Committee on Prospering in the Global Economy of the 21st Century (2007). This report led to the legislation of America COMPETES (Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science) Act that was passed with broad and a rather unusual bipartisan support in the Congress and got prompt presidential approval in 2007. Through this legislation politicians and policymakers committed substantial financial and political capital in support of revitalization of science, technology, engineering and math (STEM) education in the nation. Of course, then as now, there was little evidence that the putative poor quality of education in public schools is to be blamed for the ‘gathering storm’ that bedeviled the imaginations of economic elite and policymakers (Salzman and Lowell, 2007).

A couple of decades ago in 1980s, the public schools were blamed for the perceived loss to Japan of unchallenged pre-eminence in commerce, industry, science, and technological innovation. A Nation at Risk, a report from the National Commission on Excellence in Education (1983) constituted by Ronald Reagan warned,

Our nation is at risk. Our once unchallenged preeminence in commerce, industry, science and technological innovation is being overtaken by competitors throughout the world … the educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people. What was unimaginable a generation ago has begun to occur – others are matching and surpassing our educational attainments. (p. 2)

As Owens (2015) concludes, “Unfortunately, for the next thirty years, the report became an example of dogma on a national scale, leading to the notion that the American public school system was an utter failure” (p. 27). This threat was used to usher an unprecedented influence over public education by business groups through the standards and accountability movement that still shows no signs of abating. Again, the fact that this perceived threat had little basis in reality was revealed by the following confession of one of the members of the commission that wrote the report:
In order to be more effective some alarming language had to be used. That was immediately there, it was understood that we have to say things in an alarming kind of way – even to the point where the statistics may not have been quite correct. (Sommer as cited in Owens, 2015; p. 28).

Going further back one finds that in 1960s following Soviet Russia’s Sputnik success fears of Russian dominance in space and technology were used to usher sweeping changes in the science curricula (DeBoer, 1991). Of course, as the historians recall that the blaming and shaming of public schools by business groups has been going on for more than a century. For instance, Cuban (2004) reports that “the skills-deficit argument first appeared in the late 19th century, when industrial leaders also were deeply concerned about global competition, at that time from German and British manufacturers” (p. 238). Here again we see the zombie idea that the public schools offer poor education that hurts the industry being let loose up to haunt public education and thus force it to change in ways that benefit the material interests of the economic elite.

**WHY IS THIS ZOMBIE IDEA SO HARD TO KILL?**

Given the relatively long history of the involvement of industry in public education and its ability to influence the purposes of education, it is fair to say that the state as well as the general public has largely accepted the claim made by big business that it is indeed “a major “consumer” of the education “product” as well as an investor in the education system through philanthropic and tax dollars” (President’s Council on Jobs and Competitiveness, 2011; p. 12). Thus, any position taken by the business community becomes important in shaping the education policy of the state. In a democracy discursive legitimacy is critical for a perspective to influence policymaking. This legitimacy to the narrative espoused by big business on schools and their role in economy and the resulting STEM initiatives come from their close alignment with the neoliberal discourse that has lately become so dominant and hegemonic both in society at large as well as public education system.

Taking a Foucauldian standpoint, I see neoliberalism as a discourse of governmentality that seeks to elevate individualized, market-based competition and exchange as the central and most desirable governing principle for organizing human action and social life, even in areas usually considered non-economic, such as education (Foucault, 2008). Since 1970s, the economic elite in the United States as well as in most develop nations have selectively used this discourse to protect and enhance their material interests. Or as Harvey (2005) alleged that neoliberalism has always been “a project to achieve the restoration of class power” (p. 16). Neoliberalism has profoundly impacted schools and the education they offer by reconstituting schools as service providers, parents and students as consumers and education as an investment that a student makes to enhance her capital (Engel, 2000; Hursh, 2007; Lakes & Carter, 2011). Naturally, then such a discourse (a) legitimizes the business elite’s view of students as ‘products’ to be ‘consumed’ by them, (b) lends credence to any claims made by them as to ‘defects’ in the ‘products’ churned out by schools of the nation, and (c) positions STEM education as the only rational educational reform for schools to adopt.

Legitimation by a dominant discourse is definitely important for a claim to have any purchase among policymakers. But, what is also critical is the material support that keeps such claims in constant circulation both in the mainstream media as well as the policy world. Discursive legitimacy and material power tend to go hand-in-hand in democratic societies. In an interesting and influential paper on oligarchy in the United States, Winters and Page (2009) used the data on the US distributions of income and wealth to show how wealthiest Americans are in a position to exert far greater political influence than average citizens, and can exercise their material power to dominate policy in certain key areas. This exercise of material power is usually hidden from public view because, as Bowen (2015) suggests the discourse of liberal democracy in nations like the United States, “serve to mystify the more material relations of power that lurk under the surface of democratic institutions” (p. 53). If we demystify the STEM education reform and the “skills gap” crisis, we...
can discern the material power of the economic elite in action in: (a) composition of national committees, such as the one that drafted Rising above the Gathering Storm report in 2007, that get to frame and normalize the problems facing public education and the solutions to overcome them; (b) having direct access to policymakers, usually through groups like the Business Roundtable (Edmund, 2005); (c) framing of the issues in public media through steady dissemination of press releases and specially prepared reports (Miller, 2011); (d) advising elected officials on STEM educational policy (Jost, 1991); and (e) direct investment in STEM education reform, such as by major chemical, pharmaceutical, technology, and aerospace corporations (“STEM: Growing our next”, 2016).

This material power of the economic elite can be understood as an effect of a vast and intricately connected actor-network devoted to reconstituting science, Technology, Engineering and Mathematics as STEM disciplines. This actor network consists of actants and ‘punctualised’ smaller networks that include business groups, such as Business Roundtable (http://businessroundtable.org/issues/education-workforce/stem-education), philanthropic organizations, such as the STEM Funders Network (http://www.stemecosystems.org/), government departments, such as the U.S. Department of Education (http://www.ed.gov/stem), advocacy groups, such as the STEM Education Coalition (http://www.stemedcoalition.org/), material assets of the economic elite, information technology, (many but not all) members of the professional and managerial class, and intellectual fountainheads of capitalism, such as the Heritage Foundation. This immensely big actor-network continually engages in translation of “materials, actors, and texts into inscriptions that allow influence at a distance”, and organizes “centers of translation where network elements are defined and controlled, and strategies for translation are developed and considered” (Crawford 2005, p. 2) such that STEM comes across as the only intelligible and legitimate field of articulation for school science, technology, engineering and mathematics. That is, this actor-network actively works to hoist STEM education as a national priority by advocating the idea that STEM education is critical for the competitiveness and economic prosperity of the United States (see: http://www.stemedcoalition.org/stem-ed-coalition-activities/), and operates a regime of truth that legitimizes and normalizes the view that “STEM is more than just a grouping of subject areas. It is a movement to develop the deep mathematical and scientific underpinnings students need to be competitive in the 21st-century workforce” (Jolly, 2014). This actor network has endured over the years and has accumulated enough actants to exert enough material power and acquire needed discursive legitimacy to unleash initiatives like the current push for STEM education on the public education in the United States at every available opportunity or perception of external threat.

**SO IS COUNTERING THE STEM AGENDA A MISSION IMPOSSIBLE?**

The grouping together of science, technology, engineering and mathematics as STEM is an act of hegemonic articulation that seeks to normalize a neoliberal ‘common sense’ about these disciplinary fields. Such a hegemonic articulation is always precarious, temporary, based on the exclusion of other possibilities and, thus, always in need of constant reiteration and reaffirmation. I believe that realization of this precarious in hegemonic articulation of STEM opens up possibilities for thwarting the STEM agenda for educators with alternate and progressive vision for public education. These possibilities and the concomitant course of action cannot be outlined by someone like me who is a bit removed from the action on the ground. It is a task that will have to be accomplished by educators themselves. University based intellectuals like me, as Apple, Au and Gandin (2009) argue, can help the activist-teachers by ‘bearing witness to negativity’, and acting as ‘secretaries’ for them by producing ‘thick descriptions’ of the ill-effects of STEM initiatives and efforts by activist-teachers to counter this educational reform.

In my view, educators seeking to build alternative, more progressive visions of science education may do well to begin with a social critique of STEM that is typical of radical politics in the sense that such a critique
aims to “disarticulate the existing discourses and practices through which the current hegemony is established and reproduced, with the aim of constructing a different one” (Mouffe, 2008). In this task an educator may not be able to depend upon her ‘common sense’ because as a “philosophy of non-philosophers” (Gramsci, 2000; p. 343), it is quite possible that ‘common sense’ is will be “in conformity with the social and cultural position of those masses whose philosophy it is” (p. 343), and where “one can find there anything that one likes” (p. 345) including dominant interpretations that naturalize the injustices in question. That is, it appears to me that educators will likely need to develop their own philosophy of praxis, or ‘good sense’ (Gramsci, 2000; p. 327) that combines local knowledge with critical awareness of the self and an understanding of the ways in which STEM is being naturalized as a unitary disciplinary field in public education. Of course, disarticulation of hegemonic practices associated with STEM education, albeit necessary, may not be sufficient on its own. This is because liberatory politics needs both deconstruction and reconstruction (Fraser, 1995). That is, educators will need “a strategy whose objective is, through a set of counter-hegemonic interventions, to disarticulate the existing hegemony and to establish a more progressive one thanks to a process of rearticulation of new and old elements into different configuration of power” (Mouffe, 2008).

Further, educators will need to keep in mind that behind the hegemony of STEM education lies a big and powerful actor-network that exists to support the hegemonic practices, institutions and positive knowledges associated with STEM education. This actor-network, thanks to the considerable material power at its disposal, maintains its hegemony by continuously reiterating and strengthening the discursive elements that support and legitimate STEM education. Taking cues from the success of this actor-network, educators may need to form strategic alliances among themselves as well. Local struggles have the advantages of being more democratic and participatory and being directed at specific locally identified issues with narrowly focused strategies. However, we believe that a multitude of disconnected local struggles cannot on their own engender change at the global level. As Laclau (2001) averred, “no overall historical transformation is possible unless the particularism of the struggles is superseded and a wider "collective will" is constituted” (p. 8). According to Laclau and Mouffe (2000), this would require acts of political articulation in which different local struggles are brought on a common platform connected together by relations of equivalence. That is, educators and educator groups working to disarticulate STEM and rearticulate an alternative progressive vision of school science should benefit from coming together on a common platform to form a global movement against STEM – a coordinated mobilization that has been labeled by scholars as grassroots globalization or globalization from below (Appadurai 2000).

An example of this globalization from below can be seen in the United States where a diverse collection of activist teacher groups, such as Association of Raza Educators (San Diego/Oakland), Education for Liberation Network, Educators’ Network for Social Justice (ENSJ) (Milwaukee), Metro Atlantans for Public Schools (MAPS), and New York Collective of Radical Educators (NYCoRE), have come together on a common platform to disarticulate hegemonic practices associated with neoliberal standardization of curricula, high stakes testing and teacher accountability. These educators have come together to form the Network of Teacher Activist Groups (TAG), a national coalition of grassroots teacher organizing groups (http://www.teacheractivistgroups.org/). I are of the view that educators can begin a similar collective struggle aimed at disarticulation of STEM education and creation of creative spaces that can be populated with more progressive and democratic visions of science education.

REFERENCES


