Sociomateriality and Learning: a critical approach

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Abstract

This chapter provides an introduction to perspectives that may be described as 'sociomaterial', discussing their premises and examples in educational research. These perspectives have been influenced by a range of theoretical families including actor-network theory and sociotechnical studies, complexity theory, new feminist materialisms, poststructural geographies, and others. The main premise they share is that there are no clear, inherent distinctions between social phenomena and materiality. Everyday practice is constituted through entangled social and material forces that continually assemble and reassemble. Objects, events, identities and knowledge are understood to be performed into being through these social and material relations. Effects such as capacity and 'skill' are understood to be distributed, not located as agency within human beings. One task for analysts is to trace just how these relations work: how human and more-than-human forces act upon one another in ways that mutually transform their characteristics and activity, how they produce assemblages that become stabilized, and sometimes become extended and powerful. Examples from research in education show how materials actively influence learning and teaching practices, how learning itself is a material matter, and how educational processes are in fact temporary sociomaterial achievements.

INTRODUCTION

As many have argued throughout this volume, context is critical: learning cannot be considered effectively if the sole focus is upon individual cognitive processing. The content and process of learning change dramatically as it pulses through particular situations and discourses, the tools available, technologies, social relations and environmental dynamics. Conventional metaphors of knowledge 'acquisition' and transfer are being replaced with understandings of 'participation' and active collective engagement in particular contexts. Thus we have seen a vast swarming of interest in examining learning in 'communities of practice', experiential or informal learning, and notions of 'expansive' affordances for learning in situated environments. These sociocultural orientations have eschewed representationalist conceptions of knowledge that continue to dominate educational curricula. They explore ways that learning and knowing emerge in action – including the ongoing action that brings forth the objects and identities constituting our worlds. These views also have been important for interrupting fixed notions of knowledge as powerful packages of ideas developed by some and ingested by others – the others assumed to be individual learning minds who can be tested for attaining acceptable levels of both ingestion and subjectivisation.

Yet notions of participation take us only so far. The community of practice approach has been critiqued not only for its conservatism, managerialism, and limited analysis of power relations in learning situations, but also for its romantic notions of 'community', and its vague analyses of practice and participation (Hughes, Jewson

and Unwin 2007). Context may be critical, but to treat context as an abstract container is to miss the turmoil of relationships among these myriad nonhuman as well as human elements that shape, moment to moment, particular dynamics of context. Materials – things that matter – are often missing from accounts of learning and practice. Materials tend to be ignored as part of the backdrop for human action, dismissed in a preoccupation with consciousness and cognition, or relegated to brute tools subordinated to human intention and design. This treatment still tends to privilege the intentional human subject, which is assumed to be different or separate from the material; the material is the non-human. In educational research therefore, Sørensen argued in 2009 that there was a 'blindness toward the question of how educational practice is affected by materials' (p.2), a consequence of which was a general tendency to grossly underestimate materials as mere instruments to advance educational performance.

Today however, it is fair to acknowledge growing educational interest in understanding everyday material and social inter-relations: why *matter* matters, and how to unpick the abstractions that can blind us to the micro-dynamics that influence everyday practices. This interest moves beyond the 19th century materialism of Marx or Nietsche informed by Newtonian mechanics, to materialist understandings enlivened by 20th century insights of new physics and fractal geometry, dark matter and multiple causality, biotechnical innovations, the frighteningly rapid proliferation of powerful software, and new materialist studies of power circulating through discursive practices. Researchers have pressed for much more recognition of the ways that materials *actively* configure practice and knowing. Educators working from sociomaterial approaches are encouraging learners to attend to these quotidian material details that stitch together their practice, knowledge and environments – not just to *attune* very closely to the connections, but also to *tinker* and improvise, to interrupt, and to seize emerging possibilities.

What socio-material approaches offer to educational research are resources to systematically consider both the patterns as well as the unpredictability that makes educational activity possible. They promote methods by which to recognise and trace the multifarious struggles, negotiations and accommodations whose effects constitute the 'things' in education: students, teachers, learning activities and spaces, knowledge representations such as texts, pedagogy, curriculum content, and so forth. Rather than take such concepts as foundational categories, or objects with properties, they become explored as themselves effects of heterogeneous relations. Finally, sociomaterial perspectives offer important approaches for understanding the power relations and politics that constitute learning: not just analytic tools for picking apart the ways powerful webs become assembled as knowledge, but also pointing to affirmative ways to intervene, disturb or amplify these webs. These ideas are particularly useful for reconsidering what it means to promote 'critical learning', which arguably is a central concern for educators at all levels.

The remaining discussion is divided into four main sections. The first offers some examples from current educational research. These are diverse, but help to illustrate the questions and understandings that are emerging through sociomaterial approaches. The second overviews certain theoretical understandings that are associated with the different perspectives that can be roughly grouped into the category 'sociomaterial'. The third examines questions of politics and critique in terms of insights from

different sociomaterial sensibilities. The fourth returns to issues of learning, suggesting implications for educators who might be interested in adopting a critical sociomaterial approach in developing learning. The overall sociomaterial argument is about shifting from a subject-centred view of learning that insists upon the overriding importance of the personal and the social, to accepting a more-than-human world (see Edwards, this volume) and what it means for education.

HOW MATTER *MATTERS* IN LEARNING AND EDUCATION

Practices of knowing are specific material engagements that participate in (re)configuring the world. (Barad 2007: 91)

Materials – objects, bodies, technologies and settings – permit some actions, and prevent others. They convey particular knowledges, and can become powerful. Think of how everyday things such as doors, seat belts, keys and car parks are indeed political locations where values and interests are negotiated and ultimately inscribed into the very materiality of the things themselves – thereby rendering these values and interests more or less permanent. Waltz (2006) is one who argues strongly for attention to things in educational research. He claims that material non-human things too often are analytically subsumed by human intention, design, drive and treated merely as representatives of human ends. As tools, the role of non-human things is typically limited to extension, transportation, distribution, and prevention. Overall this subjugation of things to humans obscures their own particular contributions and hides the qualities of the entities themselves. One example Waltz (2006: 57) offers is the school playground, where equipment combines with children's behaviours to produce particular activities, speech, social groupings and exclusions, injuries, even gender identities. The point is here that material things are performative. They act, together with other types of things and forces, to exclude, invite, and regulate particular forms of participation. What then is produced can appear to be 'gender identity' or 'expertise' or 'knowledge' or a social 'structure' such as racism. A focus on things therefore helps us to untangle the heterogeneous relationships holding together these larger categories, tracing their durabilities as well as their weaknesses.

The aim here is not simply to identify the things involved in learning, but to make visible and analyse the particular relations among them. The focus is on relational materiality, or patterns of materiality infused with affect, power relations and cognition. This is quite different to conceiving a material world as inherently separate from a human world of consciousness and interpretation, and then reinstating links between them. In explaining this critical notion of material relations in terms of human learning, Hultman and Lenz Taguchi (2010:536) put it this way:

> We can never reflect upon something on our own; to reflect means to inter-connect with something. This corresponds to Latour's concept of infra-reflection that takes into account that reflection is always done in the midst of a complex network and thus immanent to a vide variety of forces and never the product of an isolated individual that reflects upon something from an external point of view (see Latour 1988). Thinking is not something that is grounded on a decision or a rational cataloguing of different external objects: rather, it is an event that happens to us – it 'hits us' or 'invades us'.

Sørensen (2009), in fact, argues that even to speak of 'relations' is to reify a sense of well-defined entities that become linked. In her own research on the materiality of learning, Sørensen traces the patterns that emerge in education to produce different learning practices. Things matter, not as discrete and reified objects with properties, but as effects of dynamic materializing processes that cause them to emerge and act in indeterminate entanglements of local everyday practice. For example, she examines the children's learning activities at a blackboard, then in a classroom project to build a bed loft, and finally in an online virtual environment. Each material pattern produces different forms of knowledge (representational, communal, and what she calls 'liquid'), and different performances of human presence. Her conclusions are that:

> Liquid knowledge is inseparable from learning. Representational knowledge can be stagnant. It is not dependent on learning taking place, and it is indifferent to whether or not learning takes place. Communal knowledge can endure without learning, but, when learning happens, the communal knowledge is affected. The ongoing mutation that characterizes liquid knowledge is the epitome of learning. (Sørensen 2009:131)

Sociomaterial studies also have brought new insights to issues of intercultural learning and inclusive education. Verran, for example, has been illuminating cross-cultural implications of materiality and learning. One of her most influential studies (Verran 2001) examined how Nigerian Yoruba children learned science concepts in schools that employed British curricula dictating abstract Western notions about what numbers represent and how they can be manipulated (e.g. measuring volume, quantities, distance, and calculating changes in matter). But Yoruba scientific understandings are ontologically very different: they begin with particular sorts of matter and then generate units appropriate to quantify that matter in the here-and-now. What surprised Verran was finding that Yoruba children not only learned to inhabit these two profoundly different accounts of what was real, but that the children also could move across both sociomaterial worlds working-thinking with the same objects: choosing one reality or the other, or juggling both simultaneously. Verran (2007: 34-35) characterized this as 'learning to manage knowing along with doubt; weaning oneself from certainty that is allowed by working within just one metaphysical frame'. For her, it showed that children can learn to interrupt the very structures of knowledge, to recognize multiple ways of enacting reality and to even intervene among these different realities.

These are just a few examples of the alternative understandings of learning that can be yielded through sociomaterial analysis, when educators permit themselves to explore the radical suggestion that 'entities lie suspended between enactments of their possibilities' (Verran 2007: 38). But let us pause to examine more closely the theoretical bases being employed in these 'sociomaterial' approaches to educational research.

WHAT ARE 'SOCIOMATERIAL' PERSPECTIVES?

A range of theoretical 'families' emerging in educational research can be described as sociomaterial, from actor-network theory (and 'after-ANT') or 'new materialisms' to

complexity theory, to name only a few[1]. These families each have very different theoretical and ontological roots, and have developed particular traditions in their different scholarly fields such as philosophy, political science, science and technology studies, human geography, theoretical physics, and organisation studies. This chapter can only provide a very brief introduction to certain shared commitments and approaches across these theories. One danger of this tactic, of course, is its potential to suggest that these theoretical families are more or less the same, as though there were a single 'sociomaterial' theory to apply to learning. There is not, and social science researchers drawing from these perspectives are usually very careful to situate their particular analysis in terms of one particular set of ideas and writers. Another danger in presenting the similarities is that useful theoretical details and debates necessarily will be obscured, over-simplified, or omitted. However for newcomers to this whole area, the aim here is to point to the range of contributions and questions for educators that are opened in different regions of this rich new theoretical landscape. A secondary aim is to avoid promoting any one theory in particular as the only or the 'best' sociomaterial approach. Hopefully interested educators will pursue more in depth study suggested by the references provided.

Shared commitments

What all of these perspectives tend to share, first, is a *focus on materials* as dynamic, and enmeshed with human activity in everyday practices. This is what Orlikowski (2010) describes as the constitutive entanglement of the social and material. 'Material' refers to all the everyday stuff of our lives that is both organic and inorganic, technological and natural: flesh and blood, forms and checklists, electronic records and databases, furniture and passcodes, snowstorms and dead cell zones, and so forth. 'Social' refers to symbols and meanings, desires and fears, and cultural discourses. Both material and social forces are mutually implicated in bringing forth everyday activities. This is an understanding of relationships that pushes beyond assumptions that objects and subjects *inter*-act, as though they are separate entities that develop connections. Instead, sociomaterial accounts examine what the physicist Barad (2007) describes as *intra*-actions of heterogeneous elements of nature, technologies, humanity and materials of all kinds. These elements and forces penetrate one another - they act together - to bring forth what appear to be actors, objects and phenomena of everyday life.

This is a second shared understanding: that all materials or, more accurately, all sociomaterial objects, are in fact *heterogeneous assemblages*. They are gatherings of *heterogeneous* natural, technical and cognitive elements. All objects and material settings embed a history of these gatherings in the negotiation of their design and accumulated uses, whether lecture halls, presentation software, testing instruments, essays, pedagogical protocols etc. In examining particular educational practices, researchers ask how and why particular elements became assembled, why some

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[1] Readers familiar with Heidegger's important conceptions of Dasein being-in-the-world, where objects can become ready-to-hand in ways that dissolve the illusion of boundaries between materials and humans, will no doubt see the influences of these ideas in many sociomaterial accounts. Similarly influential have been Bourdieu's theory of practice, as well as major feminist and poststructuralist developments in the latter 20th century including Derrida's challenges to logocentrism and the dichotomous categories structuring Western reality, Judith Butler's elaborations of embodiment and performativity, Donna Haraway and Rosi Braidotti's developments of Deleuzian thought, and many others. (see Coole and Frost 2010 for one overview)

elements become included and others excluded, and most important, and how elements change as they come together, as they *intra*-act.

Third, most sociomaterial perspectives – in different ways – accept the fundamental *uncertainty* of everyday life, as well as of the knowledge, tools, environments and identities that are continually produced in it. Unpredictable novel possibilities and patterns are always *emerging*. This may be a familiar notion, but sociomaterial theories offer specific analytic tools that can examine much more precisely just how these new webs or assemblages are emerging – why they come together to produce and mobilise particular effects, and when they do not. These are processes that complexity theory explains in terms of 'strong emergence' (Osberg, this volume), actor-network theorists call 'translation', and Deleuzian new materialists call 'becoming'. The focus is on the relations between things, how things influence and alter one another in ways that are continuously opening as well as foreclosing new possibilities.

Fourth, a sociomaterial perspective tends to views all things – human, and non-human, hybrids and parts, knowledge and systems – as *effects* of connections and activity. Everything is *performed* into existence in webs of relations. Materials are enacted, not inert; they are matter and they matter. They *act*, together with other types of things and forces, to exclude, invite, and regulate activity. This is not arguing that objects have agency: an essay does not write itself. But its particular production is an agentic assemblage of assignment protocols and literary traditions, books and other content sources (entailing all the materialities of library lineups, slow internet browsers, fortuitous tweets etc), post-it notes and piles of paper and iPads, the particular affordances and directives of word processing software – all working in and through human bodies and consciousness. Any educational practice is a collective sociomaterial enactment, not a question solely of one individual's skills or agency.

'Agency' is a problematic term for some sociomaterial researchers. Some refuse to use it altogether with its associations of human individuals' intention, initiative and exercises of power. The categories of 'structure' and 'agency' have long histories and deeply embedded assumptions: using these categories in analysis as though they are inherently valid or real begs many questions for sociomaterial researchers about the pre-determined relations that are set in motion. Others like Orlikowski (2010) write about agency as relational and distributed capacity. Bennet (2010), a political philosopher, argues that agency is possible only through assemblages whereby human desire and interests are infused in things like aging transmission wires, understaffed power plants, buildings with increased demand for electricity, energy trading corporations, deregulation policies, and a brush fire - to cite her example of the massive 2003 New York City blackout. The important issues are not *where* agency is located or *what* kind of agency is human or nonhuman, but rather the profound uncertainty about the nature of action, and controversies about how agency is distributed. Holifield (2009) points out that sociomaterial analyses register a range of competing accounts of agency, seeking to understand not what agency *is* but how certain accounts of it become stabilized. When agency is recognized as a distributed effect produced in material webs of human and non-human assemblages, Bennett suggests that a more responsible, ecological politics is possible. For education, this touches a core purpose for learning, which will be discussed further in the third section of this article.

Different interests, different approaches
For those who are interested in more in-depth exploration, a full primer to these sociomaterial perspectives is available elsewhere[1]. Those that appear most frequently in contemporary research of educational practice and learning include actor-network theory and 'after-ANT' approaches, complexity theory, new geographies, 'new materialisms', practice theory, and activity theory. ANT emerges from poststructural orientations, and is more a diffuse cloud of sensibilities than a theory given its many internal contestations among key writers such as Latour (2005) and Mol (2002). Many terms in the literature such as 'relational materiality', 'material semiotics', STS (science and technology studies), and 'sociotechnical' studies share core commitments with ANT. Its lasting influences are a networked view of reality, and a radical treatment of human and non-human elements as equal contributors to the 'networks' that continually assemble and reassemble to generate particular activities, objects and knowledge. A lengthy discussion of ANT and 'after-ANT' studies in education is available (Fenwick and Edwards 2010).

Complexity theory is quite different in orientation, another range of competing approaches emerging not from sociology but chiefly from evolutionary biology and physics (as well as cybernetics and general systems theories). Complexity theorists Barad (2007), Osberg (2008), and Davis and Sumara (2006) have become particularly influential in educational studies, suggesting that we examine dynamics of 'emergence', diffraction, and connectivity in practices of knowing.

Turning to new human and cultural geographies, these theories examine the material spaces and places of educational practice to show how they help produce the social, but are also produced by human activity and meaning. In education research, geographers such as Doreen Massey, Thrift and Lefebvre are widely influential in sociomaterial analyses (e.g. see Gulson and Symes 2007).

Another branch of studies that is gaining much traction in education is calling itself the 'new materialisms' (Coole and Frost 2010, Barad 2012) These often work from ideas of philosopher Gilles Deleuze such as immanence, creativity and assemblage to examine how particular social and material forces bring forth very different ways of being.

Cultural-historical activity theory or CHAT is becoming widely taken up in education research (see xx this volume), and is thoroughly developed methodologically. However, some would argue that CHAT does not really belong with 'sociomaterial' studies given its fundamentally different material analysis rooted in a structural Marxist explanation of the relations of capitalist production and the internal contradictions of activity systems. And, while CHAT emphasises the importance of material artefacts that mediate human activity systems, these are secondary to its central concern for *human* activity: divisions of labour, cultural rules and languages, and social purposes.

Finally it is important to mention the growing educational interest in 'practice theory' working from conceptions of 'knowing-in-practice' as enactments performed through assemblages that are more-than-human (Gherardi and Strati 2012, Hager, Reich and Lee 2012).

Obviously this chapter cannot provide adequate explanation of these and other sociomaterial orientations. Also omitted here are discussions of all these theories' limitations. Critique and rejoinders abound, as one would expect in any vibrant and maturing field, and these critiques may be found elsewhere (Fenwick et al 2011). Yet they shared assumptions that are growing in influence on educational research: that educational processes are more-than-human, and that to understand activity and learning we need to move beyond preoccupations with human meanings and human agency.

CONSIDERING POLITICS AND CRITIQUE IN SOCIOMATERIALITY

Criticality is a key concern both for educational curricula and for research. A broadly shared aim is to stimulate critical learning that will recognise and interrupt patterns that control and limit: particularly when these assemblages produce injustice and inequities. Despite what is sometimes alleged, many researchers in this diffuse realm of 'sociomaterial' explorations offer critiques of existing exercises of power and advance fundamental commitments to social change through equity and justice. What they tend to resist are forms of critique as the imposition of normative categories and ideologies on phenomena without sufficient attention being given to their specificities and contemporary material dynamics.

One example is Latour (2005), largely associated with actor-network theory. He asks how, among these effects, do some practices and objects become stabilized and entrenched as powerful assemblages (such as standardised tests) while others go unnoticed? Latour delineates matters of fact from matters of concern. Matters of fact are all those things that are assumed to be decided, certain and settled. Like a car that we drive without really knowing how it works, these things are 'black boxes' that are used in practice without critical questioning about how and why they were constructed. Black boxes can be 'facts' but also practices, policies, texts and tools in everyday work. Matters of concern are issues, controversies, uncertainties. But as Latour (2005) contends, most things accepted as settled facts of practice are really matters of concern whose debates have been foreclosed or obscured.

Critical learning is often described in terms of developing a standpoint or emancipating ourselves from something. For Latour, the danger of such enactments is that they can result in too hasty closures, turning matters of concern into matters of fact and creating hegemonic social explanations that reproduce inequalities. He argues that traditions of critical thinking promulgated by education and academia work from a logic of taking apart, separating, and unveiling - using categories that reify their own explanations. He urges educators to resist available explanatory categories and examine more closely the controversies and uncertainties about how resources and agency are distributed, the kinds of agencies that are enacted in different sociomaterial formations, and the ways that actors contextualise one another. His approach registers a range of competing accounts of agency and of flows of power, particularly in the production of inequities and how different actors are rendered more active or more passive through sociomaterial relations. Most important, Latour's 'anti-critical' critical attention is on the mechanisms of these relations that act to stabilise and 'blackbox' particular categories, hierarchies and practices. The effort of analysis, for Latour, should be 'to highlight the stabilizing mechanisms so that the

premature transformation of matters of concern into matters of fact is counteracted' (Latour 2005: 261).

In a similar line of argument, Braidotti (2013) is an enthusiastic exhorter of an affirmative posthuman politics. She suggests that teachers embrace a transversal and relational materialist conception that expands the limitations of idealist, universalist humanism. Working from Deleuze's conceptions of becoming-other, Braidotti advocates a movement of becoming more-than-human. This movement is grounded in lived experience, examining the concrete, complex materiality of bodies as part of relations of power. However, it ultimately seeks to extend justice to humans and non-humans, and to understand how to share complex environments sustainably. Both Braidotti and Latour urge engagement with the natural environment as integral, rather than other, to being human. Without the non-human, the materiality of the human may come not to matter at all in the many senses of the term.

A similar impetus informs Bennett's argument (2010). Like many sociomaterial writers, she examines the 'vitality of materiality' drawing from Deleuzian concepts of vital energies coursing through matter. This notion of vitalism, combined with new understandings of ontological emergence signaled by complexity theories, offers an affirmative politics. For Bennett, notions of generative materiality are critical for a politics of ecology that moves beyond blame and self-interest. The aim is towards learning how to construct sustainable alternative futures, and extending what Braidotti terms present 'horizons of hope' (Braidotti 2011). Braidotti eschews traditions of criticality that focus primarily on what the analyst identifies as the problem - negative critique. She argues instead for a 'critical creativity' that 'entails the creation of sustainable alternatives geared to the construction of social horizons of hope, while at the same time doing critical theory, which implies resistance to the present' (Braidotti 2011: 267). As with Latour, the politics and critical learning involved here embraces more than the human.

Our continuing categories of critique, such as those driving educational notions of critical learning, emanate from what Law (2011) calls a 'quadruple lock' of interlocking institutions and technologies, metaphysics, particular descriptions and the things being described. The hope for progressive change, he suggests, is radically different forms of knowing and versions of the world that could go along with that knowing: 'different normativities, politics and ethics co-exist and intersect with one another too; … if we can make parts of these explicit then they become debatable and contestable' (Law 2011: 10-11). To disregard or minimize the centrality of materials in enacting networks that exert powerful forces, combine and translate people and things into these networks, and configure these forces to exclude or include, is to overlook important levers for change as well as reproduction and the fact that changes will not come from human intentions and actions alone.

Persistent deep social inequalities, and other failures of justice and fairness evident in globally rampant dehumanizing biotechnological and biopolitical practices, are precisely what these writers claim are driving their efforts to seek sharper, more nuanced analytic tools. Barad (2007) is concerned about analyses that reduce every aspect of human life to an effect of social structure. She experiments with alternate analytic tools such as diffraction, intra-activity, and tracing the effects of material-

discursive apparatuses. Her aim is to enable some appreciation of the extent to which social structures are themselves perpetuated through material practices, and material inequalities produced through situated everyday practices. This lies at the heart of much sociomaterial work, which itself remains an open controversy and matter of concern. The politics may be incomplete, but it is passionate and very much focused on a worldly progressive agenda - not simply one which is human.

RECONSIDERING LEARNING: A CRITICAL SOCIOMATERIAL APPROACH

To reiterate the central idea underpinning this chapter, learning and knowing in sociomaterial perspectives are enactments, not simply mental activity or received knowledge. Mind, after all, is a dynamic of continuous neurological connections with the myriad matter of environments. Sociomaterial perspectives join those who focus not on the individual *learning subject* but the larger *sociomaterial collective*.

When we accept a view of the world full of agency, *doing* things, learning shifts from sole emphasis on preparing for this world by acquiring knowledge representations to participating wisely in situ. Learning issues become more interested in ways to attune to minor fluctuations and surprises, or to track one's own and other's effects on the emerging sociomaterial situation, and how to improvise alternative actions. In critical terms, the aim is learning how to interrupt matters that seem settled and masquerade as fact, and how to hold open the controversies for matters of concern. This suggests a turn from learning as preparation and acquisition of competency to learning as attunement, response and even interruption.

Educators as well as students can look more closely at what material elements most influence their learning and teaching processes, how materials limit or enhance possibilities for learning, why particular educational or learning practices become stabilized and powerful and when these blackboxes create problems. This is not about stuffing more activities into crowded curricula, but about opening out ways of engaging students. For example, they might be encouraged to understand 'learning' in terms of recognising their sociomaterial entanglements:

- attending to minor, even mundane, fluctuations and uncanny slips,
- attuning to emerging ideas and action possibilities – the intra-actions of ongoing mattering processes,
- noticing one's own and others' effects on what is emerging,
- tinkering amidst uncertainty, and
- interrupting blackboxes of practice to hold open their controversies and disturbances.

Orlikowski (2010) emphasises that we need to challenge the existence of independent objects with given properties and boundaries, and focus instead on situated, relational practices that enact entangled and contingent identities and effects. Curricula might cultivate students' awareness of how their everyday performances, too, are provoked through dynamic and always-shifting sociomaterial configurations, and how multiple agencies act on these configurations. Coole and Frost (2010) suggest practices of 'critical materialism', which presents a useful provocation to educators. These practices would integrate politically engaged critical social theory with an analysis of

actual conditions of material existence and their inherent inequality, combined with ongoing invention of new concepts/frames to understand the complexities of global capitalism and its diverse, localised effects on everyday lives. Barad (2012:113) argues for developing new mapping practices, 'genealogies of the material-discursive apparatuses of production which take account of the intra-active topological dynamics that reconfigure the spacetime manifold'.

As can be expected, sociomaterial analysts emphasise different positions about the political role of materials in constituting particular forms of everyday life and learning, and they promote diverse strategies for critical engagement. However, all share a commitment to restore a focus on material bodies, substances, settings and devices to show how these both configure flows of power and mediate forms of political engagement. Second, all advance a commitment to social change through equity and justice. What they tend to resist are normative categories and ideologies imposed to formulate critique of particular phenomena without sufficient attention to their continually emerging material dynamics. As Law (2011) points out, many critiques of sociomaterial approaches emanate from their threat to deep metaphysical assumptions embedded in Western or Northern common sense. These assumptions are unused to being treated as 'effects' rather than as de facto canons defining the objects, problems and procedures that perpetuate the very problems they purport to solve. To incorporate a critical sociomaterial approach into education is to disturb, not just particular prevailing models of practice and assumptions about learning, but central foundations and investments. Sociomaterial perspectives offer a way to trace the capillaries of human/nonhuman relationships that bring forth particular realities in practice and learning, while highlighting the opportunities and entry points for change. With such a perspective, educators are encouraged to appreciate fully the violence of their material engagements as well as the unknown radical future possibilities that are available at every encounter.

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