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FORUM: A CONVERSATION ON 'SENSE OF PLACE' IN SCIENCE LEARNING

Miyoun Lim and Angela Calabrese Barton provide an excellent essay on science learning and students' sense of place that offers insight into and opens scholarly conversation in relation to a number of domains. The authors ask, what do we mean when we refer to urban students' sense of place and how does it affect what happens in middle school science classrooms? By sense of place Lim and Calabrese Barton are referring to "a living ecological relationship between a person and a place" that includes "physical, biological, social, cultural, and political factors with history and psychological state of the persons who share the location." The conversation that followed between the authors and the respondents led us on a journey of complexity to a "connected science" that opens a conceptual window to a plethora of transgressive concepts. The exchange that took place indicates how difficult it is to document and describe any person or group's sense of place, let alone trace the effects of place on specific science classroom activities. Undoubtedly, this was a particularly difficult research assignment undertaken by Lim and Calabrese Barton.

This paper is an attempt to follow through the exchange of ideas we had as we each resided in our particular places – Joe, Miyoun and Angie located in New York, USA and Liz in Auckland, New Zealand. And while our main task was to comment on the paper Lim and Calabrese Barton had written, one could not help but engage simultaneously with our own sense of place and what that meant in relation to our understanding of O/others sense of place. How does someone relate to another's sense of place, especially when that person did not grow up in New York? For example, Miyoun grew up in the bustling city of Seoul Korea, Joe grew up in rural Appalachian USA, and Liz in small town New Zealand. Yet, along with Angie, the four of us make this conversational piece. Does our own sense of place contribute or hinder imagining O/others sense of place? Or does it present a multiplicity of curricula possibilities? Our paper is best described as a bricolage – interrupted conversations brought about through the seasonal differences of each hemisphere – the northern hemisphere on summer holiday while New Zealand is in the midst of an academic semester. In an attempt to

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write an interactive paper, we offer a textual narrative interspersed with somewhat stilted email 'conversations'. Each conversation is connected to further conceptual possibilities and other conversations, especially around characterizations of sense of place and "connected sciences".

PERSONAL BEGINNINGS

Upon receiving Lim and Calabrese Barton's paper "Science learning and a sense of place in urban middle schools", the respondents were immediately drawn to discussing personal experiences and understandings of place – their own place which both Kincheloe and McKinley have written about before.

Joe

The concept of the sense of place is a thorny and sometimes ineffable construct. The often-tacit nature of the way one "leverages" her sense of place makes it especially difficult to document in any final empirical way. I understand that in my own autobiographical analysis of the way my southern Appalachian sense of place has helped construct my relationship with academia throughout my life, insights have not been quick to emerge. Indeed, it took decades for me to begin to understand the ways such dimensions of place helped shape both consciously and unconsciously my affective and cognitive interaction with scholarship. After years of studying these dynamics I find my autobiographical interpretations to still be quite tenuous. With these dynamics in mind I edited a book with William Pinar in 1991, entitled *Curriculum as Social Psychoanalysis: Essays on the Significance of Place*. We wanted to entitle the book: *Curriculum and the Southern Experience: Essays on the Significance of Place*, but SUNY Press argued that no one would be interested in a book on the South.

Thus, with our imposed title, Bill and I and our authors set out to explore the nature and the pedagogical effects of the southern sense of place. Operating within a critical theoretical macro-context I needed a phenomenologically sensitive method to create the general-particular, whole-part, macro-micro hermeneutical circle. In this quest I explored the canon of southern literary theory where I found several compelling discussions of place especially in relation to the theory of the novel. In this context these analyses in their lived world specificity served as the theoretical lynchpin I was seeking. Eudora Welty (1977) was particularly helpful. Feelings, she wrote, are bound up in place. Focusing on the phenomenological "what is it like to be. . ." question, Pinar and I maintained that the

relationship between place and feeling was central to a curriculum theory of place. In this context we argued that place is the construct that brings the particularistic into focus; a sense of place sharpens our understanding of the individual and the psychological and social forces that direct her. An appreciation of the interaction of place and feeling particularizes and exposes embedded social forces.

Liz

I am immediately drawn to the phrase 'sense of place' because to me, as an indigenous person, it incorporates the complexity of language, history and environment, and the inherent issues of identity and subjectivity. I would describe place as a palimpsest – a parchment where successive generations have inscribed and re-inscribed the process of history. There are several layers to place – even urban playgrounds I suggest. Place can be read in so many different ways. When I look out my work office window I see a cathedral and the museum prominent on the landscape and I can't help but think of them as instruments of colonization; I see motorways carrying traffic that have been constructed along gullies and over rivers that no longer exist; I see the old sports ground that has been converted into a carpark for university students; and I imagine battles raging over the hilltops – before and after colonization. This was, and continues to be, a place that is contested in many ways – historically, environmentally, geographically.

In Maori culture each person has a *turangawaewae* (literally, a place to stand) which has nothing to do with where I currently live. This *turangawaewae* is about my ancestry – biological and social (we call it *whakapapa*) – and is a place where I belong. It is a place of identity – usually represented through a *marae* (ancestral meeting place), an *urupa* (burial site), and through features of the land that surrounds these places, such as mountains, rivers, lakes, and so on. When I introduce myself in my culture – anywhere in *Aotearoa* (New Zealand) – it is with these signifiers and people know who I am – where I come from, where I belong, what my history is in relation to them, and how I relate to others from other tribal areas. Sense of place, for Maori, is complex business as it is with many indigenous peopes.

To me, when I first read the article, the use of 'sense of place' appeared detached, almost scientific in approach. Sense of place was objectified and isolated. But more importantly for me, sense of place was incised from Luis and Jameer's being – their subjectivity. How can we talk of sense of place that is removed from issues of identity? How can I get a feeling for Jameer's and Luis' 'sense of place'? At first glance they are poles apart – my feeling

for my place is about all those things which this article seems to reject or not explore. Sense of place in the article seems to me to have little or no 'sense' about it – no feeling for the place that is explored at any emotional level. Jameer's 'sense of place' is about how good the playground was because she knew it from babysitting and having lived close by for all her life. Her sense of place is portrayed as the knowledge of the objects in the playground and whether she or her charges liked playing on them. Luis, on the other hand, I thought was portrayed as having a 'sense' of the playground but it wasn't explored deeply enough. The use of psychoanalytically informed theory might enable you to explore the contradictions of Luis – to explore the emotions involved for this child who sees himself as having no place to stand except outside. But the paper glosses over this and describes it as "appropriate behaviour" and "tending to his sense of place". I get a sense that there seems to be no identifying relationship between self and place. Maybe that is why I can't seem to relate well to this sense of place portrayed. If there is no need for a sense of place to be bound to identity then what becomes of the 'sense' in sense of place?

Miyoun and Angie

Liz spoke of a 'turangawaewae' in her culture and talked about the significance of "genealogical" attachment to her place in her sense of place (Low, 1992). While we appreciate the role of genealogy plays in her sense of place, we also have to acknowlege diversity and multidimensionality of sense of place. Steele (1981) described that there would be so many different kinds of sense of place as there are different individuals. There are people who cannot simply ignore the place where they currently live in their sense of place. For many people, ancestry or genealogy alone cannot offer the ground for one's holistic and ecological sense of place.

At the beginning of this conversation, Liz points out the difference in our residing localities. Yes! It matters. But it involves more than where we are positioned right now. Being in NYC brings our attention to critical particularities and perspectives in our research. NYC as known for its diversity is filled with diverse people (and groups of people) and their sense of place coming from diverse lived experiences/histories individually and/or collectively. While Joe, Angie, and Miyoun live in NYC thus might share some of our sense of place, we cannot assume anything without knowing their histories and lived experiences.

For example, Miyoun came to the States for her graduate study and has developed her academic interests in place inquiry by going through her personal place identity crisis. The personal history here is rich: She grew up in a country with histories of being colonized and now lives and studies in a

colonizing country as a cultural, linguistic minority. Living in a place with no prior history and understanding could paralyze one's desire to connect to the place. Sense of place is based on knowledge that comes from lived experience (history). When you are positioned in a new place (displaced or truncated in terms of place history), knowing the place where you currently live becomes critical and fundamental in developing and nurturing a sense of place.

We think these points are salient: In NYC we work with urban students who are mostly immigrants or descendents of immigrants being displaced in NYC (mostly involuntarily). And so in our inquiry on sense of place we took Steele's (1981) suggestion that "we should value our own experiences as they are, not as they 'should' be on some conventional scale."

You both have raised two overlapping questions in your reflections. What does it mean to research one's sense of place? And how can we really "know" another's sense of place empirically, scientifically? We believe its impossible, and not even desirable, to empirically "capture" another's sense of place. As both of you point out, sense of place is fluid, emic, and deeply tied to the moment. Furthermore, even if you could capture snapshots of students' sense(s) of place, we think it's unwise for pragmatic reasons. What would a teacher "do" with such complex knowledge of 35 different students at any given time? Yet, as teachers and learners, we know at a gut level that our understanding of our selves in relationship to our environment matters, especially when we talk about trying to understand that environment as science tries to help us to do (and, as we, as science teachers and learners, WANT science to help us to do). How do we push beyond this intuitive feeling? How do we operationalize (for ourselves as teachers, not just researchers) what matters about ourselves, or others when we teach about pigeons or playgrounds or the carbon cycle, for that matter?

PLACE, THE NOVEL AND EDUCATIONAL INQUIRY

Having occupied an important role in the literary theory, place has helped the successful novelist connect larger themes to the local, present, unspectacular day-to-day human experience. Thus, conveying place is the *élan vital* of fiction, serving as the crossroads of circumstance, the playing field on which drama and profound insights into the ways human being evolves. The interaction between place and theme can be semiotically perceived – the reader decodes the subtle imprint of place on both the unfolding of theme and the development of character. Thus, in fiction place is used to create a world of appearance – a world essential to the novel's believability.

Curriculum studies and pedagogical research, likewise, must possess a particularistic social theory to parallel macro-political and social concerns of criticality. Place theory can be used to play the particularistic role, to sharpen and extend one's phenomenological consciousness in educational research.

Educational researchers learn from literary theorists that fiction can take readers to unexplored realms of consciousness, in some cases altered states of consciousness. It is not only the sense of place that sets up the backdrop that allows literary "flights" to work but it is also place that brings us back from imaginary experience, permitting us to find our way home. In this literary understanding of place, we gain new insight into ethnographic and other qualitative forms of educational inquiry. Macro-social and political theory move us to a higher conceptual ground – we stand on the mountain or the tall building with their sweeping vantage points and gaze at the cosmos of educational activity. Our understanding of the sense of place precludes the possibility that we might get stranded in these higher elevations where deterministic interpretations too often emerge. Place theory reminds us that the mountain and the skyscraper are mere places – not Archimedean points from which "the truth" can be discerned. With place we remember that the general and the particular represent two sides of the same epistemological coin.

Place, Welty (1977) speculated, is not simply to be *used* by the fiction writer; place is to be unearthed, discovered as the novelist plies her trade. The act of writing is self-reflective – it reveals the connection between self and place. This discovery, she concluded, does not connote that place is something new. It suggests that we are. Thus, the analyzed sense of place is a window to the *Lebenswelt*, a vehicle to not only self-knowledge but to a knowledge of other selves. In educational research that is informed by an appreciation of the sense of place and that studies the effects of the sense of place, unanticipated meanings and insights emerge. A research process is set into motion in which particulars evolve into generalities without losing their status as particulars.

In critical historical or critical ethnographic analysis of particular educational settings, researchers working with the sense of place are better equipped to expose the profound in the mundane. A profound synergism is constructed when the rhythms of time and fleeting glimpses of the unconscious are integrated with knowledge of place to reveal hidden designs. In such a process not only place itself is exposed but also the elusive conversation between place and education becomes more audible. That we can hear it clearly or even that we understand it in some final determination of it's meaning is not the claim. By nature place and one's sense of it is evasive, slippery.

COMPLEXITY AND MULTIDIMENSIONALITY OF SENSE OF PLACE

It is one thing to write of the importance of place, it is quite another more complicated undertaking to discern what it is exactly we're dealing with in this context and what difference it might make in particular educational circumstances. As judicious ethnographers, the authors sought to identify "sense of place events" in the data they collected. As they analyzed such sense of place events, Lim and Calabrese Barton quickly came to sense the complexity of place. Students' sense of place, they maintained, "came from diverse sources and dimensions of their lived experiences" – geographical, biological, historical, socio-cultural, and political. Sense of place, they came to understand, is not simply about where students live but "how they live and what kind of ecological relationship they have with their place."

Joel Kovel's (1981) concept of totality can be used to deal with the complexity of the sense of place and its effects on students and teachers. According to Kovel totality encompasses both particularity and a generalized socioeconomic pattern. People are entwined in numerous ways in this totality, which in the particularistic domain involves place and individual consciousness while in the generalized realm includes psychological, social, political, and economic patterns. The multilogical perspective denoted by totality demands that researchers view individuals in relation to historical context. Educational research and history so viewed constitute neither a linear story of social, economic, and political forces nor a series of particularistic anecdotes. Historically contextualized educational research that draws upon totality engages the generality of the social and the particularistic of what Lim and Calabrese Barton call sense of place events and their dialectical/multilogical interplay.

The multilogical epistemological syntheses of totality help researchers subvert any sense of certainty that serves to immunize research findings and theoretical assertions from the reassessments that interaction with lived experience often necessitates. An ossified Marxism, for example, that disregarded the particularistic was unable to account for the conservatism of the proletariat. The Frankfurt School had to explain the social and psychological forces that worked in concert to move working people to act in a manner contrary to their own interests. In the twenty-first century these concepts become more important than ever, as working class white culture in particular becomes more and more right wing in its view of socio-economic policy, cultural politics, and the role of education in one's life. Contemporary students' and teachers' sense of place are indelibly imprinted with these larger socio-historical forces. Thus, once researchers identify sense of place events, they begin to identify multiple rhizomes reaching out in diverse directions to connect with an array of socio-historical, political,

economic, religious, psychological, and many other forces. Here the study of student (and teacher) agency as it interacts with these forces becomes profoundly important.

Angie and Miyoun

We believe that what matters is not "knowing" another's sense of place but rather it is important to understand how a sense of place can and does shape who/how one is in the classroom (or any other space for that matter). We see sense of place as how students' appropriate their lifeworlds in order to build an ecological relationship with their place. In other words, what we do claim is that developing a propensity – a mind-set or a way of understanding another – that envelops the social, cultural, geography, historical complexity of another sheds insight into how and why they do what they do to learn in science class.

Joe

In this context, Santiago cognitive theorists Humberto Maturana and Francisco Varela maintain learning takes place when a self-maintaining system develops a more effective relationship with the external features of the system. In this context their socio-cognitive complex theory of enactivism highlights the profound importance of *relationship* writ large as well as the centrality of the nature and quality of the relationships an organism makes with its environment, with its particular circumstance.

The notion of place, thus, becomes a central factor in the production of selfhood in its social, cultural, and political macro- and micro-contexts. As educators work towards a form of critical curriculum these relationships always involve students' connections to cultural systems, language, economic concerns, religious belief, social status, power dynamics, and the factors of place that constitute them. With the benefit of understanding the self-in-relationship teachers gain a new insight into what is happening in any learning situation. Living on the borderline between self and external system and self and other, learning never takes place outside of these relationships. Such knowledge changes our orientation to curriculum and pedagogy.

Thus, in response to Lim and Calabrese Barton's research the concept of critical ontology induces science educators to focus on the concept of the relational self (Noddings, 1990; Thayer-Bacon, 2000). Humans are ultimately relational entities – not fragmented monads or abstract individuals. From Francisco Varela's perspective this notion of humans as constructs of relationships corresponds precisely to what he is labeling the virtual self. A

larger pattern – in the case of humans, consciousness – arises from the interaction of local elements. This larger pattern seems to be driven by a central controlling mechanism that can never be located. Thus, we discern the origin of traditional mechanistic psychology's dismissal of consciousness as irrelevant. This not only constituted throwing out the baby with the bath water but discarding the tub, the bathroom fixtures, and the plumbing as well.

A CONVERSATION ON THE LANGUAGE OF SENSE OF PLACE

Calabrese Barton and Lim's question "What does it mean to research one's sense of place and how can we "know" another's sense of place empirically, scientifically?" demands us to explore the theoretical and methodological dimensions of the sense of place. Inherent in this question is not just the physical and psychological complexity of place (as discussed above) but the critical positioning of language in characterizing 'sense of place'.

Liz

As I read this paper I was challenged in having to take stock of my 'sense of place' in relation to O/others sense of place in the world. There is a language (or languages) associated with my sense of place. For example, names of places in New Zealand *in te reo Maori* (Maori language) being renamed in English – the English names displacing the Maori signifiers. My 'sense of place' has embedded in it a sense of displacement. Te reo Maori was the language of *Aotearoa* (New Zealand) before colonial settlement. Auckland was known as *Tamaki Makaurau* (The place of a thousand lovers); some mountains now have dual names, like Mt. Cook/*Aoraki*, and Mt Egmont/Mt *Taranaki*; and then there are the native flora and fauna with Maori names, Latin names, English names. A sense of place named in Maori, renamed in English and now have been re-inscribed again as dual (or even triple) entities – place, displace, replace.

Angie and Miyoun

How one "sees" sense of place in the classroom is indelibly linked to who one is, and what one can see. For us, this is where the issue of "language" raised by both commentators becomes critical. How we name others (and their senses of place) is grounded in who we are and what we know. It is a particularly interesting question for us because in science (or at least as science teachers) we are expected to engage in a form of communication that marginalizes our presence and participation. We wonder, if efforts to

connect sense of place to science learning are truncated by the language of science that dismisses the subjectivities that constitute a sense of place. This is a difficult paradox for us as science is part of who we are – we've both been scientists before going into science education.

Liz

Sense of place is not totally outside the canon of science but we agree it is restrained/contained by it. The only way 'sense of place' can be spoken of in terms of disciplines generally is only within what defines the disciplines anyway (Audrey Lorde's criticism about the master's tools comes to mind). Surely we can only talk about 'fragments' of a sense of place being part of science.

Gayatri Spivak (1990) argues that language is "something we cannot possess, for we are operated by those languages as well". You point out that maybe science and its language are acts of delimitation (Said, 1978). School subjects and disciplines organize and authorize the classification, arrangement, and selection of forms of knowledge. It is at best compartmentalized knowledge. The canon of science (and hence science education) represents a selective tradition, a particular intellectual heritage that is supposedly drawn from the best that we know. The politics that permit the 'science' and 'science education' selection is never part of the conversation and neither are the assumptions and structures of power that authorize its discourses and practices. Canonization is a process whereby selection implicitly devalues the cultural expressions that do contest its hegemony. Furthermore, fragmented knowledge can never capture something that requires more than the subject can offer – it can only offer fragmented experience. Fragmented experience is dissociated from all that made it in the first place.

My point is that how we go about identifying is as important as the act of identifying itself – the approach we take to identify 'sense of place' can constrain us in the characterization of it. You want to know how 'sense of place' emerges in science lessons but such an approach characterizes 'sense of place' as an object (among other objects presumably) that can emerge in science lessons. From my point of view there is a double disciplining here – the subject discipline (science education) is finding a way of disciplining the subject (Foucault, 1977). A question we need to ask is, does the approach outlined in this study help us understand, as Calabrese Barton and Lim suggest, how a sense of place can and does shape who/how one is in a classroom? If so, in what ways does it do this? Should we pursue such an approach? That which characterizes our understanding of 'sense of place' will characterize the shape of any emerging subject in the

study. While capturing identity on paper is an impossibility, as we have all indicated, should this stop us from attempting to explore sense of place in classrooms?

This is why science, science education and their languages forbid a more comprehensive form of 'sense of place'. In this sense, I am asking too much of the article when I made the criticism regarding objectivity. If we think that exploring sense of place in science lessons is productive, then how might we find ways to disrupt the language and its disciplining effects? Should we be talking about 'sense of place' as "incidences" or how it "shows up in classrooms"? As Angie and Miyoun ask, how do we construct a science that is inclusive/reflective of self and our relationship with the environment if our tools won't let us? One of the ways a 'sense of place' embeds itself in indigenous knowledge is through the stories or narratives people tell (and pass on to younger generations). Maybe Jameer and Luis have stories to tell about their playground and neighbourhood.

Angie and Miyoun

In our own efforts, we have viewed our central challenge as NOT about picking apart an individual's sense of place per se (because it is not the purpose of this paper, and also its an impossible task anyway) but rather to document "incidences" where using such a mind-set might help us to understand what is going on in the classroom a little bit differently, hopefully a little better. How should you document this in a way that reflects the subjective, temporal, political nature of a sense of place? How should you put words to something that is so complex in a short number of pages? How do you conceptualize one's sense of place in a "teaching moment" where what matters is making a good decision about how to help students to investigate playgrounds?

We don't know. But, that gut feeling is too strong to ignore especially when we attempt to recount the number of times our students have seemingly resisted our pedagogical and curricular approaches for things that appear to matter more to them. As we fumble through these feelings that something different needs to be done – something that moves us *beyond* objectifying students' experiences in the classroom – we wonder if what matters more to us is how a sense of place "shows up" in science class. Does a student actively resist an activity because he is too grown up for it? Does a student reject her teacher's ideas for an activity and work to persuade her peers to extend the lesson because she thinks it will benefit her neighborhood? In either case, we think that a teacher could see these students as deviant, as trying to "get out" of what they want their students to do in their classrooms. We argue that "knowing" how/why one's ecological

relationship to place matters could help teachers to see these students and their actions differently.

In a sense, the frustration that Liz expressed about our students' sense of place (or lack thereof) speaks to the reality of our classroom. Students' sense of place is visible in a science classroom only through those snapshots or fragmentations. Although Jameer tells us a rich stories of her sense of place, a strong critical sense of social justice of her neighborhood, this never becomes visible in her classroom. What became visible was her knowledge of the playgrounds in her neighborhood which comes from her particular lived history. The focus of this paper was to explore this reality. We dealt with what was visible and observable in terms of sense of place. We acknoweldge that this exploration is not complete at all. But this is what is happening in a science classroom and this is where we have to start.

CONNECTED SCIENCE

The key question the authors raise in this context involves how do young people bridge their experiences with schools science to their lived worlds out of school, to their sense of place? What is disturbing in this pedagogical context, Lim and Calabrese Barton tell us, is that "contemporary mainstream school practice fail to teach students about their relationship to place." This conceptual context allows for forms of pedagogical standardization that dismiss the study of place as a silly waste of time. As Lim and Calabrese Barton put it: "today's education follows an 'anywhere and anytime' general approach by establishing national (if not globalized) standards and subsequently developing curricula which can be used anywhere and anytime." The dismissal of the importance of the sense of place, curricular standardization, and the demonization of the previously discussed multilogical, multiperspectival theoretical/methodological concepts all come from a form of epistemological universalism that has regained a new dominance in the contemporary era.

We have come to a watershed in socio-intellectual and educational history when the discussion of the ways we make sense of the world and then construct curricula about it are viewed as the impractical activities of an irrelevant group of pedagogy scholars. Without articulating it, right wing politicos and their educational cronies have created an anti-intellectual worldview based on a universalist re-articulation of positivism. Not only a manifestation of hyper-rationalization, this neo-positivism justifies the standardization of curriculum in the process becoming an effective means of insuring ethnocentrism and ideological indoctrination in the classroom. Such an ethnocentrism is suspicious of concepts such as diversity, multiple

perspectives derived from multiple forms of research, criticality, difference, multiculturalism, and place.

Ideologically, it works covertly to promote the interests of dominant culture over less powerful minority cultures. Such interests involve the power of the privileged to maintain their privilege, as students from economically poorer families – those students whose families possess the least formal education – are transformed into "test liabilities." In such a category their problems in school can be blamed on finding deficits in the home, the culture, and their very being. In this ideological/research/pedagogical cosmos there is absolutely no reason to engage in research such as Lim and Calabrese Barton's on sense of place.

Angie and Miyoun

An issue that we need to think more about is how is the science of school imbued with sense of place? In other words, can one attempt to discuss how students leverage sense of place to learn science (as we have attempted to do) without implicating the specific relationships that produce epistemological and ontological processes that make up "what" students are expected to "learn" in schools? Joe's point of the neoconservative efforts driving current educational policy and practice is the very reason we got ourselves into this investigation. Sometimes it "feels" to us (and we use the word feel purposefully) that policy makers are working to "sanitize" the educational system and the students and teachers who make up those systems: wash away the indigenous knowledges that challenge.

Joe

The decimation of indigenous knowledges by imperialistic pedagogies and colonial knowledges and the relationship of this process to the curricular issues that the authors raise involving place is important. When science educators ignore issues of place, they erase the powerful indigenous knowledges students often bring with them to school. From a critical perspective the study of indigenous knowledges is an examination of how different peoples construct the world. Here we connect the epistemological with the ontological, as knowledge vis-à-vis place helps shape selfhood and selfhood vis-à-vis place helps shape knowledge. In this context science's and science education's encounter with indigenous knowledge can enrich both scientific and pedagogical processes.

When educators respect indigenous knowledges, they automatically grant more importance to the particular, to the specific relationships that produce epistemological and ontological processes. In this context they see

previously unseen problems and encounter perspectives that can move them to new levels of insight and cognitive ability. Questions that are constructed by an encounter with indigenous knowledges hold kinetic, revolutionary effects. As educators take indigenous knowledges seriously, epistemic power is shared and classroom structures change. Indigenous knowledges demand that place be considered, as a central dimension of indigenous knowledges involves their "place-centric" dimension. Remove place from the epistemological mix and indigenous knowledge is destroyed.

Liz

The notion of connected science reminds me strongly of Ted Aoki's (2005) work in this area, although he moves further towards a psychoanalytic understanding of curriculum as well. The tensions between 'curriculum-as-lived' and 'curriculum-as-planned' (to borrow from Aoki) has been well covered in his work, although from a teaching and learning point of view rather than focusing on students particularly. However, there are tensions for the teacher. For example, there are many 'lived curricular', at least as many as there are students and self, and probably many more. So what becomes of the teacher in such a situation? Furthermore, what becomes the teachable and what is the unteachable, and how does one mediate between these?

On the other hand, we can speak of the possibilities this multiplicity of curricula presents. This is also a difficult concept. We are struggling with this as a country as we are currently developing a new national curriculum – local knowledge, the collective national knowledge, and the international knowledge. It would appear to me that in a world that Bauman (2004) terms as the "liquid-modern setting of the social", where our world is less predictable now than for previous generations and there is an annihilation of space/place through time, developing students sense of place (and hence belonging) becomes even more important. For me, developing a place-based education has mainly been about students knowing who they are, where they come from, to develop a sense of belonging. For many indigenous peoples, this concept of education is important because it simultaneously legitimates indigenous knowledges and acts as a mechanism to transfer knowledge intergenerationally.

Joe

The concept of a connected science provided by Miyoun and Angie can serve as a departure point for a profound discussion of cutting edge concerns in the study of transformative pedagogies. A connected science that links scientific thinking to students' sense of place and the cognition that comes out of it appreciates the notion that any science is a social construction. All

forms of scientific thinking are produced in particular cultural contexts in specific historical eras. When Western scientists actually take indigenous knowledges seriously, they come to understand their work/pedagogies in a new way. As they gain a critical distance from their research/pedagogical methods, they gain new insights into the Eurocentrism/patriarchy/class bias of mainstream science. Such biases have produced the very forces that have constructed disconnected forms of scientific activity over the last couple of centuries. Such biases constitute the very foundation of the right-wing neo-positivism that seeks to make sure that science education never again considers the virtues of a connected science.

These issues of place and science education open a dialogue about the nature of scientific knowledge and the purpose of science education. An understanding of multilogicality and the diverse ways of seeing and learning that it promotes helps teachers and students clarify the purposes of their educational activities and facilitate their efforts to answer the question: what is the purpose of science education. Encounters with multilogicality will induce science educators and their students to answer such a question in a way that highlights issues such as cultural humility, reflections on the identity formation of students and teachers and the ways their consciousness is constructed, and an awareness of the power of difference defined in multiple ways. Indeed, a connected science in a critical context is dedicated to the needs of specific communities and is driven by humane concerns rather than the economic needs of corporate managers, government, and the military. Much too often Western science and science education is co-opted as a player in the continuation of Euro-expansion projects that reify the status quo and further the interests of those in power. In this context a connected science does not attempt some Grand Synthesis that eventuates in one final universal epistemological system. Instead, a connected science continues to question its assumptions, methodologies, and pedagogies as it seeks new insights from its multilogical encounters with difference.

Liz

Connected science may mean connected schools. I see 'special character' schools in New Zealand and the USA that do try to do this, that is, to incorporate a sense of place in their pedagogy and curriculum, but it must be encompassed in the character of the school not just a class. I visited a charter school on the island of Hawaii that was attempting to incorporate Hawaiian indigenous language, culture and knowledge into the school programme. The 'school' was not on one site but occupied 3 sites – a campus by the sea; a mountainside site; and a site between the two. Students were engaged in

productive gardens (to grow food for cultural events), a track of 'waste' land being re-established in native plants and developed with paths, and learning from marine biologists. Cultural protocols are adhered to in all areas of school and 'science' lessons are integral to the place they occupy that they call a school. But it is much more – they have a deep understanding and caring of the land/place. A sense of place for indigenous communities is about spirituality, language, history, ancestry and identity.

Angie and Miyoun

We find relatively numerous cases, stories, and examples of pedagogical approaches, programs, and schools that are based on, informed by pedagogy of place, place based education, or sense of place education. Yet none of these studies seriously interrogate how this matters to students and their sense(s) of place that they bring to learning. While it is exciting and important to have these pedagogical endeavors, we wanted to approach pedagogy of place in a different direction through this study. Yet, as we all have pointed out in our own ways, sense of place is a complicated and slippery concept. Partly due to the difficulty of exploring one's sense of place, there are not many studies addressing students' sense of place in an "empirical" way as Joe pointed out. What we need to understand is what these pedagogical efforts actually mean to our students and how they connect with their lives. We need to know what sense of place means in the process of everyday learning in classrooms, and especially how sense of place relates to enacted curricula.

OPENINGS

Angie and Miyoun

This study is about the relationship between science education and sense of place. To be truly transformative education (as Joe described), or for sense of place to be a useful and viable concept in science education, we believe we need to understand this relationship between science education and sense of place. Our study has explored only one limited aspect of this relationship: How students' sense of place is leveraged in a science class. In this sense, this paper is partial and incomplete.

Kincheloe reminds us of where we come from and where we wish to go with this study and put this study in a context of educational research: "In the development of what I have labeled a critical ontology, we learn from these ideas that critical pedagogy's goal of political empowerment vis-à-vis the cultivation of the intellect demands an understanding of the

system of relationships that construct our and our students' selfhood. Social transformation and political empowerment are simply not possible outside an understanding of particularity – the students' sense of place and the many contexts in which education occurs." Critical ontology as Kincheloe calls it, is one of the fundamental reasons why we got interested in and initiated our inquiry on place.

This study is just a beginning. We have argued that building curriculum and pedagogy upon these knowledges leads to a connected science. Yet, as we now reflect on our beginning efforts to outline a connected science, we see some gaping holes that we need to wander through:

- How should place be talked about with respect to the canon of science?
- What does it mean for "connections" to be built between sense of place and the knowledge of school, and how should these connections become public knowledge and public practice?

These two questions arise from our frustrations with multicultural approaches to science education: that most efforts to "connect" science and students' experiences are unidirectional in the sense that students' experiences are made to "fit" science. They are also uni-dimensional and objective in that the students' experiences to be connected to science are melded into content-only issues i.e., lets teach about fatty acids through soap making. At the same time we have these criticisms, we also have our worries: if students' experiences belong in the science classroom, where should the line be drawn about what should get in and what stays out. Take the recent controversy over evolution. The president of the US wants "intelligent design" taught in science class. How does talk about creationism fit in a science classroom if such religious beliefs are part of a students' sense of place?

And what about those dimensions of sense of place, which are not so public, because students don't want them to be or because the culture of schooling has not created a way to talk about them equitably or without stereotype or threat? We think these are hard questions to answer especially when considering the fact that only those things that are listed as standards and can be tested on high stakes exams seem to matter in science classrooms these days – after all, in the USA, science becomes a NCLB tested subject beginning 2007.

Joe L. Kincheloe is Professor of Education at the City University of New York Graduate Center. He is the author of numerous books and articles about pedagogy, cultural studies, education and social justice, racism, class bias, and sexism, issues of cognition and cultural context, and educational reform. His books include: "Teachers as Researchers", "Toil and Trouble", "Getting Beyond the Facts: Teaching Social Studies/Social Sciences in the Twenty-first Century", "The Sign of the Burger: McDonald's and the Culture of Power", "Rigour and Complexity in Educational Research: Conceptualizing the Bricolage" (with Kathleen Berry), and "Changing Multiculturalism" (with Shirley Steinberg). Kincheloe is

very concerned with the politics of knowledge as it relates to the socio-cultural, political, psychological, and educational dimensions of contemporary life. In this context he utilizes multiperspectival research methods (bricolage) and multiple theoretical frameworks to study these issues.

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