

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/290829532>

Towards culturally inclusive science education

Article · January 2006

CITATIONS

6

READS

45

1 author:



[Peter Charles Sinclair Taylor](#)

Murdoch University

98 PUBLICATIONS 1,723 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



Ethical Dilemma Story Pedagogy [View project](#)



Science Education and Culture [View project](#)

All content following this page was uploaded by [Peter Charles Sinclair Taylor](#) on 23 January 2016.

The user has requested enhancement of the downloaded file. All in-text references [underlined in blue](#) are added to the original document and are linked to publications on ResearchGate, letting you access and read them immediately.

Towards Culturally Inclusive Science Teacher Education

Peter Charles Taylor

I have been invited to discuss 'Keith's Story', authored by Richard Kozoll and Margery Osborne. In working with bald text, however, I am aware that there is a real and present danger of privileging the rational over the heart-felt and resorting to what Clinchy (1996) described as a 'separate way of knowing', in which the ideas of one's discourse partners become objectified and subject to the thrust and parry of self-serving contestation. I shall endeavour to honour the intended spirit of this Forum - to engage in mutual learning - by enacting a dialogical inquiry which I shall couch within a socio-cultural perspective and from which I shall advocate culturally inclusive science teacher education.

Keith's Story provides powerful insights into how a young man's passion for being in nature as a child set him on a pathway to becoming a teacher of science. Through recollections of his life experience, we learn how science came to have an increasingly important role in shaping Keith's way of being in the world and his aspirations for a science teaching career. For the authors, Keith's development of a scientific worldview is "a success story".

The paper is strongly theorized in relation to theories of identity, linking the ongoing process of identity construction recursively to early lifeworld experiences and social values. Indeed it is argued that not only did Keith become a scientist but science became Keith inasmuch as it came to constitute his worldview.

A narrative approach to interviewing elicited a rich set of autobiographical recollections (oral history) that illuminate the way in which Keith (described variously as a Jamaican-American, immigrant, minority student, Black student, student of color) learned to make sense of the natural world of plants and animals, initially as a child through play, imagination and mentoring grounded in an indigenous Jamaican knowledge system. Later, school and college science in Canada and the USA enabled him to construct a highly sophisticated scientific worldview.

From this standpoint, Keith exercises a strong sense of agency and advocacy as a confident and knowledgeable person who chooses to counteract others' non-scientific (mis)understandings of the natural world. Furthermore, his scientific worldview is infused with an ethic of care which, it seems, originates from an early childhood experience of being connected intimately with both the natural world and family/friends who helped nurture his sensibilities and sensitivities towards nature. Thus Keith's success story hinges on his early lifeworld experience of being supported strongly in seeking answers to his questions about the mysteries of nature, a disposition that evolved into a life-long quest for seeking scientific explanations for everyday phenomena. It is this passion for scientific meaning-making that commits him pedagogically to inculcating a questioning and analytical mind in his future students. He wishes to empower them through science to make similar sense of their own lifeworlds.

From Keith's Story, the authors infer that an inclusive science education should enable students to develop identities that are encompassing of (continuous, congruent and compatible with) science. However, students are likely to develop a scientific worldview only if it is experienced as meaningful, satisfying and enjoyable. The pedagogical key seems to lie in enabling students to pursue inquiries about the

natural world that arise from the spiritual, moral and emotional depths of their own lifeworlds. Such a depth of engagement would involve students in “rethinking” their lifeworld beliefs and values.

Culturally Inclusive Science Education

I invite the reader to consider the question of what might properly constitute an inclusive science education, especially for students whose natal worldview is shaped strongly by a non-Western culture and who encounter the press of formal schooling to construct a dominant Western science worldview and congruent cultural identity. I am interested in the politics of cultural identity formation ([Banks, 2001](#); [Golmohamad, 2004](#)) and the role of science education in manufacturing young people’s cultural identities ([Aikenhead, 2002](#)), an issue of paramount significance in a postcolonial world in which the West’s historical tendency to define social reality for others is being contested politically whilst being acceded to, in part, through the powerful vector of the international science curriculum export industry.

I shall propose two contrasting (some would say antithetical) perspectives – *Western Science Worldview* and *Non-Western Worldviews* – and invite the reader to reflect critically on the role of science teacher education in serving their distinctly different political and ethical interests. Although I admit to the somewhat simplistic nature of the binary opposites of ‘non-Western’ and ‘Western’, it can be a useful distinction if one focuses instead on the hybrid space created by the infusion of Western and non-Western worldviews, as has occurred historically in numerous parts of the world colonised by European powers ([Chakrabarti, 2004](#)). Indeed, [Bhaba \(1994\)](#) urges educators to develop pedagogies within the ‘Third Space’, a linguistic space created by the informal fusion of Western and non-Western worldviews wherein flourish richly hybridised languages and fluid cultural identities ([Schech & Haggis, 2000](#)).

From within the perspective of the Western Science Worldview, the primary role of science education is to enable students worldwide to develop a robust scientific worldview. The educative process involves reconstructing students’ naïve lifeworld beliefs about the natural world that are not compatible with the canons of scientific communities (of physicists, biologists, chemists, and so on). This can be thought of as a process of enculturation in which successful ‘students-as-recruits’ adopt core beliefs, values and discourse practices of scientific communities ([Willison & Taylor, in press](#)). This perspective is compatible with social constructivist pedagogies ([Driver, Asoko, Leach, Mortimer & Scott, 1994](#)) which emphasise the importance of language skills, negotiated learning, grounding inquiry in issues of social relevance, and making explicit the historical contingency of scientific knowledge building.

From within the perspective of Non-Western Worldviews, a primary role of science education is to facilitate cultural and ecological sustainability. The Western Science Worldview is recognised as a cultural construct which historically has conflicted with and displaced the traditional worldviews of many peoples (e.g., Maori of New Zealand, Inuit of Canada, indigenous Hawaiians, Australian Aborigines, indigenes of the Pacific Islands, villagers of Tanzania). It has been labelled ‘Western Modern Science’ in order to differentiate it from scientific practices (often labelled ‘ethnoscience’) embedded in Non-Western worldviews. An example of this difference is given by Japanese science educators who contrast traditional concepts of *Shizen*

and Kensatsu with their Western counterparts - Nature and observation - pointing out their cross-cultural incommensurability and warning science teachers of serious cultural distortion resulting from conflating them (Kawasaki, 1996). The privileged position in school curricula of Western Modern Mathematics, especially in formerly non-Western countries currently opening to the world, such as Nepal, is perceived as a threat to the integrity of long-established vibrant local cultures (Luitel & Taylor, in press).

Educators worldwide are working (at times consciously within the Third Space) to develop culture-sensitive (some say postcolonial) science and mathematics curricula and pedagogies that serve the diverse educational needs and aspirations of indigenous peoples (Aikenhead, 2000; Hammond & Brandt, 2004; McKinley, 2005; Weaver, Morris & Appelbaum, 2001). Of major importance is positive recognition and growth of local cultural capital, including traditional knowledge systems and languages, recognition of the non-essentialist and mutable nature of all cultures and worldviews (including Western Modern Science), and the need to develop multicultural identities which harbour a strong sense of shared humanity with the culturally different 'other' (Dei, Hall, Goldin & Rosenberg, 2002; King, 1999; Mutua & Swadener, 2004; Semali & Kincheloe, 1999). This perspective is compatible with critical social theory, postcolonial theory, postmodernism, feminist theory and theories of cultural pluralism.

Developing Keith's Professional Cultural Identity

Keith seems to have largely relinquished his natal worldview in favour of a sophisticated Western Science Worldview. There is little evidence that he retained much of his early Jamaican identity, suggesting that it was displaced unproblematically during formal schooling, first in Jamaica and later in North America. And there is no evidence of the science teacher education program purposefully nurturing a multicultural identity.

As a North American science teacher Keith stands to serve as an agent of reproduction of a Western Science Worldview. Somewhat worryingly, there is no evidence that he has a critical awareness of the problematic role of science in society. Instead Keith appears to be a strong and uncritical advocate of science as a vehicle for bringing enlightenment into the lives of his students. This might remain a non-issue for Keith, however, let me hypothesise a little about Keith's destiny for the sake of extending my argument. What if Keith finds himself at some point in his career teaching students with cultural backgrounds similar to his own, perhaps as a result of returning to the Caribbean? Interestingly, in Jamaica there is a growing intellectual consciousness that schools should provide 'vernacular education' aimed at fostering local cultural and ecological sustainability (Hickling-Hudson, 2004; Louisy, 2004). This prospect raises the question of Keith's preparedness to adopt/develop science curricula and pedagogical practices congruent with alternative worldviews. It raises the general question of the role of science teacher education in preparing teachers to be professionally adaptable to a multicultural world.

I wonder about Keith's early cultural identity and how strongly it was shaped by the informal traditional knowledge system of Jamaican village life. And I wonder about the way it was reshaped later as he transited into the Western education systems of North America. Has his traditional knowledge of Nature (or Shizen?) been entirely displaced as a result of 'one-way border crossing' (Giroux, 1992) into Western scientific discourse communities (of biology, chemistry, physics, etc.)? What of his

original 'sense of place'; does he continue to carry it in his heart? Or has it too been displaced by crossing the border into a Western Modern Worldview? Perhaps it remains intact but has been compartmentalised? Or perhaps Keith's disparate cultural identities have metamorphosed into a complex multicultural identity? Whatever the outcome, I wonder about the role of high school science education in shaping the process of Keith's cultural identity formation. Did it foster a sense of pride in or shameful suppression of his cultural difference?

In particular, I wonder about the enculturating role of science teacher education experienced by Keith at college where training of Western modern scientists and science teachers often occurs in the same classrooms and laboratories regardless of their diverse professional career aspirations and needs (Taylor, Gilmer & Tobin, 2002). There is some evidence that the Entomology classes connected with Keith's indigenous knowledge, but was this simply serendipitous? On the other hand, I wonder whether his specialist science teacher preparation classes provided opportunities to foster development of a multicultural identity, thereby facilitating his ability as a 'two-way' border crosser (Giroux, 1992) capable of sustaining a professional interest in his own Jamaican cultural capital and a pedagogical sensitivity to the diverse cultural capital of his future students?

What type of science was Keith prepared to teach; is it exclusively Western or is it 'multiscience' (Ogawa, 1998)? What type of science pedagogy would Keith need if he was to return to Jamaica, or if he decided to teach in Africa where recently articulated science curriculum policies are advocating a balance between localisation and globalisation? More generally, I wonder about the extent to which Keith has been prepared to adapt Western science curricula and pedagogy to the social and cultural values of non-Western cultures.

Many of these questions are about identity politics, and they are asked from a social justice perspective which asserts the value of global cultural diversity and the role of science education in facilitating it.

References

- Aikenhead, G. (2002). Whose scientific knowledge? The colonizer and the colonized. In W.-M. Roth & J. Desautels (Eds.), *Science education as/for sociopolitical action* (pp. 151-166). New York: Peter Lang.
- Aikenhead, G. (2000). Renegotiating the culture of school science. In R. Millar, J. Leach & J. Osborne (Eds.), *Improving science education: The contribution of research* (pp. 245-264). Buckingham, MK: Open University Press.
- Banks, J. A. (2001). *Cultural diversity and education: Foundations, curriculum, and teaching* (4th ed.). Needham Heights, MA: Allyn & Bacon.
- Bhabha, H. K. (1994). *The location of culture*. London: Routledge.
- Chakrabarti, P. (2004). *Western science in modern India: Metropolitan methods, colonial practices*. Delhi: Permanent Black.
- Clinchy, B. M. (1996). Connected and separate knowing; Toward a marriage of two minds. In N. R. Goldberger, Tarule, J. M., Clinchy, B. M. & Belenky, M. F. (Eds.), *Knowledge, difference, and power; Essays inspired by Women's Ways of Knowing* (pp. 205-247). New York: Basic Books.
- Dei, G. J. Sefa, Hall, B. L., & Rosenberg, D. G. (Eds.) (2002). *Indigenous knowledges in global contexts: Multiple readings of our world*. University of Toronto Press.
- Driver, R., Asoko, H., Leach, J., Mortimer, E. & Scott, P. (1994). Constructing scientific knowledge in the classroom. *Educational Researcher*, 23(7), 5-12.
- Giroux, H. A. (1992). *Border crossings: Cultural workers and the politics of education*. New York: Routledge.
- Taylor, P. C. (2006). Towards culturally inclusive science teacher education. *Cultural Studies of Science Education*, 1(1), 201-208.

- Golmohamad, M. (2004). World citizenship, identity and the notion of an integrated self. *Studies in Philosophy and Education*, 23, 131-148.
- Hammond, L. & Brandt, C. (2004). Science and cultural process: Defining an anthropological approach to science education. *Studies in Science Education*, 40, 1-47.
- Harding, S. (1998). Is science multicultural? *Postcolonialisms, feminisms, and epistemologies*. Indiana University Press.
- Hickling-Hudson, A. (2004). Towards Caribbean 'knowledge-societies': Dismantling neo-colonial barriers in the age of globalisation. *Compare: Journal Of Comparative Education*, 34(3), 293-300.
- Hines, S. M. (Ed.) (2003). *Multicultural science education: Theory, practice, and promise*. New York: Peter Lang.
- Kawasaki, K. (1996). The concepts of science in Japanese and Western education. *Science & Education*, 5, 1-20.
- King, L. (1999). (Ed.). *Learning, knowledge and cultural context*. (Reprinted from *Review of Education*, 45(3, 4), 1999.) Hamburg: UNESCO Institute For Education and Kluwer Academic.
- Louisy, P. (2004). Whose context for what quality? Informing education strategies for the Caribbean. *Compare: Journal Of Comparative Education*, 34(3), 285-292.
- Luitel, B.C. & Taylor, P. C. (in press). Envisioning transition towards a critical mathematics education: A Nepali educator's autoethnographic perspective. In J. Earnest & D. F. Treagust (Eds.), *Educational change and reconstruction in societies in transition: International perspectives*. Perth, WA: Black Swan.
- McKinley, E. (2005). Locating the global: Culture, language, and science education for indigenous students. *International Journal of Science Education*, 27(2), 227-241.
- Mutua, K. & Swadener, B. B. (Eds.) (2004). *Decolonizing research in cross-cultural contexts: Critical personal narratives*. Albany, NY: State University of New York Press.
- Ogawa, M. (1998). A cultural history of science education in Japan: An epic description. In W. W. Cobern (Ed.), *Socio-cultural perspectives on science education: An international dialogue* (pp. 139-161). Dordrecht, The Netherlands: Kluwer Academic.
- Schech, S. & Haggis, J. (2000). *Culture and development: A critical introduction*. Oxford, UK: Blackwell.
- Semali, L. M. & Kincheloe, J. L. (1999). *What is indigenous knowledge? Voices from the academy*. New York: Falmer Press.
- Taylor, P.C., Gilmer, P., & Tobin, K. (2002). *Transforming undergraduate science teaching: Social constructivist perspectives*. Dordrecht, The Netherlands: Kluwer Academic.
- Weaver, J. A., Morris, M., & Appelbaum, P. (2001). *(Post) modern science (education): Propositions and alternative paths*. New York: Peter Lang.
- Willison, J.W. & Taylor, P.C. (in press). Complementary epistemologies of science teaching: Towards an integral perspective. In P. Aubuson, S. Richie & A. Harrison (Eds.). *Analogy and metaphor in science education*. Dordrecht, The Netherlands: Springer.