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Incorporating Indigenous Knowledge into the Curriculum: Responses of Science Teacher Educators

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Abstract: In many parts of the world, concerns to enact a practical reconciliation between indigenous and coloniser populations are finding their expression through various action plans and formal social initiatives. At base, such initiatives require the acknowledgement of both colonial injustices and the awareness of and respect for the strength, wisdom and holistic integrity of displaced/colonised knowledge systems. In the Australian context, draft national curricula in five areas—English, Maths, Science, History and Art—all reflect a concern to incorporate local indigenous knowledge and perspectives into each respective syllabus. While there have been attempts to attach aspects of indigenous knowledge to various strands of individual State curricula in the past, the present national concern would require something of a reconceptualisation of what constitutes, for example, Science as currently taught in schools. This paper presents initial findings from a larger research project that aims to identify the concerns and opportunities presented by a rethinking of the nature of Science as a result of the national curriculum process. Here, the reactions to and ideas of arguably central figures in any successful re-orientation of “official knowledge” in school-based teaching—teacher educators—are presented by way of suggesting challenges, possibilities and imperatives for the genuine incorporation of local indigenous knowledge into the formal school Science curriculum.

Keywords: Indigenous Knowledge, National Science Curriculum, Teacher Educators

The Australian National Curriculum

THE HISTORY, POLITICS and aspirations of the most recent attempt to establish and mandate a common curriculum for all Australian schools is not the subject of this paper. Suffice to say that, in the current initiative, community and government attitudes towards such a move have tended to outweigh those of the States-rights advocates from eras gone by. Increased frequency of mobility of growing percentages of the Australian population across State and Territory borders, perceived economic efficiencies, and a belief that centralization of curriculum will lead to greater nationwide accountability and school-based achievement are all contributing reasons for the decision of Federal, State and Territory Ministers to agree to move to a national curriculum through the *Melbourne Declaration on Educational Goals for Young Australians* (December 5th, 2008).

From the Four Year Plan derived from this Declaration, the Australian Curriculum Assessment and Reporting Authority (ACARA) was established to “*to deliver key national reforms in curriculum and assessment including :*”

- “*development of a rigorous, world-class national curriculum*” (MCEECDYA 2009, p 14)

The initial drafts of curricula in English, Mathematics, Science and History were released for public consideration in March, 2010, with a consultation period ending mid-year. Final versions of these curriculum statements are expected to be released by ACARA late in 2010. One feature of the national curriculum is the expectation that three cross-curricular perspectives will be *represented in learning areas in ways appropriate* (National Curriculum Board, 2009, p 13) to each content area. One of these common perspectives is

Indigenous perspectives, which will be written into the national curriculum to ensure that all young Australians have the opportunity to learn about, acknowledge and respect the culture of Aboriginal people and Torres Strait Islanders. (National Curriculum Board, 2009, p 13)

The draft version of the Australian National Science Curriculum (ACARA March, 2010) clearly reflected this cross-curricular perspective and possibly opened up the prospect of indigenous science falling into both the content strand and the strand of learning titled “Science as a human endeavor.”

What are Indigenous Knowledge and Indigenous Perspectives?

Many have grappled with these types of question, and as Kincheloe and Steinberg argue, *the questions—what is indigenous knowledge, and why should we study it?—do not lend themselves to easy and concise answers* (Kincheloe and Steinberg 2008, p 150). At the time of writing, very few details about what might constitute indigenous perspectives in general, let alone in a curriculum sense, have been forthcoming from ACARA. The best Australian summary statement of what this might entail is contained in the Queensland Education Department’s guidelines to schools:

Indigenous perspectives include the ways of knowing and doing for Aboriginal peoples and Torres Strait Islander peoples, from pre-contact, contact, postcontact, through to today. They are diverse, complex and multi-layered. (DETA, 2006. P9)

It should be noted that this definition of indigenous perspectives is limited, ethnically and geographically, to Australia and the Torres Strait, but this should not necessarily narrow the case for a more global consideration of the value to be gained from curriculum inclusions of indigenous peoples and their knowledge broadly:

A curriculum that values subjugated knowledge in general realizes that indigenous knowledge is important not only for the culture that produced it but also for people from different cultures. (Kincheloe and Steinberg 2008, p 149).

Indigenous knowledge might be conceptualized as knowledge that has evolved in a particular societal context and which is used by lay people in that context in the conduct of their lives. It is, typically, not generated by planned procedures and rules...instead draws on existing societal wisdom and other local resources that may be available, and by using a fair amount of intuition and creativity... It is typically passed on from one generation to the next in the oral mode and is usually not to be found in the school curriculum. (George, 1999, p80).

Maurial (1999) identifies a crucial point of difference between indigenous knowledge and that of Western scientific knowledge: *The essence of indigenous knowledge is that it is alive in indigenous peoples' culture. Different from Western knowledge, it is neither in archives, nor in laboratories. (p 63)*. This, of course, translates into a central pedagogical and curricular concern: if content (“knowledge”) isn’t available in the usual forms and locations (libraries, resource materials and textbooks, for example), then curriculum development at a school and classroom level requires different professional aptitudes and capabilities on the part of educators:

[I] ndigenous knowledge is not normally “packaged” as school materials are. The school teacher must, therefore, first access the indigenous knowledge, then understand it and its likely relation to what is to be taught in the class. (George, 1999, p 84)

Teacher preparation programs would need to reflect on the degree to which they contribute to the professional development of teachers who demonstrate the characteristics of both the *hermeneuts* (scholars and teachers who structure their work and teaching around an effort to help students and other individuals to make sense of the world around them) and *epistemologists* (scholars and teachers who seek to expose how accepted knowledge came to be validated) that Kincheloe and Steinberg (2008, p 148) argue any genuine attempt to draw on the strength of alternative knowledges will require.

The National Science Curriculum

Essentially, the draft consultation version of the National Science Curriculum was an attempt to maintain a consistency with most content and process aspects of existing State and Territory curricula, with only one single area of relative unfamiliarity: a strand titled *Science as a human endeavor*:

[T]he strand in the draft Australian Curriculum called science as a human endeavour is a relatively new development in relation to state and territory science curricula for K to Years 6/7 and for some at Years 7/8 to 10 (ACARA, Australian Curriculum Information Sheet: Science March 2010, p 1)

The Research Project

In response to anecdotal concerns raised by local members of the teaching profession about the difficulties likely to be encountered in implementing the new science curriculum should the draft document bear any close resemblance to the final, mandated curriculum, the authors formed a research team to investigate the initial reactions to the proposed curriculum. A particular focus in this project was on the challenges and opportunities presented by the likely expectation that teachers would need, in some way, to incorporate indigenous knowledge and scientific perspectives into their teaching of science. The project team consisted of two experienced researchers (the authors), two novice researchers and two members of local Indigenous Australian communities who were also members of the academic staff of the university at which the project was anchored.

This project, an illuminative stage in the development of a larger project, involved seeking the reactions to the proposal to incorporate indigenous knowledge and perspectives into the science curriculum from members of a number of groups of people considered to have some

interest in the proposal. These groups were: secondary school science teachers; primary school teachers (who have science as a part of their broad teaching responsibilities); heads of science departments in secondary schools; university-based science teacher educators; members of local indigenous communities; and representatives of community organisations (commercial and non-commercial) whose basic activity involves the use of scientific knowledge and expertise. Participants have been drawn from a range of geographic locations (rural/remote communities, regional city and metropolitan sites), education sectors (primary and secondary schools, university; State and Non-State schools) and community organisations (commercial, governmental, and recreational). The total participant group numbers in excess of 60 individual respondents.

This paper reports on the outcomes drawn from interviews with only one of those groups, university-based science teacher educators. The data from this group have been collected and analysed first in the project primarily because this was the first group for whom a complete data set has become available, but also because of the significant role teacher educators play in the success or otherwise of curriculum innovation. As other data sets are completed, cross-group analyses will allow for different perspectives to be exposed. These will be reported on at a later time.

Teacher Educator Responses

Any successful curriculum innovation requires a coalescence of interested, informed and committed parties. Typically these parties will include various sectors of the teaching profession (teachers, school administrators, professional and industrial organizations), curriculum development and promulgation agencies (central and local curriculum authorities such as, in the Australian context, ACARA), professional development providers (both for pre-service and in-service professional preparation and development) and members of the broader community. While it would be nonsensical to identify any one sector here as being of prime importance, there is a lengthy body of literature that highlights the role effective teacher education—both in initial teacher education/preparation and in-service modes—plays in any successful attempt at educational innovation. This is certainly no more true than in the area of curriculum innovation. As long ago as 1971, Rutherford outlined the scope of the role of teacher educators in this regard:

[These are the] people in the universities who will direct the pre-service training of teachers, who ought to help design and conduct special training sessions for teachers in and out of the university, who should be developing the special teacher learning materials that are needed both at the university and within the schools, and who will by their scholarship and research contribute to a greater understanding of the entire process [of curriculum implementation] (Rutherford 1971, p 565)

In Rutherford's estimation, except for teachers themselves, there is no group that will have a greater influence in determining the fate of a curriculum project's work (p 565).

In the current project, we have drawn on the total staffing of a university's faculty of education science section. (A later part of this project involves us similarly engaging the ideas of staff in the Faculty of Sciences—disciplinary scientists, not teacher educators in the science area). Participants (n=4) here ranged in experience from well over 15 years in teacher education to a little over one year. All of the participants had initial degrees in a

straight science area (chemistry and biology being the most common) and all had subsequent qualifications in education. At the time of the research, all were involved in the design, delivery and assessment of at least one of two core (compulsory) science courses in a large undergraduate teacher education program offered across three physical and one online campus of the university. Three of the participants were female and one was male.

Participants were asked about their responses to the prospect of the inclusion of indigenous knowledge and perspectives in the national science curriculum. Each participant was engaged in a one-on-one conversation about the topic with the same lead researcher in the project. Interviews ranged in length of time from 28 to 49 minutes, and were based around four main sub-topics:

1. Knowledge of the emphases in the draft national science curriculum;
2. Knowledge of and reaction to the proposal to incorporate indigenous knowledge and perspectives in that curriculum;
3. Challenges such a proposal would throw up; and
4. Opportunities and benefits that might attend the implementation of such a proposal.

With the informed consent of the participants, each conversation was recorded for transcription purposes, with the transcriptions being carried out by a commercial legal-medical transcription service. Sample accuracy checks of the transcripts against the audio recordings placed the transcripts well-within the targets of Poland's (1995) protocols. Minor inaccuracies (semantic substitutions making little change to the speaker's meaning) were few and major errors (meaning-changing) almost non-existent.

(The one instance of a major transcription error, however, did add some degree of irony—and not a little wry humor—to considerations of the espoused rigor that purportedly attaches to “hard” science as opposed to indigenous science. One of the participants described their background thus: “*technically my background is that I'm a fluvial geomorphologist, which I don't get to say often enough.*” The transcription represented this statement as “*technically my background is that I'm a fluvial geomythologist, which I don't get to say often enough.*” Perhaps higher forces were at work guiding the typing of the transcriber here!)

In summary, accuracy checks of the transcriptions allowed us to claim with great confidence that “*the transcript is a faithful reproduction of the aural record*” (Poland, 1995, p. 2). It is from these transcriptions and the field notes taken during the course of each interview that the data for this paper have been drawn.

The transcripts have been imported *in toto* as Microsoft Word documents into Nvivo 8 qualitative data analysis software package. The basic unit of data—the text unit—used here is the paragraph. Typically, this is when a participant in the interview takes a new turn at speaking. The paragraphs in each interview transcript have been sequentially numbered, allowing for referencing of direct quotes from the transcripts. For example, reference *George 29/9/10 para 34* would refer to an extract from the 34th paragraph of the transcript of interview conducted on 29th September, 2010 with the participant pseudonymized as George. All participants have been allocated pseudonyms in all dealings with the data.

Themes within the Data

Awareness & Views of the National Curriculum

All participants fully endorsed the move to a common curriculum across the country and three of the four felt that the degree of change to existing State-based curricula would be least felt in Queensland (the State within which the research has taken place).

There was very limited change, apart from some changes in the ethics area for year 9, apparently. Ethics comes in at year 9, which I have a bit of an issue with too. There's very little mention, which is interesting. (Jezza, 25/6/10, para 20)

In some ways, this has meant that the task for these teacher educators in the science area of ensuring appropriate changes to existing preparation courses will be considerably less than it might have been, with the possible exception of the indigenous knowledge component.

All of the participants were well-aware of the contents and intentions of the draft curriculum and all had clear views as to the degree to which the curriculum developers had managed to “get it right.” Comments on the appropriateness of the proposed curriculum ranged from minor concerns:

Previously where there was emphasis on content, four strands and science as a human endeavour which was probably meant to be throughout all of the strands, but it existed on its own. Well now with three strands it has like an equal place in enquiry and understanding. (Sharon 23/7/10 para 30)

to major points of disagreement and almost bewilderment:

The curriculum's divided into three main sort of strains and one is content knowledge; the other is process and the other is what I'd called a social science view of science. I have an objection to that, one third of the curriculum being a social science view. Now I've nothing against social science and I think setting science in context is really important for the learning of it, but I don't think it's one third of the curriculum. (Constance 5/11/10 para 44)

Knowledge of and Reactions to Incorporating Indigenous Knowledge into the Science Curriculum

The release of the draft national curriculum in science led to a considerable degree of public comment from groups such as The Australian Council of the Deans of Science (The Australian, 5/10/10) who felt the draft curriculum presented an “incoherent” approach to the understanding of science. Interestingly, the proposal to incorporate indigenous perspectives into the curriculum seems to have raised few publicly-stated concerns or comment of any sort. However, as with any curriculum innovation, the legitimacy accorded any specific component by authoritative parties significantly impacts on the success of the innovation. What did the teacher educators in this project see as the value of this proposal?

Three of the four participants described this explicitly as a positive move.

It is important, to be honest... The reality is that, when you start to lift up the hood and see what's under the engine, science— basically, anyone can do science. The nature

of science itself is about discovery. Different cultures have their own ways of actually grappling with the environment and their nature and their context. (Jezza, 25/6/10, para 36)

Essentially, this group of participants shaped their views of the worth of this innovation around a conviction that science is a cultural activity, and as such, cannot be divorced from the activities of human beings. Sharon broached this when she argued that *science as a human endeavour makes it becomes science* (Sharon 23/7/10 para 114). From this point of view, science as a cultural activity admits of multiplicities, as opposed to a “hard science” perspective that would see modern Western science as the pinnacle of human rationality.

This second, opposing, view was articulated by one of the participants and she wrapped her reservations around a double concern: one for the integrity of the teaching of what was perceived as real science and teacher inadequacies in this regard:

I would think that it would give even further excuse for primary teachers to avoid teaching science because they could say yes, well I know — I can talk about what famous scientists have done from a social science perspective rather than doing the science. (Constance 5/11/10 para 48)

and the second for the preservation for respect for the respective indigenous cultures from which the content material was to be derived:

[T] he way the syllabus is constructed could allow people to deal with science in a very superficial way and how other cultures use it could be treated in a way that wouldn't do justice to them. (Constance 5/11/10 para 48).

One aspect of the proposal to incorporate indigenous perspectives into the science curriculum that all agreed on, however, was that this aspect of the curriculum could simply be sidelined:

On the periphery it will be look, this is how other cultures do this stuff but it's something you don't have to worry too much about. In many cases it could be core to a particular community, and I think that's the worry. It's just simply on the side. (Jezza 25/6/10 para 39)

Benefits of the Proposal

All participants saw potential benefit in the successful introduction of indigenous perspectives into the science curriculum, although this was by no means a wholehearted endorsement of such a move on the part of all participants. Some of the benefits were perceived to lie in the possible contribution to a more racially/ethnically harmonious society:

We talk about being a multi-cultural society. To be part of a multi-cultural society, you need to understand the other cultures. Otherwise, we're almost back to a mono-cultural — we have issues of, almost like a White Australia type policy effectively. It's an us and them. (Jezza, 25/6/10, para 85)

[T] rying to improve race relations within society as well. To change the way that students look at these sorts of issues. (Leilana, 26/7/10, para 80)

Other benefits likely to flow from the proposal were seen as enhancing both the teaching and learning of science in the classroom generally:

It is important that the students, especially from a teacher ed[ucation] perspective, see science as not just simply a western science. I think that's true and that's something I've woken up to as much as possible as well. The richness that's there and the science is there, is really valuable for them. (Jezza, 25/6/10, para 113)

I think that introducing indigenous knowledges is one way that it could help students broaden their idea of what science is and start looking at things different. [sic] (Leilana, 26/7/10, para 62)

I think it will make content knowledge more relevant and interesting for students if they get that sense of narrative. Kids love to be read a story and once they've got the myth or the legend or even that other perspective that makes it more meaningful for them. (Sharon, 23/7/10, para 106)

Teaching abstract ideas is sort of meaningless, so you've got to have everyday context—I'm thinking of primary—that you can explain scientifically and having an everyday indigenous context there would be a useful thing. But it's becoming aware of it. (Constance, 5/11/10, para 119)

A third perspective saw the possibility of a contribution to the closing of the educational achievement gap between indigenous Australian and non-indigenous Australian educational achievement:

I think the effort will be worth it if it improves education and outcomes for indigenous people in terms of employment, life expectancy, health... (Sharon, 23/7/10, para 94)

Further, there was the more frequently encountered neo-liberalist hope that incorporating indigenous knowledge might actually open up further market avenues for economic exploitation, even if that agenda were to be wrapped in a concern to advance the general human condition:

You've just got to think of all those rain forest plants, cocaine, marijuana, morphine. Tea, coffee, quinine, aspirin. (Sharon, 23/7/10, para 98)

The role of subaltern knowledge systems in the maintenance of intellectual health of a community was also hinted at:

I think the main thing is, or one thing is making sure knowledge doesn't get lost. If you think of examples in history where information and, really I'm talking about products, but when information gets lost it's lost forever and then you have to wait for it to be rediscovered. (Sharon, 23/7/10, para 100)

Finally, a perceived benefit of students encountering non-dominant knowledge as science might seem to accrue through the expansion of something akin to epistemological literacy:

It's a different way of knowing, it's a different system. I think that could help their thought processes, they're criticality as far as science goes. I think from a purely scientist perspective, as a scientist you need more people coming into the profession who've got big ideas, who are willing to think differently. (Leilana, 26/7/10, para 63)

Challenges Facing the Proposal

Despite the range of possibilities attractive to them all participants strongly articulated a raft of problems and difficulties standing in the way of the successful implementation of the proposal. All participants saw a number of challenges to the successful—or even partial—incorporation of indigenous perspectives into the formal science curriculum. Many of these challenges were predictable and probably attach to any curriculum change. These wailing cries of educational innovation include:

- *A highly compressed curriculum:* I don't think there's space, I think the curriculum is incredibly overcrowded and something's got to give. (Sharon, 23/7/10, para 64)
- *Lack of knowledge:* I don't think there's a lot of people who have the knowledge to teach the teachers. To be able to teach it, you need some background and some knowledge about what is an indigenous knowledge in general, what specific areas are we looking at within Australian indigenous knowledges and how does it all link together. (Leilana, 26/7/10, para 76)
- In terms of the interest of the clientele, I'm not aware that our cohort here has a big indigenous experience. (Constance, 5/11/10, para 70)
- *Limited time for program development:* Keeping my material current and up to date. The cycle of change is so fast that the minute I've written a course I feel like ripping it down and trying again. (Sharon, 23/7/10, para 84).

A further pragmatic concern about the likelihood of the proposal being adopted related to the effects of the ascendant normalising of a centralised assessment regimen working its way deeper into the core of education. Participants argued that unless some form of mandatory requirement was built in, it was unlikely that this new area would garner much attention and focus in the classroom:

Especially with all the other pressure for testing. The temptation for a lot of educators will be just to teach the stuff that's tested. (Sharon, 23/7/10, para 64)

I think a lot of science teachers feel so under pressure to get through what they've got to get through and tick all the boxes and make sure that their documents are correct when they go to panel, that they'd see it as one more thing that they have to do. If it's not something they feel confident with themselves, it's going to be a big ask for them. (Leilana, 26/7/10, para 124)

There were, however, perceived challenges that went to the heart of the epistemological tensions that exist between (at least) two discrete knowledge systems:

[H]ow does it all link together and how does such a different belief system, it's a very holistic belief system, how does that fit with that narrow reductionist white western science? (Leilana, 26/7/10, para 76).

[B]ut how do you bring it together in a meaningful way? Because we're not going to just be teaching from an Indigenous perspective, it's going to be some way of fitting together those perspectives with the white western perspectives that we've got to teach. (Leilana, 26/7/10, para 92)

You don't want to shut down those views that they might bring that might say, well this is all primitive stuff, why are we learning this in a science classroom. That's the opportunity to discuss it and to develop it. But, (a) you've got to have that relationship with your students, and, (b) you've got to believe it yourself if you're going to teach it and that might be the challenge. (Leilana, 26/7/10, para 100)

I probably wouldn't do it. I'll tell you why I wouldn't do it, because they [student teachers] don't understand any science anyway. I think I'd be focusing on actually getting them to actually come to grips with the basic science. (Constance, 5/11/10, para 80)

I can get them [indigenous Australian resource people] in to come and show bush tucker or something. But it's not science because they're not looking at it from a science point of view. (Constance, 5/11/10, para 59)

Discussion and Conclusions

Even from this relatively surface-level reading of the reactions of teacher educators to a proposal to incorporate indigenous perspectives into the science curriculum, certain points fall for further consideration.

- Curriculum development

If, as the participants here assert, “traditional” holders of scientific knowledge—Western scientists, texts, teacher educators and specialist teachers—will be found wanting with regard to indigenous knowledge and ways of knowing, it will be necessary to look to local authoritative and authentic sources of content/ knowledge. Such a move would, clearly, run counter to dominant centralizing tendencies in education and would require a whole new set of skills and sensitivities on the part of educators and curriculum developers than perhaps are currently in evidence. Whole new conceptualisations of what it means, for example, to consult with a community are thrown up (see, for example, Maxwell, in progress). As George argues,

The main hurdle to be overcome is the fact that indigenous knowledge is not normally “packaged” as school materials are. The school teacher must, therefore, first access the indigenous knowledge, then understand it and its likely relation to what is to be taught in the class. (George, 1999, p84)

Changes to the ways in which curriculum and its components are conceptualized, portrayed and presented in teacher education programs are provoked by a shift in the epistemological bases of the content aspect of the school program. This will be an important challenge for teacher educators—in all areas, not only science—to meet.

- Teacher educators and multilogicality

For teacher educators themselves to effectively work across and within Western and indigenous ways of knowing, and to be able to operate in the interstices of what Nakata (2002) has called the *cultural interface* there is a need for them to engage with Kincheloe and Steinberg's view of the educator as a multilogical pedagogue. This requires that teacher educators, in this instance, know more than discrete "facts," but rather understand epistemologies—they need to embrace and enact the belief that *any effort to understand or use such knowledges cannot be separated from the worldviews and epistemologies embraced by their producers*. (Kincheloe & Steinberg, 2008 p 149). To enact a pedagogy of multilogicality in teacher education is a serious challenge to orthodoxy, yet one that is imperative to implant for purposes far beyond the immediacy of school curriculum. (Austin, 2011).

- Practical reconciliation and science curriculum

As the participants in this study have maintained, there are broader social ends to be secured through attempting to work in multilogical ways. Meeting the social objective of a practical or concrete reconciliation of indigenous and non-indigenous peoples might be advanced by a genuine attempt to come to know, understand, respect and teach aspects of subaltern cultures. Teachers as a group are members of one of the professions most suspected by indigenous peoples of working to erase their culture, and not only in historical terms. The social hopes articulated by some participants here may well be among the more important outcomes to flow from a serious attempt to incorporate non-Western scientific perspectives into the national Australian science curriculum. If so, this would likely require a collation of scientists, cultural workers and indigenous peoples of a type rarely seen. Such a coalition might come to resemble something approaching bell hooks' *beloved community* (hooks, 2009, p 183). Such communities are places of *reconciliation, a place to come together, a way to return home. It is here that relationships with one another can be "governed by conviviality rather than suspicion, by praise rather than blame."* (p 228)

- Recognizing and resisting primitivizing discourses.

For almost all of the participants, there seemed to be an underlying and unspoken, perhaps an unthinking, assumption that the incorporation of indigenous perspectives into the science curriculum—as important as most saw this—would of necessity be an "add-on," an enhancement of the main "business" of science teaching. Such a view might causally be sheeted home to an unexamined professional socialization into a discourse of primitivism, a view that anchors non-Western cultures in their historical frames and commensurably accords value to their epistemologies and the ways of knowing that are derived therefrom based on a infantilization of their respective sciences. This is where we see the notion of "real science" coming to the fore in the discussions with the participants, and it is this area that would seem to us to present as the most urgent for genuinely critical and consciousness-raising work to be undertaken.

To conclude, the challenge to genuinely demonstrate respect for ways of knowing other than hegemonic Western postvisually-based scientific ones is a serious and problematic one. Such a move will require the development of the degrees of intellectual, political and cultural humility not often associated with "scientists." It is a task which cannot be shirked

by those academic-cultural-activists who see importance in generating those *moments of bafflement* (Spivak, 1990, p 55) that lead ultimately to the forms of *conscientização* (Freire, 1974) essential to transformative social action.

Perhaps, though, as one of the participants in this study pondered, the trigger for a pedagogical consideration of the place of indigenous knowledge in the formal school curriculum might reside more subversively in popular culture:

I really thought, “will people accept indigenous knowledge?” Then I thought about what’s in the popular media at the moment. Using the Hollywood film Avatar, which is about the greedy resource rich industrialist versus this not necessarily idyllic, but this natural environment. With the home tree and the native people have this intimate and connective relationship with the environment. So I thought Avatar was such a bit hit maybe the people are really yearning for a more natural and more authentic connection. (Sharon, 23/7/10, para 82)

Perhaps in the mobilizing of popular interest in and awareness of alternative ways of knowing is where a more pro-social “coalition of the willing” might originate. It would seem from this early report from project data that there is sufficient preparedness in key parts of the education community to view such an initiative as the national science curriculum innovation as not only educative, but imperative.

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