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Pragmatic Science: Establishing Non-Racist, Non-Hegemonic Learning From a Deweyan And Bourdieuian Perspective

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Abstract

It is inevitable that formal systems of education will promote the dominant ideology, political and economic interests and culture within which they are located. For citizens who desire a more democratic, equitable and inclusive schooling, strategies for change must be developed that will realistically combat such factors and for which, general support can be won. The curriculum of all regular schools therefore must be appropriate for Indigenous and non-Indigenous children, not only in terms of cultural awareness but in the creation of new insights and understanding across knowledge that encourage children to be autonomous and independent learners. School science is a significant site of transformation in this direction because of its uncertain character, capacity for experimentation and the range of disciplinary and interdisciplinary studies encountered. The paper briefly outlines these issues and proposes both a curriculum and subject design based on pragmatic philosophy and cycles of reflective investigation. Within a context of Deweyan inquiry, preliminary connections are made with the ideas of Bourdieu in analysing the problem. It is proposed that a pragmatic curriculum and science to diminish the impact of racism and educational hegemony are in the interests of Indigenous and non-Indigenous children alike.

Uncertainty of science

Modern science can be thought about in various ways and remains a contested area of definition. Generally speaking, scientific research involves the identification of a question or problem in unambiguous terms, the design and conduct of experiments of various types, the analysis of data and the discussion of findings that may be tentative and subject to further investigation. This process sets up cycles of inquiry that may continue for a very long period of time. There is considerable debate within the research group with both national and international views being sought including from the literature as to the direction being followed, the redesign of experimental procedure and what data actually means. This is in contrast to a common view that scientific work is undertaken in a linear manner with little dispute and with clear-cut findings, or indeed laws. The criticism of western science is often directed from outside the field and from those who have done little if any actual scientific study.

A brief overview of the ways in which science has been conceptualised serves to indicate that its nature remains open to vigorous negotiation.[1] Bacon for example proposed an inductive method whereby observations are made, data are gathered and outcomes or truth result. The famous 'problem of induction' occurs when new data tends to contradict previous data regardless of how long experiments have been conducted. The reliance on data alone is seen to override the place of human interpretation and a lack of recognition that human values and political situations impact on how the world is seen. On the other hand, the empirical work of Bacon marked a sharp break with the dominance of the church and prescribed truth and encouraged people to come up with their own views

based on their own action. In contrast to Bacon and the inductive method, Popper worked deductively where he suggested that broad conjectures are made and then a process of refutation undertaken., that is, experimenters set out to refute propositions rather than to prove them. This approach of falsification means that scientists can incorporate imaginative and creative thinking rather than rely on data and observation alone.

The American philosopher of science Thomas Kuhn took a different view to both Bacon and Popper when he considered science as developing through a series of paradigms that establish in effect a social and political framework within which scientific work takes place. At key points when the current paradigm is not able to continue to explain major questions, a 'paradigm shift' occurs so that a new framework or map is created that accommodates the new ideas and scientific results. Relativity theory and quantum mechanics marks such a shift from the previous dominant classical mechanics. Kuhn notes that the scientific community needs to accept the new way of going about its work, the new principles and theories that have emerged to guide ongoing experimentation. Finally, the pragmatic philosopher John Dewey placed great importance on the role of modern science in opening up new vistas of knowledge during the time when some of the great ideas of humankind were being challenged and formulated by thinkers such as Darwin, Marx and Freud. Dewey advocated practice and inquiry as being at the centre of human knowing with knowledge and truth being validated in social action.

Given these trends and differing views, what connections and similarities can be seen between modern western science and Indigenous science? [2] The life of those who rely on their interaction with the environment for daily existence demands that decisions are made with a deep understanding of what has gone before and what might occur subsequently. It may be that such understanding is broad such as the gathering storm clouds bringing rain rather than an explanation based on the detailed water cycle, but the understanding offers clear and verifiable outcomes. Small communities living in close connection with the environment need to be able to act autonomously, make decisions within their framework of life, accumulate observations over long periods of time and take note of more experienced community members who have other knowledge passed down throughout time. Learnings are recorded and communicated in and through a literature of ceremony, stories, dance, song and paintings.

From this, it can be seen that Indigenous and non-Indigenous science have similar characteristics, particularly when the different approaches to western science as work in progress are considered. Is it possible however for each to respect and learn from the other? In his work with the Blackfoot people of North America, David Peat (1994) points to some of these problems and issues when he comments:

> When western science claims to be speaking the truth then, by implication, other peoples' truths become myths, legends, superstitions and fairy stories. A dominant society denies the authenticity of other peoples' systems of knowledge and in this way strikes at the very heart of their cultures.

The question being raised here is perhaps not so much one of science but one of racism, an important element of the political paradigm within which science is located. It may be impossible for the dominant cultural group to truly accommodate the views and practices of dominated cultural groups; if this were the case, the ravages of racism would not be as extensive as they are. In fact, racism would be redefined. Structures, procedures and relationships need to be constructed however which move in this direction. Peat goes on to note that we need to 'suspend our prejudices and allow our consciousness to flow along new lines. Clearly it is only in this way that the Elders of both Western and Native American science will be able to learn from each other' (ibid).

Other approaches to the philosophy of science could perhaps offer a way forward, to build greater respect between Indigenous and non-Indigenous views. Feyerabend for example claims that it is not possible to distinguish a scientific method from other forms of inquiry.[3] Science involves the guess, the hunch, trial and error, the mistakes in the same way as baking a cake proceeds. The postmodern and post structuralist views would also question the basic tenets of science in attempting to develop universal laws and norms to govern both the environment and society.[4] Far better to destabilise categories of truth and to study localised situations, than to place emphasis on the traditions and threads of generalised experience that join them together. This approach may appear to fit the Australian context of small groups of Indigenous peoples disconnected from others making their own way in the natural world. It could be argued that such groups will develop their own traditions and narratives, their own language and culture and their own way of understanding the universe. Very few if any such groups exist in Australia today with the last traditional people emerging from the desert in the 1970s. In a globalised world, it is becoming increasingly difficult for separateness, particularly when health, education, material goods and services are required. While the basic nature of western science remains unsettled, the conditions for mutual practices and understandings between cultures remains a distinct possibility.

Indigenous science or ways of knowing do not have to dissect all phenomena into smaller and smaller aspects, but rely more on relationships between phenomena. It is enough to know that there is an escarpment of rock or a stand of trees and how one may have caused or interacts with the other, rather than to understand the exact way in which each is composed. Exactly why western science demands to know the corpuscular, particle, or string theory of matter is unclear, although it may be a response to the dominance of religion for centuries and more latterly, the requirement to exploit the environment for economic benefit. Indigenous peoples in recognising their relationship with the land desire to live in harmony with it and therefore only need to know their tribal connections with the eagle, not the composition of a feather. Materials do not need to be created for transportation, medicines are obtained from the available plants and animals and minimal technologies such as fire, spears and fish traps are required for survival. As mentioned previously, broad theories such as the Dreaming[5] are available to explain origin in a similar manner to Evolution and explanation for the rivers and stars are contained in the literature of ceremony and painting. The theory of 'mother earth' is very similar to the relationship between matter and energy and does not require the detail of atoms and molecules. Under these circumstances, it should be more than feasible to construct a

paradigm of science that is able to bring together the Indigenous and non-Indigenous world views and to learn from each other in an atmosphere of democratic inquiry, integrity and respect.

Indigenous Research

Similar to the concept of western science, the notion of research is subject to definition as well. Habermas proposed that knowledge could be produced from three distinct schema, the empirical/analytical, the hermeneutic//historical and the critical/emancipatory.[6] The first is associated with a positivist approach where truth is considered to be located within the data obtained through measurement of various kinds. The second brings into account human interpretation of observation and leads to more open outcomes. The third places knowledge within a socio-political framework where notions of power and privilege must be confronted. Like science, the field of research is contested and uncertain and with strong differences being seen across and within the human and physical domains. How knowledge is produced and evaluated within both Indigenous and non-Indigenous communities requires therefore ongoing dialogue and investigation.

In his elaboration of a social theory that is 'scientific, critical, practical and non-idealistic all at once', Fay (1987) puts forward the proposal that a complex of interrelated theories is required comprising 'a theory of false consciousness, a theory of crisis, a theory of education and a theory of transformative action'. This is a very comprehensive approach to knowledge production and is very distinct from the mainly empirical and indeed the hermeneutic as well. It requires that participants examine the ways in which their accounts of society do not correlate with the facts of actual events and that a process of questioning and self-understanding is necessary. It must confront and identify social crises as the context within which participants live, work and know. Finally, there should be agreement on how problems and issues can be resolved and taken forward so that better conditions can be created. This may be an ambitious program for a group of researchers or practitioners, but it does show that knowledge and understanding does not emerge from the mere collection of data disconnected from social life. Unfortunately, there appear to be few examples in the literature where education or research is undertaken as described here is executed, let alone resulting in significant organisational and personal change.

Participatory action research offers a way of bringing together the elements of a critical social science in schools and other organizations.[7] Action research itself can be described as having technical, practical or emancipatory outcomes allied with the three approaches to knowledge of Habermas. The work of Carr and Kemmis (1986) and of McTaggart (1991) provides a theoretical background for action research and demonstrates the distinctions between the different approaches very clearly. According to McTaggart, action research with emancipatory intent is considerably more than 'radical critique' in that it:

> extends beyond the interpretation of meanings for participants to an understanding of the social, political and economic conditions which cause and allow meanings to be as they are. The advocates sought not only the transformation of individual

> practitioners and the profession of teaching, but ultimately a transformation of the language, organization and practice of education.

The use of specific terms here is important with presumably a dialectical relationship existing between the changing understanding of researchers as they participate in the research and changes that are occurring around them in their work. An appropriate way of arranging action research projects is in spirals of 'plan, act, observe, reflect' where hopefully many cycles are engaged, the team can reflect on their experience and construct new explanations and interpretations. Many if not most action research projects seem to result in non-emancipatory findings, indicating that either this was not the intention, or that outcomes of this type, that is the 'transformation of individual practitioners', are very difficult to achieve. The research team will need to agree before any research work proceeds and ensure that the methodology allows for transformation and how this might be noted and documented.

On the grounds of this discussion, participatory action research may be suggested as an appropriate way of conducting Indigeno us research. It enables groups of researchers to discuss their world views and perspectives and to locate the project within a context of cultural and community inclusiveness. For example, it will be impossible for any work to proceed if there are undertones of racism or lack of respect. Research findings must clearly be owned by the local community for community interest. Elders can participate as 'critical friends' if they so wish. A difficulty that may be encountered when the group contains both Indigenous and non-Indigenous participants is that some Indigenous knowledge may be considered as sacred and private and not available to the group as a whole. This will often not be known by the non-Indigenous researchers meaning that the project must continue somewhat in ignorance of the complete conditions that actually prevail. An advantage of action research is that it is cyclical rather than linear enabling tentative findings and outcomes to be reinvestigated over time so that misunderstanding is minimised. Issues such as these are taken up by Tuhiwai Smith (1999) when she discusses 'communities of interest' in a Maori context:

> Indigenous communities of interest have formed quite extensive networking and collaborative relationships. They are talking circles of people with similar interests. The community has its own borders and negotiating entry can be every bit as complex as entering a local village. Communities of interest have formed around their own priorities and particularities, they often have their own language or codes, they have their own analysis of self-determination; they may have a strong suspicion of the outsider, some may have formal membership, others may recognise each other through various language and dress codes.

The notion of 'talking circle' meshes nicely with that of 'culture circle' as employed by Freire in his work on literacy. Conceptualising the 'community of interest' also reminds us of the communities of scientists that form within the paradigms proposed by Kuhn as new conditions crystallise. Once again, connections are being drawn between important ideas in the literature of western science and Indigenous structures. Incorporating the idea of 'circle' within a research framework, links with the cultural concepts of healing, equity

and completeness. Smith notes that entry to the circle needs to be negotiated and cannot be assumed or imposed. For western researchers, such negotiation can take a very long time and will not occur until trust has been established. Many Indigenous peoples quite rightly see European research as another form of exploitation and will refuse to join projects when democratic protocols and personal relationships have not been established to the satisfaction of the local community. Indigenous members of cross-cultural groups in any field are very aware that they represent and act in the interests of their community and agreement must be reached by the entire community before work can proceed.

Tuhiwai Smith (ibid, p 185) quotes a summary by Graham Smith that Kaupapa Maori research has the following features:

1. is related to 'being Maori'
2. is connected to Maori philosophy and principles
3. takes for granted the validity and legitimacy of Maori, the importance of Maori language and culture and
4. is concerned with the 'struggle for autonomy over our own cultural well being'.

On this basis and as we have seen earlier, Indigenous research needs to spring from a strong cultural setting so that all practitioners are fully aware of the world view context that will fashion both process and outcome and how these will be congruent with the interests of the community. Critical theory[8] which takes these considerations as its starting point, that is the impact that power and discrimination has on people and knowledge, together with participatory action research again seems the most likely framework for democratic Indigenous research. At this stage, an Australian equivalent to Kaupapa Maori research has not been articulated, although many research projects including ethics procedures would attempt to head in this direction. The Maori situation is somewhat different to Australia in terms of a single language, being a much larger proportion of the population and the Treaty of Waitangi that formally recognises the Indigenous people.

In a recent discussion of what they call the Indigenous Research Reform Agenda, Henry et al (2002) refer to the work of Rigney who suggested the principles of Indigenist research as being resistance as the emancipatory imperative, political integrity and privileging Indigenous voice. They also note the features of cross-disciplinary, collaborative and participatory and reflexive methodologies and while supporting this position, alert us to the dangers of such approaches in that:

> These forms of research methodologies are always activated within institutional contexts and their attendant political and ideological underpinnings. Without a critical awareness of the framing of 'research-in-practice' by the deep messages emanating from the institutional context of the research projects, the liberating potential of the adopted research methodologies may be diminished as the 'research-in-practice' defaults to the desires of the most powerful.

Realistic procedures that make 'defaulting to the desires of the most powerful' less than inevitable need to be put in place so that the principles of resistance, integrity and voice can form the basis of Indigenous research. These principles will need to be more clearly defined and be set alongside others that place control of process and ownership of outcomes firmly in Indigenous hands, or at least, in collaborative hands for community benefit. From this perspective, Indigenous research still needs to proceed through numerous practice/theory cycles before a general protocol becomes apparent.

Indigenous Education

How do we take account of Indigenous culture, history, science and research as discussed above when turning our attention to the construction of a formal education system in Australia? Table 1 below shows a brief summary of such issues and some possible implications for education.

The broad areas of culture, history and knowledge in both Indigenous and non-Indigenous societies appear to involve generalities and particularities that are in a state of flux. Both involve reference points that are passed on from generation to generation which can remain the same, or be subject to contemporary pressure as social conditions alter. Both however include laws, customs and traditions that are held as sacred and constitute identity for the group as this change takes place. The British sociologist Anthony Giddens (1999) in commenting on the process of globalisation suggests that it is very difficult to discern the features of what he calls 'a global cosmopolitan society' but:

> It is shaking up our existing ways of life, no matter where we happen to be. This is not – at least at the moment – a global order driven by collective human will. Instead it is emerging in an anarchic, haphazard, fashion, carried along by a mixture of influence. It is not settled or secure, but fraught with anxieties, as well as scarred by deep divisions.

If the Giddens' analysis is correct, then culture and knowledge will not remain the same, although it may be that for some communities, buffer zones will exist or will be created to limit the impact. For this to happen, a strong and independent cultural base will be required, perhaps a cultural base that is more distinctive than similar to major social and political pressure that exists world wide. This raises another central aspect of culture, the capacity to be both stable and adaptive at the same time, to recognise what is essential for maintenance, but what can also contribute and cause positive change in the interests of the group. A strong framework of language, ceremony, artefacts, customs and values will be able to withstand attack from without and accept the challenge of reconfiguration as new realities dawn.

The school curriculum in Australia will also need to change as the continuing process of globalisation and the establishment of new world orders work themselves out. In this regard, the time is propitious for a new curriculum structure that incorporates principles of community, uncertainty, autonomy, respect and participation. The community schools of the past in Victoria and many primary schools would already argue that these feature

Table 1. Issues impacting on Indigenous education

	Features	**Themes**
Indigenous Culture	Arts, social systems, habits, customs Religion, spirituality Dreaming, Evolution Land and totems	Values and artefacts Ideas and experience Culture and knowledge
Indigenous History	Time of arrival, creation Land owners, stewards Stolen children Interpretation of history eg frontier wars, massacres Black and white culture Dispossession of land Autonomy and self-determination Separatism Science and technology	Respect for Indigenous culture, history, land Cultural hegemony Autonomy, co-operation
Indigenous Science	Trends to be defined Different approaches Cultural dominance Postmodern view of science	Science as narrative Field and methods to be defined Connection between Indigenous, non-Indigenous
Indigenous Research	Trends to be defined Different approaches Emphasis on participation Communities of interest Research in cultural settings	Being participatory, critical, cross-cultural, participatory, reflexive Research as power
	Key Features	**Key Themes**
	Thinking, practices still being defined, interpreted Cross-cultural work possible Connections between Indigenous, non-Indigenous Cultural dominance, contest Links between culture, history, science, research, knowledge.	Areas of uncertainty Change and dynamism Autonomy and respect Issues of participation, community Dominance and resistance
Indigenous Education	Schools part of system of cultural hegemony, but provide avenues for cultural work, discourse, contest in interests of all peoples.	Incorporate into curriculum principles of: Community, uncertainty, change, autonomy, respect, participation.

in their daily forms of organization. The weighty presence of public examination systems in the senior secondary years however makes them unlikely. As well, the conservative ideology of school education in general where intense power relationships exist between school and community, teacher and student and student and knowledge determines that the possibility for radical systemic change is slim. What is striking about table 1 however is that it reveals principles that are well in line with pragmatic philosophy and the theoretical framework of inquiry learning that has been advanced and acted upon for many years in large numbers of Australian schools. This means that proposals for a restructured curriculum for all schools will potentially benefit both Indigenous and non-Indigenous students across the country.

Looking through Bourdieuian eyes

Pierre Bourdieu[9] was a French sociologist who came to prominence with the publication of his work on cultural reproduction in education and society at large. Bourdieu spoke very powerfully about the place of schools as structures that impose meanings through somewhat invisible power relations and by so doing, contributes to a strengthening of its own power relations. Schools and universities therefore promote the continuance of both disadvantage and advantage. The intensity of reproduction theory was taken up by others (Bowles and Gintis, 2002), but in such a way that the approach was criticised as being reductionist to the point where all of human activity is dominated by the economic. This criticism may have prompted Bourdieu to consider a broader and more nuanced social analysis resulting in the concepts of habitus and field, the former being constituted by the dispositions and values that underpin social action and the latter, those areas of action that embody social life such as the cultural, economic, educational. The habitus and field involve not only a consideration of each, but the interaction between each and the sites of intersection between various fields themselves. Thus, social life is not reduced to the economic alone, but recognises a complex web of factors. Bourdieu then comes from a structuralist origin, but his later work has provided a theoretical frame for a more differentiated analysis.

Table 2 below shows a preliminary analysis of the habitus and field as may apply to science in schools. Suggested elements or values of the habitus are indicated together with the implications that accrue for science as a field. For example, if racism is embedded in the mind, then means of combating such tendencies can involve a change to the structures and procedures that govern the workplace. A number of the specific elements of science are then positioned and the implications that flow for the design of science as a school subject. As a contested area of knowledge, school science should not promote the view that current ideas and theories are inviolate, but change as new data becomes available and new points of explanation are reasoned. The significance of table 2 is the relationship depicted between habitus and field and the impact that one has on the other. A strengthening of culture and the development of mutual respect will come about not so much by the identification of specific areas of knowledge each of which can be valued to different extents, but by an equality of knowledge and of epistemology. This enables learning to proceed through a drawing upon the community understandings and

experience of different cultures for new strategies into the future. Ultimately, such practices will have the potential to change elements of the habitus and therefore to bring into being people of a more enlightened and self-reflective character, people who 'do their own thinking' rather than rely on false authority, bias and prejudice.

Table 2. Bourdieuian analysis of school science

1a. Habitus	**1b. Implications for science as field**
Racism	Change structure, procedure, policy, practice to combat tendencies of fear, power, discrimination, status of knowledge.
Culture	Strengthen cultures and interaction between cultures.
Political and educational hegemony	Support democratic investigation and independent thinking.
Ideology	Encourage radical and transformative action.
Spirituality and land; epistemology	Dialogue of consciousness, mind, learning, culture, action.
2a. Field	**2b. Implications for science as school subject**
Science vs humanities	Science as legitimate subject with principles, techniques, content that connect with humanities.
Site of contestation	Knowledge viewed as uncertain.
Practice/theory and inquiry for production, evaluation of knowledge	Cycles of investigation for reflection on practice and trustworthiness; combination of local and general concepts.
Ideological and material resources	Access to an equality of knowledge, processes and equipment.
School curriculum	Integrated and specialist themes, content.
Connection with daily life	Community participation and description of stories, experiences, explanations.

This approach of Bourdieu provides a mechanism for isolating the specific aspects that constitute human endeavour, of displaying the relationship between them and of opening up possibility for change in quite fundamental ways. An epistemological template for school science crystalises from a consideration of the implications of habitus and field when taken together. The analysis sits comfortably within a Deweyan framework of pragmatic philosophy where truth, knowledge and spirituality emerge from action and which enables the conceptualisation of learning for all children from different cultural backgrounds within a regular curriculum.

Pragmatic curriculum and science for all

What is the current situation of Indigenous education in Australia? This is a difficult question, given that a majority of Indigenous people live down the east coast of Australia with their children attending regular schools, while a minority live in regional and remote communities. As Giddens would argue, even the latter are subject to globalisation and do not necessarily live in a more traditional world. In broad terms then it is possible to say that most Indigenous children have access to primary schools which focus on immersion in European language and culture. Indigenous families see literacy as being a democratic right providing access to white knowledge and opportunity. Retention rates in secondary schools are much lower than for non-Indigenous students, with many Indigenous students dropping out at the Year 9/10 level. This may be ultimately due to the culture clash that exists within the curriculum itself and within schools generally, which cannot be tolerated any longer by age fifteen. The Australian Government (2002) is conscious of such issues and supports 'a growing partnership between Indigenous parents, Indigenous students and schools to improve student participation and to promote more successful teaching methods'. To this end in 2002/03 'the Government has allocated $445 million to tackle Indigenous educational disadvantage'. All education must have an appropriate resource base to achieve quality outcomes, but the ideology of teaching and learning that does not depend on resources is equally important.

Such an equitable and inclusive education system for all Australian children will depend on alliance rather than compliance. It will be extremely difficult to achieve. For example, the children and community at Papunya (2001) in Central Australia begin their wonderful book with the stirring words:

> At Papunya School, *ngurra* – country – is at the centre of our learning. It is part of everything that we need to know. We learn about our history and our country from our elders and our community. We learn by going to our country, by living there and being there. We learn through the *tjukurrpa yara* – the Dreaming stories. We learn through the different songs and dances and paintings that belong to different *ngurra*. But as well as learning in this traditional way, we can also find out about our country and our history by putting some of the pieces of the story into a book. That's two-way learning, *Anangu* way and western way.

This could well be the opening paragraph of a charter or mission statement for many schools. John Dewey would be very happy. It places learning at the centre of schooling, identifies the site of knowledge and the sources of tradition and understanding, it nominates a literature and it recognises that others have something to offer. This description of school organization surely applies to the vast majority of primary schools in Australia. The difficulty arises when schools attempt to understand the significance of such a direction and how to implement it within a European culture on a daily basis. Prospects for having such an approach underpin the senior secondary years are very limited indeed. What can take place is the adaptation of these ideas to a greater or lesser

extent within a formal context of regulation and accountability as some curriculum guides and support materials demonstrate (Education Victoria, 1998).

For more remote and smaller Indigenous schools, it could be expected that outcomes would be much better than what they are and that the guidance offered from Papunya would be possible. These schools are located within their own country and have access to the land every day of the week. It seems appropriate under these conditions that a curriculum could be constructed around the culture, history and land of the local people and that a two-way approach could begin with an Indigenous emphasis. The bringing together of different cultures in this way, as in the *ganma* view of the Yolngu people of Arnhem Land (see Watson and Chambers, 1989), is an attempt at so doing and to avoid western domination. It may be however that a number of impediments prevent this from happening including the control of local schools, pressures on the curriculum from state authorities, the provision of appropriate staff and resources and the social conditions that exist within the community. For schools in regional and urban centres and particularly those with a very small minority of Indigenous children, other organisational problems exist. Of course, problems can be mediated if the curriculum as a whole is to be restructured for all children, rather than attempting to accommodate some within a rigid framework that has been established for the many.

A distinction can be made between 'teaching about' and 'learning with' Indigenous communities. The usual approach of Aboriginal Studies in schools has been the former often defined in terms similar to 'The study of Aboriginal societies or Torres Strait Islander studies past and present, including histories, cultures, values, beliefs, languages, lifestyles and roles, both prior to and following invasion' (Craven, 1999). While conducted with complete respect, this approach can be the mere transfer of information as in any other subject and not necessarily lead to a depth of understanding. It also seems somewhat strange that Indigenous families would see the 'teaching about' direction as being significant given that cultural education is a community rather than institutional responsibility; knowledge that is sacred and in the private domain is also not the preserve of the school. What would seem more appropriate for all students is the development of Indigenous perspectives across the curriculum and an approach towards teaching and learning that supports Indigenous epistemology. A framework of 'learning with' enables students, teachers and communities to work together on important questions and issues and in their resolution, the development of mutual understanding. Education is serious business that should be of practical use to participants in a variety of ways and not be trivialised by passive information transfer. Serious issues being confronted by serious people for serious outcomes should character all classrooms.

A detailed curriculum proposal of this type and intended to work in the interests of all children has been advocated by Hooley (2002). Two-way enquiry learning expands the notion of two-way learning by including the inquiry learning ideas of Dewey. In this way, an actual process for the generation of new knowledge and understanding by children is outlined, rather than schools remaining content with an appreciation of different cultures only. That is, the entire purpose of cross-cultural settings in schools is for groups of people to come together to not only understand different perspectives, histories and

biographies, but to create new ways of confronting changing circumstances and difficult situations, new knowledge emerges from the old which both strengthens and develops each. Two-way enquiry learning is similar to a bridge that links different sides of a landscape. A bridge must be designed and built somewhere for a specific purpose, from time to time it must be maintained and it enables a crossing over of erstwhile barriers and borders that were impenetrable before. More than that, for the bridge to be successfully anchored at either end, there must be a detailed understanding of the complete terrain. Two-way enquiry learning suggests that the notions of Dewey regarding integrated knowledge, negotiated projects, unities of practice and theory across all studies and systematic inquiry as the determinant of knowledge and trustworthiness should characterise the curriculum at all year levels and is the epistemological mechanism for inclusive and equitable learning.

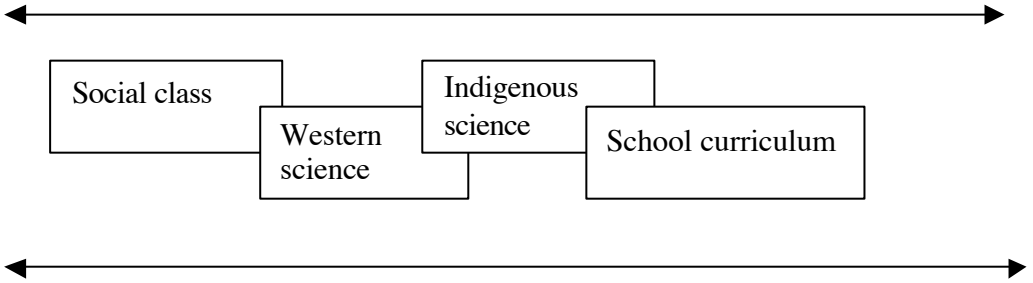
More recently some curriculum detail has been added to the outline of two-way enquiry learning (see Hooley, 2003a, 2003b). It has been suggested that Dewey's pragmatism can be applied across the curriculum through a structure of four integrated studies of arts, humanities, sciences and technologies with negotiated projects of student interest and democratic assessment procedures. Multi-media library resource centres and integrated technology centres will be required for all schools to ensure experimentation with all knowledge forms. Of particular concern is the area of mathematics, given the usually conservative approaches to teaching and learning followed by many schools. There is a need here to move beyond activity to systematic reflection on practice as students construct their own interpretations and meanings. School mathematics is often treated procedurally rather than experientially with predetermined algorithms being seen as the substance of learning. Progress in the pragmatic reconceptualizing of mathematics will need to occur if the curriculum is to be inclusive of both Indigenous and non-Indigenous children.

In writing on what he calls an 'Indigenous Standpoint Theory', Foley (2002) draws upon the work of Rigney as well and the Aboriginal philosophy of Errol West in Australia and of Indigenous Hawaiin epistemologies. The result is a mutual relationship between the physical, human and sacred worlds and an acceptance that the practitioner must be Indigenous and familiar with the broad range of social theory, that the research must be conducted in the interests of the Indigenous community and that traditional languages should be the first language for the research whenever possible. Again, a distinction needs to be made here between research conducted within Indigenous communities and that conducted within non-Indigenous contexts. An 'Indigenous standpoint' will need to form the foundation of an approach for adoption within non-Indigenous fields so that recognition and respect of both cultures and process can be established with joint learning occurring as the outcome. This problem is at the heart of understanding reconciliation generally and of reforming the curriculum of regular schools.

Is it feasible to reach settlement on a curriculum for all children in all schools which encompasses inter alia the principles, ideas and practices of Dewey and of Tuhiwai Smith, Rigney, Henry and colleagues and Hooley above? This is a daunting task, but the theoretical underpinnings and considerable practical experience are on offer. A major

longitudinal curriculum reform program across Australia embracing smaller and larger schools could be undertaken with the Papunya statement as a starting point. If the key themes indicated in table 1 are reasonably accurate, then practical and realistic proposals for curriculum change based on them, will need to be developed for primary and secondary schools. This approach moves us past a concentration on one subject only such as social studies/SOSE and an emphasis on a minority of children from Indigenous families. It is a democratic right of all children to attend state schools and to experience learning that is challenging, stimulating and life defining. The curriculum must be equitable for all, not divided into different streams for some.

The connections shown above between Indigenous and non-Indigenous culture, history, science and research show that their uncertain character and relationship provides fertile ground for inclusive educational and epistemological development. This is to be preferred to many current arrangements that rest on a facile compartmentalism and an assumed knowledge separatism. Rather, science can be seen as a grand social and epistemological narrative that extends across Indigenous and non-Indigenous experience which must then be taken into account when considering the design of school curriculum. Such an interlocking of socio-cultural elements can tentatively be shown as below:



Specifically, the commonality between these elements involve autonomous action; a utilisation of practice and theory through cycles of observation, interpretation, reflection and dialogue; the incorporation of culture and literature in various forms; advice from respected colleagues such as elders and critical friends; independent decision-making for both survival and meaning; a recognition of the importance of knowledge, tradition and identity; broad frameworks and reference points that provide the context for human activity; respect for community and the sharing of outcomes for the public good. This connection can be theorised or generalised into 'science as narrative' to guide further research and to investigate whether narrative can be local and grand. Significantly, it locates the study within the debate between Habermas and Popper on the nature of science, that is whether western science is inherently instrumental, technical rational and therefore oppressive, or communicative and moral serving human interest. In this way, local and personal experience can be linked with some of the great ideas of humanity. It also suggests that a school curriculum can realistically be designed to incorporate principles that support both Indigenous and non-Indigenous ways of knowing based on democratic processes of inquiry.

Notes

1. For an earlier discussion of the philosophy of science, see Thomas Kuhn's *The Essential Tension: Selected Studies in Scientific Tradition and Change,* University of Chicago Press, 1972 and a more recent biography, *Thomas Kuhn,* by T. Nickles (Ed), Cambridge University Press, 2003.
2. The term 'Indigenous science' is not widely used in Australia, although it does have reference in the literature. The web site of Michael Michie contains many appropriate references (http://www.ozemail.com.au/~mmichie/bushtucker.html).
3. Feyerabend's approach to science and method is sometimes thought to be radical and even anarchic. A discussion of such matters can be found in *The worst enemy of science?: essays in memory of Paul Feyerabend,* by Preston, Munevar and Lamd (Eds), Oxford University Press, 2000.
4. Concepts such as postmodern and poststructuralism can be difficult to pin down, particularly in regard to practical application. A useful sweep of the field can be accessed in *Social Theory and Modernity,* Polity Press, 1999, by Nigel Dodd,
5. The *Dreaming* is a European expression to cover Indigenous explanation regarding human creation, formation of the earth and relationship with the land and between species. Different Indigenous words are used in different parts of Australia for this purpose.
6. The range of Habermas's work provides a progressive framework for social theory, but his Theory of Communicative Action can be criticised on idealistic grounds. John Dryzer's chapter headed Critical theory as a research program, in *The Cambridge Companion to Habermas*, Cambridge University Press, 1995, combines a general introductory discussion of Habermas's approach to knowledge and of critical theory.
7. A comprehensive outline of different approaches and contemporary debates concerning action research can be found in *The Action Research Handbook,* Reason and Bradbury (Eds), Sage Publications, 2000.
8. *The Handbook of Critical Theory,* Blackwell Publishers, 1996 and edited by David Rasmussen provides a detailed outline of the main aspects of critical theory together with a useful bibliography.
9. A critique of some aspects of Bourdieu's work relevant to this discussion has been compiled by Kingston, P. W. (2001) The Unfulfilled Promise of Cultural Capital Theory, *Sociology of Education Extra Issue*, pp 88-99. Useful references are included.

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