Innovation Chains:
Possibilities and constraints for critical perspectives on computers, difference and quality educational innovation.

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Abstract

While declarations of 'innovativeness' are easily found in most educational contexts, it is significantly more difficult to locate detailed definitions of what educational innovation actually means. In this paper we are interested in identifying the extent to which mainstream takes on 'innovation' (as played out in contemporary technology and equity debates) reflect or respond to what we will define as the more innovative dimensions of innovation literature itself.

Our aim throughout this paper, then, is to begin the complex process of developing a means for distinguishing between projects that are 'badged' as innovative and projects that are more demonstrably (and sustainably) innovative. In this process we will distinguish between what Shiv Visvanathn describes as "innovation chains"—dynamic, rhizomatic, transformative responses to the contemporary world that lead to fundamentally new ways of conceptualising technology, culture and difference—and the constraints—or chains—provided by dominant understandings of innovation: chains which anchor us to existing, hegemonic and limiting understandings of student diversity and educational technology.

Introduction

In the contemporary education landscape, much is made of the importance of so-called 'innovative' practices. Schools and universities are consistently challenged to demonstrate both the innovativeness of their activities and the ways in which they are 'producing' students with innovative potential. This emphasis reflects not only marketing philosophies which read claims of innovation as a useful device for capturing consumer interest, but also a broad policy environment for Australian education within which the capacity to 'innovate' is increasingly presented as "one of the key capabilities of the knowledge economy" (Committee for the Review of Teaching and Teacher Education, 2003: 11).

In this context it is hardly surprising that the innovation has become very much a part of every day educational discourse. But while declarations of innovativeness are easily found in most educational contexts, we are interested in this paper with the ways in which innovation is understood within two fields of enquiry: first, within debates focused on educational technologies and computers; and second: within explorations of uneven/inequitable student outcomes. More specifically, we are interested in identifying the extent to which mainstream takes on 'innovation' (as played out in contemporary technology and equity debates) reflect or respond to what we would see as the more innovative dimensions of innovation literature itself.

Our aim throughout this paper, then, is to begin the complex process of developing a means for distinguishing between projects that are 'badged' as innovative and projects that are more demonstrably (and sustainably) innovative. In this process we will distinguish between what Shiv Visvanathn (2001) describes as "innovation chains"—dynamic, rhizomatic, *transformative* responses to the contemporary world that lead to fundamentally new ways of conceptualising technology, culture and difference—and the constraints—or chains—provided by dominant understandings of innovation: chains which anchor us to existing, hegemonic and limiting understandings of student diversity and educational technology.[1]

Introduction

Put simply, this paper is focused on innovation: what it is, what it is not, how we can tell the difference, and who 'wins' or 'loses' within various innovation discourses. More specifically, it aims to open up debate about the ways in which 'innovation' is being understood and evaluated both *within* two key 'sites' of contemporary education reform—reforms based on educational technology, and reforms focused on student diversity—and at the *intersections* between these sites. We are particularly interested in the ways in which technologically based educational innovations (whether they focus explicitly, implicitly or not at all on improving learning opportunities for diverse cohorts of students) can be read in terms of either the innovation chains they generate (and the transformative potential they engage) or the "chains of innovation" they are constrained by and the limiting practices that result.

Making distinctions between 'real'/'good' innovation and 'fake'/'bad' innovation is a difficult task and attempts to do so clearly run the risk of appearing prescriptive, elitist, judgemental or essentialist. These risks have in many ways constrained our previous work in this area, as we have struggled to develop a language for talking about well intentioned educational reforms that do not, in our analysis, have truly innovative potential. In more recent years we have come to the point where the risks of not speaking about the topic appear to outweigh the risks of doing so. During this time the criteria against which the innovativeness (for educational contexts) of an idea/project/performance can be read appears has become, to us, increasingly self-evident: will it improve the educational experiences of a diverse student group.

It is, of course, possible to express this relatively simple criteria in more sophisticated terms. Specifically, we are interested in distinguishing between practices that work to contest mainstream understandings of technology's relationships with cultural diversity (and thus to address the experiences of educational discrimination) and those that don't. In making this distinction we are influenced by the work of theorists such as Gilles Deleuze and Felix Guattari who argue that in cultural analysis it is possible to differentiate between processes associated with the production of *molar* structures—that is, those tied to the production of a majority politics where certain values are coded as natural and normal and against which 'other' interests are produced as subordinate—and *molecular* structures—those that work to disrupt the appearance of unity and seek, instead, to demonstrate change, difference and fluidity (Deleuze & Guattari, 1987). Although we will not focus exclusively on the framings provided by Deleuze and Guattari, as an opening move, and to locate the kind of perspective that

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informs the rest of the paper, it is useful to make the point that throughout the paper we read 'genuine' innovative practices as molecular and more problematic *claims* to innovation as molar.

While our individual journeys to this point have been complex, the resultant rationale is quite simple. Contemporary literature demonstrates clearly the fact that despite years of educational reforms, students continue to experience education in demonstrably uneven and inequitable ways (Collins et al., 2000; Teese & Polesel, 2003; Vinson, 2004). Some groups of students remain more likely than others to enjoy/engage with/benefit from their schooling experiences, and the post-school opportunities for members of particular groups and individuals are markedly different. So while it is possible to trace all manner of educational innovations designed to respond to changes in the real world, and while it is similarly easy to identify a plethora of activities that take up the challenge of responding to the technologised dimensions of this 'real' world, these reforms have apparently done little to address serious, persistent, *consequential* social patterns including (but not limited to) sexism, racism, homophobia and poverty. Indeed, in many cases it is possible to argue that school based uses of technology actually work to *perpetuate* patterns of discrimination and inequity. And yet technologically mediated innovations consume vast amounts of educational resources (including the time, energy, 'good will' and *hope* of teachers, students and family members).

Our frustration with this situation is compounded by our increasing awareness that while we (the authors) are each interested in technologically mediated innovations *and* responding to student/cultural diversity, in a great many educational contexts we are regularly asked (individually) to speak to only *one* of these agendas. One of us is brought on board to speak about technology, and the other to talk about cultural diversity: these conversations usually happen in discrete locations that intersect rarely if at all.

This separation is reflected, of course, in the literature and conference circuits associated with educational technologies and education and equity. While both domains contain interesting, insightful and motivating articles (and while clearly there has been some excellent work focused on the relationships between technology and equity), there is, nevertheless, an absence of sustained conversations *across* the fields. This is not to say that there are not instances where the literature is brought together, but it is still quite rare to find reports of educational innovations that interweave the more radical aspects of these two fields. The end result can be the perpetuation of cycles of innovation which re-trace safe and familiar patterns around the use and integration of technology in education and which ultimately do little to *transform* the educational experience that results (Comber & Green, 1999; Snyder et al., 2002).

To move beyond this situation, it is necessary for us to build upon our initial declaration of the 'line in the sand' for determining what is innovative and what is not—that is: will it improve the educational experiences of a diverse student group—and to identify the sort of work that needs to be done before this kind of evaluative criteria is likely to become in anyway mainstreamed. It is this work that occupies us in the rest of this paper. In part one we will identify common ways in which innovation is understood and the relationship between these understandings and debates about educational technology, and educational equity. Our primary goal in this

section is to identify the limitations of these molar frameworks and the things they are almost literally unable to say. In part two we will develop some alternative (molecular) perspectives/frameworks for thinking about innovation in relation to technology and equity. And in part three we will illustrate the respective strengths and weakness of the mainstream and alternative perspectives through brief readings of a number of educational innovations.

Part One: (Innovation) chains that bind us

In this section our goal is to examine common ways in which innovation is understood with regard to both educational technology and educational equity. In examining these common explanations we will draw upon the distinction made in the introduction to this paper between the molecular and the molar, with particular attention to the ways in which the 'logic' used to claim 'innovation' reflects mainstream/traditional/dominant/existing social practices. More specifically, we are interested in identifying the extent to which mainstream interpretations (or invocations) of innovation make explicit, contest, or in anyway move beyond the kinds of cultural norms that routinely position certain individuals in marginal relationships with Australian society generally and educational practices more specifically. While there is insufficient space here to explore the diverse ways in which this marginality is produced, naturalised and policed (and this work has, of course, been done well and persuasively in many other texts) the key point to make at the beginning is that we are looking at the capacity of dominant takes on innovation to either recognise or respond productively to the experience of marginality. The themes identified below are not intended to be exhaustive nor to reflect all dimensions of educational technology literature. What we are aiming to do, instead, is show how understandings of innovation can work to focus on issues quite different to those explored in considerations that foreground issues of student diversity.

<u>Common criteria for measuring innovation</u>

Innovation as 'newness'

Innovation is clearly a vogue term in education and elsewhere. Taken broadly, the word innovate means to do things in a new way. This understanding has led to all manner of 'new' educational practices being branded as innovative. Within many educational debates, the addition of 'new' materials or the development of a 'new' framework (new basics, essential learnings etc etc) is read, *ipso facto*, as innovation. While we are not suggesting that new things *aren't* or can't *be* innovative, within this particular discourse innovation is linked to the apparent recency of a product, rather than the 'newness' of its underlying politics. This is further complicated by the fact that in many contexts, the motivation of most innovative moves is to improve or enhance an existing practice or set of circumstances. Because of the tight association of innovation with *aiming* to improve, the term often becomes synonymous with improvement, or more generally something that is good, and thus doubly difficult to contest.

The clear problem here is that there is no guarantee that 'newness' is necessarily a good thing! While consumer cultures tend to celebrate the new over the existing or the old or the second hand, the 'quality' of the resultant product is often not sufficiently analysed. To take a simplistic example, Australia's response to 'illegal immigrants' and the resultant Pacific Solution was certainly new. The extent to which it was

innovative—i.e. anything other than a new form of discrimination against groups and individuals who have long been accorded marginal status in Australian society—is clearly more questionable.

Innovation as re-mediation

It is common to see the label 'innovation' given to any move that involves presenting an existing set of material in or through a different medium. In this logic it is innovative to put teaching materials online or on videotape or CD ROM. Questions concerning the content, the pedagogy, the relationship between the material and cultural diversity are therefore rarely addressed.

A related dimension of this approach sees innovation as the use of 'new' technologies to complete 'old' kinds of tasks. So using powerpoint to transmit existing lecture content, or asking students to use the columns feature of word processing software to produce 'authentic' newspaper articles are examples where the re-mediation (or perhaps the re-presentation) of ideas through a new technology is seen as innovative. Once again, the effects of this use upon diverse students (who uses it, who does not for instance) are generally obscured. So, too, are critical analysis of the *content* and how it speaks to cultural difference: who is included, who is excluded, who is valued, who is devalued, who is represented as natural/normal, who is produced as other…)

Innovation as technology

A third and extremely common dimension of innovation discourses sees innovation and technology (old or new) as inextricably linked. In this framework technology is seen as fundamentally innovative, and the use of educational technology as evidence of innovative teaching. Let us give a simple example. One of us has recently sat in on some discussions about a new course being developed for an Australian university. During discussions about the content of various subjects within the course, two comments were made: the first was that a subject titled something similar to 'innovative practice' would "obviously be focused on on-line teaching". An interesting dimension of this literature is that innovation via technology is seen as *so* good, that few questions need to be asked about the specific practices the technology supports. At the same discussion where innovative practice was seen to be unproblematically linked to on-line teaching (a practice which is not, in itself, anything like 'new') another person suggested that there would be no need for a focus on dealing with difference, as that was, after all, "just good teaching". In these comments, on-line teaching is automatically accorded the status of innovative, and innovation is assumed to be good. This innovative teaching, by extension, would automatically attend to the needs of all students (regardless of their specific backgrounds) because this is, as previously noted, what good teaching does and innovations are, in this logic, good. The flaws here are obvious. Clearly technologies can be involved in either positive or negative processes. Computers are not immune to sexist, racists or homophobic discourses. They do not automatically repel harassing or violent texts. They do not, in short, guarantee that a 'new' experience involving technologies, will be any different to an 'old' experience that did not.

Innovation as commerce

The Australian federal government's statement on innovation—Backing Australia's Ability, defines innovation as "the process by which new ideas are transformed, through economic activity, into sustainable, value creating outcomes—into tradeable products, processes and services". (cited in Committee for the Review of Teaching and Teacher Education, 2003: 3).

A related perspective is expressed by Australia's "Chief Scientist" Dr Robin Batterham who states that "innovation is the process that translates knowledge into economic growth." He goes on "innovation is much more than invention or R&D. it encompasses all activities encouraging the commercialisation and utilisation of new technologies—scientific, technological, organisational, financial and business". (Committee for the Review of Teaching and Teacher Education, 2003: 3).

It is difficult to be anything other than cynical about these kinds of definitions, both of which see commercial activity (in one form or another) as the key criteria for measuring innovation. These kinds of frameworks make it extremely difficult for educators to draw attention to processes and practices which may offer little in the way of immediate 'products' but which work to develop new/transformative/truly innovative ways of thinking about cultural diversity. It is far more likely that these definitions will produce educational programs designed to produce the kind of 'good citizens' most likely to perform the roles assigned to them by conservative, patriarchal governments.

Innovation as pretence

We have argued elsewhere (Bigum, 2004) that one of the most common ways in which schooling systems deal with technological developments in the real world is through the use of 'pretend' technological tasks which involve students in the use of technologies to produce 'fridge door' assignments: projects that may involve the use of a word processor, or a digital camera, but whose primary goal is to produce schooled versions of 'real world' technological practices. Such practices are little more than hi tech busy work where what matters is that students make some use (any use!) of what has been a very expensive investment by schools over more than twenty years. Once again, the detail about who does this work, how it connects with the 'real' real worlds of students, what messages students receive about their status/value/ability are obscured. To give one specific example, one child, asked to do a report on one of her 'favourite things' produced a home made iMovie focused on WWE Wrestling. The teacher never watched the tape and made no attempt to recognise the significance of the fact that a young girl, never particularly confident with technologies, or oral presentations, found a way to learn skills in this new area and apply them in the presentation. For him, the work was done and satisfactory just because it had a physical presence.

Innovation as response to crisis

This particular take on innovation is particular common in equity debates. The cycle goes something like this. Government/department/lobby group/individual identifies the existence of an 'at risk' group or individual. Policies and resource are directed at this group. The resultant activities can be clearly labelled as interventions, and are generally read as some kind of evidence that a problem has been solved. It is this kind

of perspective that produces what have been identified as liberal or equal opportunity approaches to educational reforms around social justice. Official barriers are removed, opportunities are created for groups/individuals to 'reach their full potential', emphasis is placed upon the importance of all individuals being able to make an active contribution to their society. In this framework, individuals often find themselves doubly betrayed: first by an education system that has routinely devalued their lives, experiences and needs, and second by the very innovations ostensibly designed to meet their 'specific needs'. This phenomenon has been experienced by girls, by indigenous students, by ethnic and migrant children, by kids with disabilities and by students from low socio-economic backgrounds (to name just a few of the most 'at risk' categories of students) who find themselves confronted with 'innovations' that work ultimately to reinscribe their otherness, by representing their differences in simplistic, tokenistic, stereotypical and uni-dimensional ways.

The most recent example of this kind of innovation-through-crisis is found in debates about the best ways to engage 'failing' boys with schooling. Emphasis is placed upon the importance of providing boys with opportunities to reconnect with their essential masculinity, and to make use of 'male' learning styles/resources and activities. Completely missing in many of these debates is any understanding of the diversity associated with the category 'boy' and an appreciation of the ways in which simple invocations of 'the real boy' may work to further marginalise boys who do not fit this stereotype. But the lure of these crisis managed innovations is clearly powerful. No one really wants to hear that changing cultural problems takes many, many years. For many people an off the shelf, persuasive and logically presented solution has far greater appeal. It is very hard, in fact, to translate the language of post-structuralism that underpin many critiques of simplistic responses to difference into newspaper headlines or appealing sound bites. And so innovations in these fields are usually defined by the easily digestible solution.

<u>What can't be said in the constraints of these innovation chains</u>

While this brief overview of common ways in which the term innovation is employed is not intended to be exhaustive, it certainly can be *exhausting* when one identifies the consistency within which the radical potential of innovation is continually brought back into debates that are centred on economic efficiency, techno-fantasies, or narrow representations of learners. In these frameworks, it is extremely difficult to draw attention to either the multiple and complex 'nature' of technology, or the ways in which economics (and technologies) are also complicit in the production of *negative social effects.* These relate not only to the obvious financial consequences experienced by so many people as a result of global approaches to trade and industry, but also to some of the more social effects associated with the on-going production of cultural diversity in opposition to euro-centric norms.

Particularly invisible is any consideration of the fact that any innovation may be experienced, performed, responded to *differently by diverse student groups.* This silence reflects an ongoing and increasingly sophisticated positioning of 'difference' as a category to be managed in one of two main ways: through demonisation or consumption. Demonisation is a common strategy. At precisely the same historical period when concepts of difference, heterogeneity and multiplicity are prominent in critical discourse, mainstream media, political and popular culture, these same texts

are just as likely to insist upon the desirability of sameness, homogeneity and consistency.

Let us give a simple example: Australia has worked for twenty odd years to present itself to an international market place as a land of cultural diversity and tolerance. In recent times, this same diverse and tolerant society has embraced particular cultural fictions that work to vilify and demonise particular groups of people. Indigenous Australians, homosexual Australians and, most recently, migrants and refugees have been portrayed in ways that position 'them' in opposition to 'us'. This positioning has worked to suggest that the real, fair-minded Australian who works hard for a living and waits their turn patiently in queues (and in life) should be rightfully intolerant of those who seek to circumvent the aussie commitment to a 'fair go' by taking handouts, looking for charity, leading unnatural or flamboyant lifestyles, or trying to enter the country through anything other than 'official' means.

In this process, both new and old technologies (and associated media products) are manipulated by governance technologies to try and preserve the fiction of a worthy 'us' protecting our country from the problematic of 'them'. The politics of this process are captured well by Appadurai when he reminds us that "minority groups" (and outsiders) "do not come preformed. They are produced in the specific circumstances of every nation and every nationalism" (Appadurai, 2001: 5). He goes on:

> They are often the carriers of the unwanted memories of the acts of violence that produced existing states, of forced conscription or of violent extrusion as new states were formed. And, in addition, as weak claimants on state entitlements or drains on the resources of highly contested national resources, they are also reminders of the failures of various state projects (socialist, developmentalist and capitalist). They are marks of failure and coercion. They are embarrassments to any state-sponsored image of national purity and state fairness. They are thus scape goats in the classical sense. (Appadurai, 2001: 6)

From this point of view it is hardly surprising that Australia—like many other countries—has periodically demonised refugees, 'illegal immigrants', and those imprisoned in 'detention centres'. This is one clear example of producing an 'other' to ensure the stability of the centre, in fundamentally troubled and troubling times. As Appadurai notes: "minorities are the major site for displacing the anxieties of many states abut their own minority or marginality (real or imagined) in a world of a few mega states, of unruly economic flows and compromised sovereignties" (Appadurai, 2001: 6).

A second (but related) approach to the challenge of difference is outlined by Rosi Braidotti who points to the way that difference is, in some commercial contexts, now being produced as a commodity. She writes:

> 'post-industrial' societies have taken 'differences' into a spin, making them proliferate with an aim to ensure maximum profit. Advanced capitalism is a difference engine – a multiplier of de-territorialized differences, which are packaged and marketed under the labels of " multiple or multicultural identities". It is important to explore how this logic thereby triggers a

> consumeristic or vampiric consumption of 'others', and how this logic fuels the new forms of contemporary social and cultural practice. From fusion cooking to "world music", the consumption of 'differences" is a common practice. (Braidotti, 2003: 1).

Thus, while we live in an age which regularly asserts the emancipation of women, homosexuals and lesbians, people of colour, people with disabilities and so on—and while it is certainly possible to point to significant evidence that tends to support the original assertion—the vampiric consumption of otherness referred to by Braidotti masks the ongoing production of some bodies in less powerful relationships to contemporary culture than others:

> the bodies of the empirical subjects who signify difference (woman/native/ earth or natural others) have become the disposable bodies of the global economy. What exactly is a disposable body? It is a set of organs disengaged from organic unity, consistency or integrity: a collection of organs that are up for grabs. See the case of women's bodies farmed for their ova, the nurturing capacities of their uterus, their generative powers, as Vandana Shiva points out. See how the bodies of animals, just like black or native bodies are "farmed for their productive, reproductive and generative powers; think of the commodification of bodies for sexual services in the global sex trade; for spare parts in the organ transplant industries. Think of the martyrized body of onco-mouse, the farming ground for the new genetic revolution and manufacturer of spare parts for other species; think of trans-species organ transplant. (Braidotti, 2003: 10)

She goes on:

> Looked at form the angle of the disposable bodies of 'others' of the dominant subject, the on-going new scientific revolution is neither very new, nor particularly scientific. What we have, in fact, is the return of the masters' narratives: science turns into technological applications, gets fuelled by a massive hype and it perpetuates traditional modes and patterns of exclusion. This is the contemporary variation on the theme of the ruthless exploitation of bodily materialism and bodily matters. The age of globalization has shown rawer and more brutal power relations that we had seen since the first industrial revolution. What we are getting is a perversion of the subversive and creative potential of those very technologies which we have invented. It is old (master) narratives in new (scientific) bottles. (Braidotti, 2003: 9-10)

Braidotti highlights here the point that is central to this paper: invocations of innovation in education may regularly refer to technological 'newness', changes to how things are 'done', the development of innovative capacities (and the creation of a socially compliant workforce) but none of this necessarily addresses long standing, underlying issues concerned with the way different *bodies* are positioned in *different relationships* with the practices that result. In a context where innovation is a associated almost unproblematically with improved and desirable developments in education, to stay within these dominant frameworks is to silence and ignore the bodies and voices of people for whom the innovation ignores, exacerbates or multiples extant experiences of marginalisation.

The way forward, then, is to identify ways of speaking about innovation that can co-exist with the kinds of perspectives identified by Braidotti above. In the next section we outline what these kinds of perspectives may involve.

Part Two: Innovation (chains to redefine 'us')

In the previous section we drew attention to the ways in which common criteria for measuring innovation work to obscure attention to the consequences of an innovation, particularly in terms of the extent to which an innovation improves (or otherwise effects) the educational experiences of diverse students. These perspectives generally fail to draw attention to the ongoing marginality experienced by many students within and beyond their educational environments and to broader cultural patterns associated with the production and consumption of difference. Clearly, however, it remains important to emphasise the fact that interventions within/challenges to/transformations of these patterns *are* possible. To borrow again from Deleuze, we acknowledge that the tension between the *molar* and the *molecular* is played out in a process of *reterritorialization* and *deterritorialization*. Reterritorialization is the process by which lines of rigid or molar segmentarity confine movement within specific territories, codes and conventions. In contrast to this, lines of molecular activity deviate and depart from molar codes. These 'lines of flight' serve to trouble and destabilise the rigidity of molar lines. They do not follow coded pathways but cut across them in a process of deterritorialization: by making connections across multiple strata lines of flight produce assemblages that are new, different and, most importantly, continually changing. (Deleuze & Guattari, 1987; Hills & Rowan, 2002)

Braidotti makes a similar point about the transformative capacity of marginal groups:

> Let us remember, with Foucault, that power is a multi-layered concept which covers both negative or confining methods (*potestas*) as well as empowering or affirmative technologies (*potentia*). This means that the paths of transformation are engendered by the 'difference engine' of advanced capitalism are neither straight nor predictable. They rather compose a zig-zagging line of internally contradictory options. Thus, human bodies caught in the spinning machine of multiple difference at the end of postmodernity become simultaneously disposable commodities to be vampirized and also decisive agents for political and ethical transformation. How to tell the difference between the two modes of becoming other is the task of critical theory. I consider it a political practice. (Braidotti, 2003: 2-3)

Our goal in this section is to outline some ways of identifying those lines of flights with a capacity for supporting decisive agents for political and ethical transformation. To refer back to our earlier distinction between molar and molecular structures: our aim here is to identify molecular potential of alternative 'takes' on innovation. Once again, the list we produce is not intended to be an exhaustive statement on the character of innovative innovation. It functions, instead, as a basis for exploring in more detail positions and philosophies that are perhaps better able to ask complex questions about the purposes outcomes and consequences of activities branded as innovative.

So: alternative/transformative/molecular/political approaches to innovation may share some of the following characteristics:

- A rejection of all frameworks based on essentialist understandings of technologies.

This involves rejecting any claims made about the 'nature' of technologies and what they automatically bring to or do for education. It has been common practice for computers and related technologies to be referred to as 'learning technologies' that will automatically improve, enhance, aid and abet learning. McDermott (1976), many years ago, referred to these practices as 'wishful naming'. An alternative (equally problematic) line has to been to talk about computers as 'just tools', implying that somehow these technologies appear free of any historical or cultural influences.

- A rejection of all frameworks based on essentialist understandings of learners.

This relates to frameworks that see all learners as the same (and which argue that education is simply about 'good teaching' which will benefit 'all learners) and also to those which seek to respond to student difference through the provision of educational opportunities based on simplistic understandings about the 'nature' of differences. Transformative or molecular approaches to student diversity recognise differences at three levels: between groups, within groups, and within individuals themselves. (Braidotti, 1994a, 1994b)

- A commitment to analysing the diverse/complex interrelationships between technology and social effects.

There is a large literature that grapples with this problem. We have found that actor-network theory (Callon, 1986; Latour, 1996; Law, 1988) allows the full range of associations between the social and the technical to be traced.

- An emphasis on the importance of attending to the technical AND the social in any educational intervention.

We have argued elsewhere (Bigum & Rowan, 2004, in press) that attention to either the social or the technical in educational innovation results in projects that treat either the social or the technical as 'context', that is focus on one or the other and effectively make irrelevant in any analysis, the other side of the binary.

- A commitment to identifying the outcomes of any educational innovation with an emphasis on those outcomes that may not be easily measured by 'tests' or evaluations.

Concurrent with these beliefs is an acceptance of the following:

- Creating genuinely innovative environments where difference is celebrated and valued (not just tolerated or 'consumed') requires the circulation of diverse understandings of learners where the categories 'successful learner' and 'good learner' are brought into sustained and legitimated relationships with diverse bodies.

These diverse understandings can be produced from the most marginal position. As Braidotti (2003: 2) notes: "Otherness remains the site of production of counter-subjectivities. Feminist, post-colonial, black, youth, gay, lesbian and trans-gender counter-cultures are positive examples of these emergent subjectivities which are "other" only in relation to an assumed and implicit 'Same", that functions as the centre.". To give a specific example, we have worked on a project where the production of a group of students as 'failures' and 'trouble makers' was so well rehearsed that even after ten weeks within which the students were able to demonstrate significant levels of computer literacy their 'regular' teacher rated their work as bare passes. Our challenge was to introduce and legitimate the idea that these students could also contribute to the school's image of 'the good learner'.

- These new/diverse images of learners and learning cannot be willed or wished into existence.

Transformation in this context involves both the patient and persistent unravelling of existing logics about diversity and the introduction and legitimation of new ways of understanding difference and learning. In the case of the boys mentioned above, we spent as much time trying to disconnect teachers from their existing explanatory frameworks (the boy won't learn because he's dumb/stubborn/poor/not motivated etc etc) and connecting them in safe ways to new ways of understanding the students' experiences.

- It is often the space 'in between' two positions that is often the most innovative

This is a significant point. In contrast to standard takes on innovation that emphasises 'newness' and instant effect, alternative frameworks see innovation as a dynamic, rhizomatic process. If new images or figurations of learners (and new understandings of how these learners connect with technology) are seen as lines of flight that enact a deterritorialization, it is important to acknowledge that deterritorialization is a process not an achievement. The molar structures that lines of flight serve to disrupt will work to capture and re-code a molecular flight back within a fixed position. Marcus Doel makes the point well when he writes: "[the] momentary escape of absolute deterritorialization--once it is detected by the molar apparatus--will come to be clamped down upon with the full force of the Law and confined within a new identity" (1995: 337). The important point here is that the rhizomatic and arboreal intersect continually in a process of *mutation* and *excess* countered by *overcoding* and *capture*: it is between the process of deterritorialization (molecular mutation) and reterritorialization (molar overcoding) that change occurs. This intersection and exchange is a vital component of the rhizomatic framework for, as Deleuze and Guattari argue, the only way to get out of a dualism is to be-between: (Deleuze & Guattari, 1987: 277). It is not so much that binaries disappear as that they cease to regulate activity and possibility. *It is therefore in the space between two positions that transformation occurs.* Latour (Latour, 1993) makes a related point, that binaries, rather than being explanations, are rather things to be explained.

- Transformation of understandings about learners depends on repetition.

Clearly, within the framework that emphasises the ongoing tension between the molar and the molecular, innovation (in regards to student difference, technology or anything else) is never done. The work is, by definition, on going and constant, a point we have previously illustrated through reference to Trinh Minh-ha who writes:

> By questioning over and over again what is taken for granted as self-evident, by reminding oneself and the others of the unchangeability of change itself. Disturbing thereby ones own thinking habits, dissipating what has become familiar and clichéd, and participating in the changing of received values—the transformation (without master) of other selves through one's self. (Minh-ha, 1990: 332)

- Transformative projects require constant attention

We have made the point elsewhere (Bigum & Rowan, 2004, in press) that "….anything can become more or less real, depending on the continuous chains of translation. It's essential to continue to generate interest, to seduce, to translate interests. You can't ever stop becoming more real." (Latour, 1996: 85). This is another important point. In the year 2004 it is almost impossible to open up and sustain convincing debate about the on-going marginalisation negotiated by women in Australia's workforces (Moore, 2003). And yet phallocentric practices have *not* been universally replaced: rather, the legitimacy of claims to the space required to speak these 'truths' have been consistently eroded. Getting these agendas back on the table is a difficult and exhausting task.

Taken together, the perspectives and philosophies outlined in this section provide an alternative approach to conceptualising innovation. No longer is it about 'things' or chronological 'newness' but rather about people and processes and relationships. In this context, technologies are subject to as much critical scrutiny as any other cultural artefact and it is possible for questions concerning the *effect* and *outcomes* of an innovation to be asked. This allows, in turn, attention to our initial criteria: does an innovation improve the educational experiences of a diverse student group. Clearly the resultant critiques of innovation are significantly different. In the third and final section we will illustrate the vast differences between what the two broad sets of innovation lenses draw attention to in the analysis of some sites of educational innovation.

Part three: reading innovations

In this third and final section we want to draw attention to the ways in which different takes on innovation identify different potentials/possibilities/problems with various educational innovations. In our analysis of the examples that follow, our goal is not so much to identify innovations that absolutely are not or positively are transformative in their understandings of technologies and cultural diversity, but rather to point to the extent to which they are more or less likely to end up sustaining any kind of 'line of flight' away from dominant responses to the fields.

Let us begin with an analysis of one kind of educational activity that is routinely read as innovative and good value.

A popular online activity for many teachers is to give students a task called a Webquest which is, according to the originator, “an inquiry-oriented activity in which some or all of the information that learners interact with comes from resources on the internet” (Dodge, 1997). We illustrate the basics of a Webquest with a project called *A cell is a small city* (Winstead, 1999) which is regarded as a good exemplar. The quest requires students to use a set of predetermined links that provide them with explanations, definitions, diagrams and fill in the blanks sentences to support learning various parts of the cell in order to “build” a cell in the manner that a city might be built. The students “share their research notes with other members of the group” and then using the role assigned (one of Architect/City Planner; City Builders; Reporter) “your group will work together to plan, design, and construct a 3-D "Cell City" based on your research of the organelles and what their function is.”

On the face of it, this is an activity that makes use of online materials to support student learning about cell function and structure. Webquests like this enjoy considerable popularity. The Web provides an easy distribution mechanism for such teaching materials and various Webquest sites encourage teachers to submit their own work and evaluate the work of others.

The name of these tasks—WebQuest—implies at least *some* kind of search that makes use of the Web. Actually it is a worksheet style of exercise very common in classrooms that has been moved onto web pages. The task provides a single metaphor, that of a city as the only device for making sense of cell structure and function. Little use is made of this metaphor in the “research” phase of the task as the materials linked to the task page are written in language that is typical of upper secondary biology texts. The learner, apart from the assumption that being online somehow makes this task attractive, is assumed to be familiar with cities, their planning and the inter-relationships between various components. The project does not actually require *any* Web access. The successful learner in this task is one who can name various parts of the cell, connect them and make use of the city metaphor.

In our analysis, tasks such as these reproduce and maintain the existing hierarchical, competitive and ranking practices of schooling (Hodas, 1996). Their popularity with teachers derives from the strong resemblance to standard classroom worksheet activities and the removal of any unanticipated outcomes that might have arisen in making use of the Web. There is absolutely no imperative within any WebQuest literature for teachers to look critically at what kinds of students engage most actively with this task. Nor is there any analysis of who generally takes on what kinds of roles (who, in terms of gender, cultural background, socio-economic status, is the architect and who is the reporter?) and how this reflects broader social patterns. In short, there is nothing in the ‘innovative’ WebQuest framework to encourage students to look critically at their own, or others, social/cultural positioning. We would argue, therefore, that the chances of projects operating within this kind of mindset embarking on any radical departure from mainstream understandings of students, cultural identity and difference are minimal.

Slightly more possibilities can be seen in our second example. This example comes from the early 1980s and the Microelectronics Project in the UK. In those days a popular piece of software delivered a multiple choice quiz (by any account a fairly routine and unremarkable application of computer use in a classroom.) But some

teachers, reasoning that they learned a great deal when they constructed these quizzes, gave the quiz construction task to their students. One student, working on a quiz about geological time scales came across a set of conflicting data in different texts concerning the answer to a question (When was the Cenozoic era?). Within the learning spaces provided by the teacher this student was encouraged to pursue his own answer and the 'right answer' was left unresolved until the class went on a field trip in Denmark and visited a museum. In this museum there was a collection of the work and artefacts of, Nicolaus Steno, a geologist whose work laid the basis for the distinction of different time periods in geology. The student nominated the year, 1669, in which Steno described his two basic principles of geology, as the answer to the original question. This interpretation—which shows a sophisticated understanding of the ways in which scientific projects can 'create' realities—was accepted by the teacher as a legitimate demonstration of knowledge about geology.

There are several important points here. First, the choice to use technologies in ways that hand authority and control over to the students stands in stark contrast to the routines associated with WebQuest where control of all 'the answers' that are going to be found rests with the teacher. Second, the teacher's acceptance of the student's answer shows a similarly radical willingness to de-centre the teacher (and the authority of formal science) and to validate alternative perspectives on scientific knowledge. And it is particularly worth noting that this kind of 'innovative' take on knowledge (and the associated link with computer technology) was happening more than twenty years ago. Unfortunately, however, there is insufficient detail provided in the original account of this story for us to make any clear evaluations of the way it dealt with cultural diversity. 'Who' was the student? How did his gender/cultural background/economic standing impact upon the teacher's willingness to accept the 'alternative' nature of his answer? Would an indigenous, working class, or female student have received the same endorsement? What were the longer term outcomes for the student? The teacher? The other students in the same class? The point here is that this project (unlike mainstream performances of WebQuest) at least begins in a transformative way. The extent to which this potential is 'realised' is uncertain. Like all other innovative approaches, it is clearly possible for this to be brought back within the terms of mainstream education.

Indeed, an example of how this happens can be found in contemporary discourse about the capacities of a popular platform for delivering online university courses: WebCT. WebCT (in its various incarnations) allows educators to offer on-line ('self correcting') quizzes. At every professional development activity we have attended on this software, this is put forward as an automatic benefit. So, too, is the facility offered within WebCT for instructors to identify who, out of their students, have been 'on' the site. This is also celebrated as a significant teaching and learning feature. The reasons why these features are beneficial (and analysis of who they benefit) are absent. The consistent problem with these examples is that the challenge of constructing learning opportunities that will benefit all students is either completely ignored, or else delegated to the capacities of the technology (via the good teaching is inclusive; technology produces good teaching, therefore technologies in education are inclusive syllogism referred to earlier in the paper). So while all of these examples can be read in ways that appear innovative, (particularly in terms of their ability to connect education with technology and 'measure' student ability to manage certain sets of information) it is far easier to sustain any claim that they draw attention to, or

attempt to work against, routine operations of power. By extension evidence concerning the extent to which the innovations benefit diverse learners is noticeable in its absence. It is this invisibility that suggests more than anything else that these kinds of innovations are more likely to reproduce narrow and limited understandings of the 'typical' student than to contest, extend or challenge these same understandings.

Let us look at one different example: one that may not appear at the outset to be innovative when read through the lenses provided by the takes on innovation reviewed above, but which can be shown, nevertheless, to contest dominant responses to cultural diversity. Some years ago we worked on a literacy/technology 'intervention' that was designed to engage some 'at risk' students who were designed as failures in a secondary English classroom in a regional Australian high school. From lower-socio-economic and relatively diverse cultural backgrounds, the boys had all been identified as 'poor students' who did not understand, did not endorse and could not perform the school's understanding of 'good learners.' Three of the boys appeared to be closely aligned with mainstream masculinity (in its 'rebellious boy' manifestations) while one was more consistently represented as a 'computer nerd'.

Our official task with these boys was to use ICTs to re-engage them with literacy activities. Our unofficial goal was to find ways to re-connect them (or, indeed, connect them for the first time) to understandings of 'good learner' that were not in direct opposition to their own understandings of themselves as boys. To this end, choices that were made about the technologies to be used, the activities to be undertaken and the kinds of interactions to be facilitated were all subordinated to our consideration of the extent to which the boys would be supported in deconstructing their own sense of themselves as boys-who-will-fail, and reconnecting them to understandings that all kinds of boys can learn in schools. An understanding of this commitment to producing with the boys new figurations of learners needs to be brought to bear in an analysis of the 'innovativeness' of the resultant program.

For instance, the project worked with four boys, in the development of a web site, focused on motorcycles. They worked with computers, basic software, digital cameras and video recorders. On the surface this kind of design appears merely to reinforce traditional masculinity: with its links between technology/masculinity and the kind of 'macho' personas associated with motorcycle racing (and this criticism, indeed, has been made of the project). These interests, however, were only one trajectory of the project. Throughout the activities that underpinned the intervention, the boys were provided with opportunity to talk about their understandings of schools, of learning environments, and of themselves as learners. They were introduced into a learning network that involved people outside of their own school system (the researchers, a student teacher, and his baby). They were provided with supported spaces to identify the things that they did know, and to reflect on the ways in which they were able to acquire and display new kinds of knowledge. Every move they made away from narrow conceptions of themselves was celebrated and in this slow, painful process, the boys shifted individually (and collectively) to an understanding that there was no automatic opposition between their own identities and the possibilities of being 'good' learners. By the end of this project boys who had been excluded from 'mainstream' English classes were actively asking to be put back in those classrooms as the 'experts' on the software they had worked with.

This is not to say, of course, that as a result of this project the boys' educational experiences were fundamentally transformed. Indeed, many of the teachers in the schools continued to read the boys as under achievers, and resisted our own attempts to highlight precisely how much the boys had accomplished. But what we would like to emphasise here is that this project began with and maintained a commitment to improving the ways in which the boys understood their relationship with education. The technologies, the pedagogies, the classroom designs were all analysed in terms of how they would facilitate this goal. In the process, the boys were able to critique understandings of what it means to be 'their kind' of boy; to critique understandings of what it means to be a 'good student' and a 'good teacher' and to give a legitimated and widely endorsed performance of 'tough-kid-as-good-student'. In this way, the technologies merely helped to spark off what can be described as either a line of flight, or a productive chain of innovations. These kinds of shifts are perhaps partially communicated by the confident attitude expressed by one of the boys at the end of the project. In the early days Stuart described himself as 'a slow learner' who was 'no good' with technology and who didn't really want to try because he was unsure about how he would be treated. Fear of being labelled a nerd was particular apparent. In the last days Stuart changed his mind about this. He said:

> I don't mind getting called square, now I'm a computer whiz. I know the codes. When I put my pages on [the internet] it's like when I was looking up motorcross [on the internet] for our magazine, and there was one page in there where it had like all these little pictures but they were all circles, not square and you press on them and they were all movies. Everyone can see them and they'll see my pages too.

We are hesitant indeed to read too much into this one example (which is described in more detail elsewhere (Rowan et al., 2001)), but we are equally hesitant to dismiss it as a small-scale, localised project. The key issue here is that innovation, in the way it is conceptualised in this paper, is not determined by scope or scale, but by direction and effect. For this reason, providing any kind of disruption to normative perspectives on education, technology, masculinity or schooling, can be a basis for laying claim to the innovation 'tag'. As a final point, however, it is vital to acknowledge that the ability to conduct these kinds of readings depends upon an associated ability/willingness to bring together robust understandings of technology, with critical perspectives on cultural student diversity. For it is the combination of perspectives that prevents what might be described as a technologically 'rich' but 'diversity blind' innovations from being unproblematically celebrated. Similarly, it is this both/and perspective which allows for projects that may appear a first glance to be technologically unimaginative, to be assessed in terms of the extent to which they ask new questions about student diversity. As is so often the case, it is at the intersection between these two discourses that the most dynamic, productive, truly innovative ideas are likely to be found.

Conclusion

We referred in our introduction to this paper our interest in distinguishing between molar and molecular approaches to innovation and in parts two, three and four we have sought to identify some of the different stories that can be told within particular innovative frameworks. Clearly we position ourselves alongside those molecular

frameworks which resist essentialist and limited understandings of technology and difference and which open up new ways of performing the relationships between difference, technology and educational success. In making this distinction we are motivated by our belief that having a clear understanding of where the two sets of innovation perspectives will allow an innovation to 'go' is vital for educators planning their own classroom innovations. Whether in universities, schools or early childhood settings, all educators have the capacity to either critique, contest, problematise and move away from limited and limiting cultural norms, or to remain with their boundaries. The theories and assumptions we associate with in this process helps to determine whether we operate within the 'chains of innovation' provided by dominant frameworks, or in the creation of new chains of innovation that conceive technology, culture and difference in fundamentally new ways. It is for this reason that developing and sustaining meaningful conversations *across* areas such as those associated with technology and student diversity is so very important. Clearly there is much more work that needs to be done in this area including ongoing efforts to map and articulate the constraints and potentials of the sets of resources explored in this paper. But in a world where educational outcomes are consistently inequitable, committing (again) to this discussion seems to be both a political and a moral necessity. And as is always the case, it is the people in our classrooms (however virtual, real, or other otherwise distributed they might be) who will live with the consequences of our choices.

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