

**Educating the Posthuman: Changing Understandings
of Nature, Knowledge and Human Progress**

Yoshi Budd, University of Tasmania, Yoshi.Budd@utas.edu.au

Abstract

This paper presents research data that demonstrate how computer metaphors shape teachers' literacy pedagogy and their understanding of the role of information and communication technologies (ICT) in education. Although literacy and ICT are currently promoted as key elements of educational reform, and the number of studies connecting the two fields of ICT and literacy are increasing, the majority of such research continues to be informed by positivist, quantitative or descriptive research paradigms. Consequently, the broader cultural, political and philosophical implications of ICT in education and the effect of new technologies on teacher pedagogy remain undefined, unexamined and, therefore, uncontested. This paper begins by examining and problematising determinist and instrumentalist research approaches to ICT in education, and then presents an alternative methodological framework for exploring the mechanisms of, and for, educational change.

The research methodology is informed by feminist and poststructuralist theories that challenge the presumed neutrality of language practices. These theories are used to provide a new lens through which issues of agency, identity, access and equity in education can be more critically examined. A qualitative, combined methods approach incorporating Constructivist Grounded Theory and a Foucauldian approach to Critical Discourse Analysis enables connections to be made across seemingly disparate data sources and research paradigms. Analysis focuses predominantly on sixty pre-service teachers' discussions of their experiences with computers in the classroom and their reflections on an ICT case study.

Pre-service teachers' responses are examined in close detail for their connections to the language practices of the computer industry. In particular, digital metaphors, such 'the brain is wired', or 'reality is just another window', are examined for the ways in which they facilitate conceptual shifts, drawing together what might otherwise be incommensurable realities, by overlooking the qualitative difference between knowledge and information. Key words such as interactivity, literacy and creativity, for example, can mean very different things depending on the knowledge frameworks within which these terms are used and understood. The findings explain how pre-service teachers' participation in ostensibly natural and neutral language practices can contribute to the marginalisation of teachers who resist taking up the language practices of the computer industry.

Key Words

Teacher education, information and communications technology, literacy.

Introduction

'Educating the posthuman', sounds more like the title of a science fiction novel than a study of pre-service teacher pedagogy. This paper, however, presents research data that suggests that the concept of a posthuman subject, as theorised by Hayles (1999), is currently being promoted by the collective language practices of many pre-service teachers. Hayles' exploration of the posthuman articulates the symbiotic relationship between humans and machines, and engages with fundamental questions about what it means to be human. Such philosophising might seem to be only distantly related to teachers' work in the classroom but this paper argues that, as bodies are the sites for pedagogical intervention, teachers' work should be informed by an understanding of the potential, purpose, or telos of the individual bodies that populate their classrooms. If pedagogy is a political and moral enterprise that is predicated on "the ability of the nascent subject to change, to alter, to become something other than what it was" (Todd, 2001, p. 432), then teachers need to think about the kind of futures they are currently constructing for their students through their language practices and classroom pedagogies.

Background information

Certain metaphors find favour and a receptive audience at particular points in time (Renshaw, 2003), and in the current digital age, the cyborg metaphor is a prominent and popular symbol of human potential. The conflation of the two concepts, 'cybernetics' and 'organism', is significant because it represents a blurring of the boundaries between technological and biological processes. Wiener's book, *Cybernetics: Or the science of communication and control in the animal and the machine* (1948), laid the groundwork for cybernetic theory, arguing that all human endeavours can be reduced to issues of communication and control. In a later text, Wiener (1950) explains that language is not 'exclusively an attribute of living beings but one which they may share to a certain degree with the machines man has constructed (p. 103). This reconfiguration of language/information and human/machine boundaries opens up new understandings of human potential and promotes an intensification of the symbiotic relationship between humans and machines and underpins the posthuman worldview:

In the posthuman, there are no essential differences or absolute demarcations between bodily existence and computer simulation, cybernetic mechanism and biological organism, robot teleology and human goals. (Hayles, 1999, p. 2-3)

The cyborg metaphor is widely disseminated and promoted through popular texts. Early examples include the widely successful television series, *The Six Million Dollar Man* (Bennett & Larson, 1974-1978), and the film *Blade Runner* (Deeley, 1982) from the book *Do Androids Dream of Electric Sheep?* (Dick, 1968). More recent and dystopian visions of our technological future are presented to a wide audience in films such as *The Terminator* (Hurd, 1984) and *I, Robot* (Mark,

Davis, Dow, & Wyck, 2004). Medical documentaries and tabloid journalism also provide information about the numerous ways our technologies can intercede with our biological processes to enhance and control degenerate and unruly bodies: prosthetic devices to replace faulty body parts; cosmetic surgery to reshape our external features; and chemical supplements, such as Prozac, Ritalin or Viagra, which control aberrant emotions and behaviours. The constant stream of information promoting new and innovative forms of intervention in biological processes reshapes the collective imagination to reinform understandings of the potential of bodies as well as the best means of improving or controlling them. Consequently, the teleological assumptions implicit in posthuman discourses promote the cyborg as a symbol of human potential.

Metaphors act as epistemic frames and the increased ambiguity of meaning-making processes through the use of metaphors points to the subversive potential of language practices. Metaphors such as, 'the brain is wired' or 'the body is a machine', draw together what might otherwise appear to be incommensurable realities (Lyotard, 1984). Depending on the context of their use, metaphors can operate not only to stabilise meaning but also to facilitate a shift in perspective. New metaphors instantiate new relationships and, therefore, are "not merely decorative so much as indispensable to the creation of new meaning" (Heuser, 2003, p. xli). This is significant for understanding the construction of new epistemic and pedagogical practices within educational contexts as a result of the introduction of information and communication technologies (ICT). ICT discourses, for example, are powerfully informed by the cybernetic paradigm, where "the root metaphors are information processing and automaticity" (Heffron, 1995, p. 500). Hodas (2006) writes that "each shift to a new metaphor drastically affects the way cultures view the natural and human worlds" (p. 203). These new perspectives are facilitated by seemingly innocent language practices:

Cyberneticians took such common physiological and psychological concepts as *memory*, *homeostasis*, and *purpose*, and extended them into the realm of machines. Physiologists, on the other hand, took such concepts as *information*, *programming*, and *feedback* out of their technical context, and applied them to living organisms. (Gerovitch, 2002, p. 340)

Similarly, discourses promoted by the computer industry that construct real life as 'just another window' (Turkle, 1995), or conflate artificial intelligence with human intelligence (Wiener, 1967), have important implications for the way pre-service teachers prepare for, and understand, the role of ICT in education.

Providing students with access to ICT can reasonably be argued to be an educational imperative if the use of cyborg metaphors, which construct the posthuman as just another node in

the flow of information (Hayles, 1999), remain uncontested in educational contexts. Pedagogies that support and promote ICT use are consistent with a posthuman worldview because the science of cybernetics foregrounds the informational continuities between humans and other self-organising systems such as machines. This means that interfacing students with ICT would immediately represent an improvement in their information storage and processing capacities, and minimise interference from the teacher, who represents an unpredictable interface between the student and the information. In educational contexts, therefore, posthuman discourses represent a highly sophisticated strategy aimed at disciplining and rationalising the learning process (Heffron, 1995). Postman (1992) explains:

The computer redefines humans as “information processors” and nature itself as information to be processed. The fundamental metaphorical message of the computer, in short, is that we are machines. (p. 111)

Posthuman discourses diminish alternative ways of being and knowing by making the body less visible. Removing bodies from informational processes is desirable because, although the cyborg provides a model for human progress, the body continues to be problematic as it represents the “leaky” (Haraway, 1991, p. 152) and liminal interface between nature and culture, the biological and the technological, the self and the other. Consequently, educating the posthuman means focussing on the skills required to access and to disseminate more information with greater efficiency, rather than exploring the range of interpretive possibilities represented by the unique perspectives afforded by individual, and sometimes unruly, bodies.

Hayles (1996) argues that a defining characteristic of the present cultural moment is the belief that information can circulate unchanged across different material substrates. This represents a fundamental epistemological and ontological shift as “reality is considered to be formed not primarily from matter or energy but from information” (p. 112). The cybernetic paradigm, therefore, in promoting the endless circulation of information with complete disregard for the uniquely embodied experiences through which information is reshaped and given new meaning, undermines the importance of bodies as sites for creative processes and as the locus for social change and renewal. Instead, bodies are reconceptualised as extensions of the machine, and language and knowledge are defined simply as bounded information loops. In contrast, the posthuman vision idealises the unbounded dispersal of the self as information and promotes the idea that if you are online, you are omnipresent. For example, in the ‘non-space’ of Face Book, an individual can have hundreds of friends across the globe, thereby establishing a vast social network. This perspective effectively changes understandings of what friendship means in terms of ethical human interactions and social obligations in ‘real time’. Online identities ensure constant

visibility and this has the paradoxical effect of making cyber-citizens appear more substantial than embodied human beings. Continual messaging creates a sense of constant presence and social engagement: an effect that overshadows physical bodies that get tired, can't afford travel expenses, get sick, or age. Consequently, the Cartesian mind/body dualism has been extended beyond the physical boundaries of the body. Not only is the mind separate from the body, but in cyberspace, the body is separate from representations of it, with the representation often being more visible, appealing, infinitely more replicable and manipulable and, therefore, also highly commodifiable. As a result of posthuman discourses that encourage the development of economies based on the manipulation of information, the simulacrum is valued over the original. This cultural phenomenon is an example of Baudrillard's (1994) concept of the hyperreal.

The cyborg, as both "technological artifact and cultural icon" (Hayles, 1999, p. 2) is promoted by the computer industry to enact the modernist fantasy of augmenting the power and control of human beings over the perceived deficiencies of nature. This continuation of modernist agendas is achieved through the increased separation of the mind/body relationship and the dislocation of knowledge from embodied contexts:

The cyborg is also the awful apocalyptic *telos* of the "West's escalating dominations of abstract individuation, an ultimate self untied at last from all dependency, a man in space". (Haraway, 1991, p. 150)

The pressure to find a place for new technologies in the classroom not only acknowledges these changing socio-cultural practices, but also reflects the escalating corporatisation of education (Bigum, 1997; Snyder, 1999). This pressure is evident in pre-service teachers' language practices as they attempt to navigate the murky discursive waters at the confluence of ICT and educational discourses.

The following sections of this paper present the methods and findings of a research study that examines the knowledge frameworks pre-service teachers draw from when discussing the role of ICT in education. The aim of the research is to investigate the relationship between language and technology in order to extend and enhance understandings of the pedagogical impact of ICT discourses on pre-service teachers' understanding of the role of ICT in education. The findings demonstrate how posthuman discourses inform the pedagogical development of one group of pre-service teachers.

Theoretical framework

This study uses a feminist poststructuralist research orientation (Lee, 1992) to apply a critical lens to the examination of the discursive tensions at the intersection of educational and ICT discourses. The Foucauldian (1972) concept of discourse that underpins this approach represents a profoundly dialectical process because discourse, as knowledge, both shapes and is itself shaped by socio-cultural relationships and traditions of practice. Discourses determine “not only how we view language, but also how we practise it” (Green, 2006, p. 3). It is with this understanding that Phillips and Jorgensen (2002) declare that “people do not possess a set of fixed and authentic characteristics or essences” (p. 5). Consequently, the literature used in this study does not provide answers to teleological questions about what the future holds, the purpose of education or the nature of human being and human progress, but engages instead with the mechanisms by which any answer to these questions can be given any legitimacy at this moment in human history.

Carabine’s (2001) approach to Foucauldian genealogical discourse analysis is used in this research in order to make visible the assumptions that structure and limit ways of thinking and being in the world. The first section of this paper establishes a brief genealogical context in order to disrupt “the supposed unity of reason, the subject and history” (Tamboukou, 1999, p. 205), as opposed to “accepting and legitimating what are already the ‘truths’” (p. 203) of ICT in education. Genealogy assists in opening discourses up to examination and critique as it traces the changing history of the body within particular discursive contexts and makes visible the regulatory effects of a discourse in terms of the “conditions under which we might consider certain utterances or propositions to be agreed to be true” (Mills, 2003, p. 25). Foucault (1984) writes:

Genealogy, as an analysis of descent, is thus situated within the articulation of the body and history. Its task is to expose a body totally imprinted by history and the process of history’s destruction of the body. (p. 83)

Genealogy is concerned with “describing the procedures, practices, apparatuses and institutions involved in the production of discourses and knowledges, and their power effects” (Carabine, 2001, p. 276). Feminist, poststructuralist theory and critical discourse analysis cohere with Foucauldian genealogical discourse analysis (Carabine, 2001) as they substantiate claims about the role of discourse in constituting and sustaining unequal power relations through the enacting, reproducing and legitimating practices of dominant groups and institutions.

Diversely located discourses can destabilise the boundaries of the body and establish various systems of subjection. In this paper, particular attention is given to the discourse of cybernetics, which is examined to explicate the ways in which new epistemic practices, informed by

computer metaphors, construct the posthuman subject (Hayles, 1999) and inform educational practices. The aim of this macro contextualisation (Carabine, 2001) is to contribute to an understanding of the power/knowledge relationships that operate in the broader social context within which this research takes place. Genealogy shifts the focus away from the truth, to a focus on the conditions under which one might consider “certain utterances or propositions to be agreed to be true” (Mills, 2003, p. 25). In this research, genealogy has been used to denaturalise ways of being and knowing in cultures where increased dependency and consumption of new technologies and digital texts are taken for granted. Teachers need to question the directions of change and think more critically about how they talk about and use ICT in the classroom.

The reason for taking up a critical research lens is not to deny or discredit the many positive outcomes of ICT use in education, such as increased access to information, ease of publication, and the representation and dissemination of marginalised worldviews. Feminist poststructuralist researchers, however, do not seek a neutral position on an issue, but are required to constantly acknowledge the subjective nature of enquiry and be transparent about the principles that guide the collection and interpretation of data.

This research applies a critical lens in order to take up a position that serves as a counterbalance to determinist and instrumental approaches to research on ICT in education. Determinist approaches to research on ICT in education are reactive in the sense that they are an “inevitable response to large-scale technological change” (Bigum, 1997, p. 247). Such an approach privileges the presence of ICT in the classroom by shifting understandings of pedagogical frameworks to accommodate the new technology:

Computers, if not materially, at least symbolically provide schools with the means of appearing to respond to an increasingly technologised world by becoming increasingly technologised themselves. (Bigum, 1997, p. 249)

Constant change and technological innovation mean that educational research and the development of teacher pedagogy take up a reactive, rather than a proactive stance. Schools’ ongoing investment in ICT is reflected in the changing language practices of education. Terms such as, multiliteracies, computer literacy and technological literacy, combine technology and literacy to associate ICT competency with social competency, cohesion and progress. This is an example of literacy *for* technology (Bigum & Green, 1992), where available technologies determine what literacy is and how social relationships can best be conducted.

Furthermore, a determinist approach to ICT research marginalises the teacher in the teaching and learning process. Instead of asking, for example, how teachers’ use of ICT in the

classroom affects learning outcomes, the question shifts to ask how ICT affects learning outcomes irrespective of teacher pedagogy (Warschauer, 1998). Determinist discourses make it easy to forget that “a robot’s goals and purposes are not intrinsic to it but are ultimately explicable in terms of human purposes” (Boden, 1995, p. 69).

Another approach to researching ICT in education is based on the premise that ICT is “simply a tool – and a benign tool at that” (Knobel & Lankshear, 1997, p. 2). This is the instrumental view, which “downplays how new technologies affect the broader ecology of the language learning environment” (Warschauer, 1998, p. 758). An instrumental approach to understanding the role of ICT in education supports determinist perspectives by obscuring the political effects of ICT use on classroom relationships and teacher pedagogy.

Technologies are never neutral elements in the practice of education (Lankshear, 1997; Postman, 1992). They are always implicated in understandings of the body and world. With the development of new technologies, the potential to construct new understandings and act upon the world in new ways increases (Postman, 1992). New technologies, however, do not simply augment aspects of a culture, but also diminish some aspects by reconstituting and reordering subjectivities, social values and priorities. Teachers and students, therefore, do not merely use technologies but are in/formed by them (Kellner, 2002). For example, ICT discourses provide additional categories for identifying competent or incompetent social behaviours. As new discourses circulate, new social relationships and subjectivities are produced as an effect of these discourses. Categories such as ‘computer technician’ and ‘computer programmer’, for example, construct figures of authority or credibility. Alternatively new forms of criminality or antisocial behaviour also come into being: for example, hacking and cyber-bullying.

Furthermore, the introduction of ICT into a school immediately creates its own imperatives. This includes the demand for the latest hardware, software and network packages, as well as the privileged social positions that affirm the importance and benefits of ICT use, such as technical staff, and students and teachers with ICT skills. Consequently, the introduction of ICT into the classroom changes the practice of education by redefining what teachers are and by changing what they do: redirecting their attention to different classroom processes and outcomes and providing a new interpretive framework for understanding students’ learning processes by re-defining key educational concepts such as literacy, interaction, authenticity and creativity (Lankshear, 1997).

Methodology

A qualitative, multi methods approach, combining Foucauldian Critical Discourse Analysis (Carabine, 2001) with constructivist grounded theory (Charmaz, 2000, 2006) has been used to focus attention on the ways in which language supports and informs the social and cultural processes of change. Through their strong commitment to social constructivist research agendas, both Critical Discourse Analysis (Carabine, 2001) and Constructivist Grounded Theory (Charmaz, 2000, 2006) cohere with, and support, feminist poststructuralist perspectives. Critical Discourse Analysis (Charmaz, 2006) is not only a methodology or set of assumptions that explains how and what can be known about reality by foregrounding the constitutive effects of language, but also a method or set of techniques for conducting a “structured investigation of texts” (Phillips & Hardy, 2000, p. 5).

Constructivist Grounded Theory is consistent with the provisional, flexible and inductive approach of critical discourse analysis and is used in this study to ensure close and systematic analysis of the data. The use of Constructivist Grounded Theory aids the development of theories that are conceptually dense and also facilitates transparency by recording patterns of action and interaction within and across codes and categories. While Constructivist Grounded Theory adopts Grounded Theory guidelines as tools, it does not subscribe to the objectivist and positivist assumptions articulated by Glaser (1967). A constructivist approach problematises the notion of ‘saturation’ (Charmaz, 2005) and acknowledges that researchers use their own histories, interpretive frames and interests to inform the process of data gathering and analysis. This fits with a feminist, poststructuralist position that claims there is no such thing as purely inductive, apolitical theory building. Theory building cannot be separated from deductive processes: All research is informed by pre-existing discourses and those discourses construct and shape the object of inquiry by framing our view of the world and drawing our attention to valued and recognisable features.

Methods

Theoretical sampling began with the researcher attending ten online teaching sessions. During these sessions, the researcher recorded, in an observational journal, the content taught and all online interactions between participants. Additional data drawn from the research site includes a school handbook for primary and high school students studying through the online teaching program. During data collection, Constructivist Grounded Theory principles informed the process of early and ongoing analysis of textual data: Initial codes were recorded and categorised as open codes; axial coding concurrently served to establish the dimensions of each category as well as relationships between codes and categories.

After a wide range of open codes were identified, the researcher located a set of extant texts as a primary data source: 66 pre-service teachers' exam papers on an ICT case study (Garthwait & Weller, 2005): The ICT case study was also analysed as a separate data source. These exam papers discussed and critiqued the case study from the perspectives of individual pre-service teachers after they had incorporated the use of ICT in their lessons during a recent school experience. The relevance of this data set was confirmed by its contribution to the saturation of existing codes developing as a result of theoretical sampling. In addition, the iteration of similar discursive strategies across different educational sites and contexts confirmed the broad influence of the identified codes.

- From initial codes to open codes

Ongoing, line by line coding resulted in hundreds of initial codes and demonstrates how the researcher can claim that the findings are 'grounded' in the textual data ('empirical' being a problematic term in this research). While all 66 pre-service teachers' exam papers were coded in their entirety, only ten examples of initial codes are provided in Table One to demonstrate how open codes were constructed. The initial codes presented in Table One are typical of the first two pages of most of the examination papers, which focus on the qualities of the two teachers in the ICT case study referred to as Rick and Susan. The underlined initial codes identify a shift in focus from teaching to learning.

Table One: Examples of initial codes from Pre-service teachers' examination papers

Initial codes (students' words)	Open code (researcher's code)
<i>Susan runs a teacher directed classroom</i>	Teaching pedagogy
<i>Susan's <u>students learn by listening and reading</u></i>	Constructing literacy
<i>Rick has spontaneous student oriented classroom</i>	Teaching pedagogy
<i>Rick's <u>students learn by inquiry</u></i>	Constructing literacy
<i>Teachers find <u>ICT facilitates independent learning</u></i>	Constructing literacy
<i>Susan dominates by selecting online resources</i>	Teaching pedagogy
<i>Susan feels the need to direct learning</i>	Teaching pedagogy
<i>Rick lets students take responsibility</i>	Teaching pedagogy
<i>Susan prefers quiet</i>	Teaching pedagogy
<i>Susan circulates to directs learning</i>	Teaching pedagogy

- From codes to categories

While initial codes were being classed together to produce a total of 29 open codes (Table Two, 'Properties' column), axial coding concurrently ensured that initial codes were not de-

contextualised into a amorphous groups, but instead systematically recorded in terms of their relationship to each other. Axial coding was not used as a process of simple classification: It was used to identify and make explicit the manifold dimensions, diverse properties and unique contexts out of which a category was constructed and to explore the complex relationships that made individual categories internally complex and all categories mutually dependent (Table Two, 'Dimensions' column). In Table Two, the open code Constructing Literacy, recorded above in Table One, is represented as a dominant property of Category Two, Practising Literacy which is supported by three other codes: . The open code Teaching Pedagogy, however, is related to three other codes to support the dominant code Constructing Teacher Efficacy. Together these codes construct the category Constructing Pedagogy

Table Two: Properties and dimensions of categories

Category	Properties	Dimensions
Category 1: Controlling ICT	Controlling ICT Teaching ICT Providing access Qualifying access Funding access Promoting ICT Confronting technology Offering freedom Engaging ICT Managing classrooms Qualifying teacher efficacy	ICT as central or peripheral learning focus Inclusive/exclusive practices Positive and negative effects of ICT use Increasing and decreasing levels of agency
Category 2: Practising Literacy	Constructing literacy: Appropriating texts Constructing texts Interpreting texts	Valued and devalued forms of literacy
Category 3: Engaging Community	Engaging community: Representing the self Identifying bodies (are you there?) Presenting bodies (physical) Delegating responsibility Dispersing responsibility	Ethics: Individual or community identities

Category 4: Constructing Pedagogy	Constructing teacher efficacy: Engaging pedagogy Qualifying student skills Teaching pedagogy Managing student behaviour	Behaviourism or constructivism: Theories informing human development and purpose
Category 5: Changing Education	Locating ICT in education: Changing education Determining ICT futures	Promoting or resisting change

Limitations

Key issues for consideration in terms of the limitations of the research include the following: the problematic concept of 'saturation'; the difficulty of defining the boundaries of codes, categories and discourses; the lack of clear cut-off points for data collection; and the inevitably partial and provisional nature of the researcher's account.

Discussion and Findings

This section provides an overview of the discursive techniques and strategies used by pre-service teachers to articulate their understandings of ICT in education, thereby explicating the ways in which pre-service teacher subjectivities and ICT practices are constructed at the nexus of educational and ICT discourses. Categories have been renamed as discourses for the purpose of separating and shifting the focus from the development of categories to their analysis within a critical framework.

The order in which the discourses are discussed does not represent a hierarchy of discursive techniques or strategies, as discursive boundaries and relationships are fluid, indeterminate and dependant upon context and purpose. Nevertheless, the discourse of Progressive Bodies, drawn from category one, Controlling ICT, has intentionally been presented first and discussed in greatest detail in this paper in order to foreground the importance of the body as a site for meaning making, and to explain how the posthuman worldview has gained prominence. The tight relationship across discourses is evident in the increased frequency with which the discussion loops back to draw from the previously discussed issues. To some degree, this is indicative of an attempt to 'saturate' the data and to develop only those codes and categories that contribute most directly to explain the contradictory positions taken up by pre-service teachers. The discourse of Posthuman Pedagogy, drawn from category four, Constructing Pedagogy, examines the effect new understandings of the body have on the construction of teaching and learning subjects. This is followed by the discourse of Interaction, drawn from category three,

Engaging Community, which discusses the ethical implications of new bodies and new social relationships. The discourse of Literacy, drawn from category two, Practising Literacy, examines new literacies promoted by pre-service teachers' ICT practices. The discursive relationships, within and across all discourses, inform the fifth discourse, Changing Education.

Initial codes and excerpts from the data are represented in italics throughout the following sections of this paper. In places, these initial codes are grouped together to demonstrate the multifarious discursive techniques and strategies used to construct and justify a range of pedagogic perspectives on ICT practices in education. In such groupings, initial codes contributed by different pre-service teachers are separated by a semi colon. Tensions and inconsistencies within and across initial codes and excerpts represent pre-service teachers' struggle to operate within contesting knowledge frameworks.

The Discourse of Progressive Bodies

This section makes visible the discursive strategies used by pre-service teachers to align educational theories with the posthuman worldview. It explains how educational goals and outcomes are implicitly linked to various ideological perspectives that imbue certain educational practices with greater or less value; teleological arguments that construct a vision for human progress; and language practices that inform pre-service teachers' understandings of human 'nature' and reality.

1. ICT is a new literacy

One discursive strategy that supports the discourse of progressive bodies is to promote the integration of ICT across the curriculum by positioning it as a new literacy: This discursive strategy constructs ICT as an integrative and integral medium for teaching and learning. Although accepted and promoted by many pre-service teachers, it also creates a considerable amount of confusion and tension in their practice as ICT in the curriculum can take on a central, an integrative or a peripheral learning focus, depending on the knowledge frameworks pre-service teachers draw from:

Expenditure of time acquainting students with ICT operations should not be an issue of concern; Susan found laptops can divert the teachers and students away from the topic; Students would gain computer skills yet neglect the focus of the learning experience.

The first notable tension exists between the teaching of ICT and the teaching of key learning areas such as mathematics, science and English. One pre-service teacher explains how a

subject hierarchy in the curriculum might inform their position on this issue, pointing out that the hard sciences such as mathematics, physics and chemistry should be privileged over those areas of learning categorised as soft sciences, and this should inform the amount of time spent teaching ICT skills:

Subjects such as maths also have such a high curriculum and need good brain power that I feel computers only hinder this sort of subject. Science, music, art subjects though can benefit greatly.

Another pre-service teacher sees computer literacy as a fundamental skill, but separates the teaching of ICT skills from the teaching of their subject:

I believe that laptops would be useful in certain situations. However, there would be much greater effectiveness in firstly creating a computer literate environment or culture from earlier years as opposed to trying to introduce it at the same time as teaching high standard lessons.

As a form of literacy, ICT implicitly becomes an integral part of any curriculum. As a teaching tool, however, ICT can be compared to other devices such as the whiteboard or television and takes on, as a result, a more peripheral role. How ICT is used and taught impacts on its place in education: as a subject area in its own right; an innocent teaching tool; a justification for the teaching of new literacies (Cope & Kalantzis, 2000); or as an integral and integrative element that influences the direction and delivery of the curriculum. Furthermore, what is available online can also inform the content to be delivered in a subject area. Consequently, web resources or available software can function as a guide for teaching: *I spent more time helping certain kids to use the mastering music program than helping them with the content they were supposed to be learning about.*

In the field, it was noted that, regardless of the subject being taught online, learning was constantly interspersed with ICT terms and instructions. The constant reiteration of specialised ICT terminology had the effect of forming a background noise that presents itself as the underlying fabric of the subject area. This also applies to face-to-face classes as one pre-service teacher writes: *Technical problems dominate the organization and running of classes.* The constant use of computer terminology justifies, to some degree, pre-service teachers' references to ICT as a literacy and to the integrative capacity of ICT in the curriculum, even though it is not always clear which fields of endeavour are being integrated and for what learning outcomes. Technological issues, therefore, can undermine a clear sense of sense of purpose and a strong vision for students' educational progress:

If students need urgent teaching in an area then this should be provided without worrying about wasting class time ... I believe class time is never wasted if students are learning even if not on the required topic; It would be an advantage to implement at the start of each lesson work on technical skills; I wonder if there is danger of our classrooms becoming computer centred rather than student centred if teachers feel that laptops, when provided have to be used to recoup economic value?

2. ICT is inclusive

Another discursive technique that reinforces the discourse of Progressive Bodies is to emphasise the inclusive nature of ICT. If ICT facilitates more inclusive educational practices, then providing students with access to ICT becomes an ethical imperative in school programs. Providing access to ICT has become a primary focus of education and represents a commendable trend that emphasises the need for a more inclusive education system. To establish ICT as a literacy is also to foreground the importance of providing students with access to ICT as a form of social inclusion:

Computers are inclusive of students because they give instant feedback on progress; More inclusive as computers can cater for the needs of a range of learners; If a computer is used as a tool for learning and there are a variety of different resources that meet the learning needs of others then it is a very inclusive tool .

Pre-service teachers' reflections on their school experiences, however, identify a range of non-inclusive ICT practices, many related to the issue of funding:

Technology is extremely expensive and depreciates quickly. It is counter productive to have students struggling with outmoded systems at the expense of their enthusiasm. How often will the government be able to afford to update? ... One school in [X] approached this by laying the responsibility on the families. This is not practical for all people; Schools limit access; Only five computers in a class of twenty-four; One large computer lab always fully booked; Only one printer in room so students had to wait; Poor availability makes it hard for students to finish work started on ICT; Not all students have access to computers at home.

Pre-service teachers' also introduce a complex problematic when they refer to the unique 'nature' of individual bodies and their representation in ICT and educational discourses. Non-inclusive practices foreground the importance of considering embodiment not only in terms of the more openly discussed issues of disability and socio-economic disadvantage, but also in terms of age, as one pre-service teacher writes: *For some old teachers, they have very little ICT knowledge, which becomes the biggest problem as they cannot give children clear instructions or guidance.*

Another issue relates to gender. One pre-service teacher argues that:

Additionally research shows a gender difference in computer use and interest. It has been shown that generally boys show more interest in and enthusiasm for using computers. Girls enjoy the use of computers as well but not as often or as much so as

boys. They prefer social interaction and working in groups. Therefore, this may affect the levels of computer literacy between males and females.

The significance of gender for informing pre-service teachers' interpretations of the ICT case study (Garthwait & Weller, 2005) is also represented in the surprising number of negative comments directed at Susan's teaching practice and her 'relationship' with ICT. In contrast, across the 66 pre-service teachers' papers, only three negative comments on Rick's teaching practice were recorded: Rick was seen to be less reflective than Susan; he did not plan for explicit curriculum outcomes; and he did not carefully observe students' work for assessment purposes. Susan, on the other hand, drew 87 negative responses including the following:

[Susan's] view of what content should include may illustrate a conflict with the emerging ICT paradigm; [Susan] may not have had as many issues with ICT if she had embraced the idea of spontaneity; [Susan shows] deficiency in computer knowledge; [Susan] did not have an easy relationship with ICT; [Susan has] questionable ICT competency; [Susan has] a limited and narrow view. Other negative descriptions of Susan include: Not happy; Not spontaneous; Has technical issues; Struggles to find good websites; Is too subject oriented, Needs encouragement; Feels unsupported; Is less committed; Is sceptical, Is controlling; Struggles with too much information; Overlooks ICT potential; Too cautious; Unrealistic; Negative; Too much planning; Not enough planning; Frustrated; Unwilling to adapt to ICT paradigm; Has a less productive class; Less confident; Could improve; Irrational; Needs to structure instructions; Needs to increase group work; Not up to date; Not authentic: No interaction; Apprehensive; Rushed students; Caused many problems by her attitude; Missed opportunities for critical literacy; Under pressure: Stressed; Creates own problems; Students are bored and disengaged; Overly concerned about the curriculum; Passive; Uses behaviourist approach; Uses IT as an extrinsic motivator; Has behaviour management issues; Focuses on small issues; Practice is not built on sound theory.

The ICT case study (Garthwait & Weller, 2005) explains that Susan was enrolled in a graduate course on the use of laptops for teaching, and had also agreed to be the lead teacher in the Maine Learning Technology Initiative program. Nevertheless, she was criticised 13 times by pre-service teachers for having questionable ICT competency and nine times for not using ICT to her advantage. In addition, Susan was criticised seven times for losing or wasting time, even though the lost time was due to technical issues such as slow Internet connections and inaccessible printers, or represented the time she had spent outside of class time, searching for quality web sites that include suitable content, correct spelling and grammar, up to date web links, and appropriate degrees of difficulty for the range of reading abilities in her class. The case study also recorded that Susan always kept the state learning standards in mind when planning her lessons.

The role gender plays in constructing understandings of technological competence is powerfully demonstrated in pre-service teachers' responses to the two teachers in the case study. Leech (2007) confirms that:

Teachers are subject to the same social and cultural constraints and responsibilities as their students ... Teachers, like their students, then, grapple with social and cultural constructions of gender in relation to technology, which always already position women as less confident and competent than their male peers. (p. 8)

The issue of gender is also evident in the ICT case study (Garthwait & Weller, 2005) itself. Although the ICT case study does not present ICT competency as an issue for either of the two teachers, it does state Rick's higher ICT qualification, a recent Masters in Instructional Technology. Furthermore, although the comment on Susan's family life, "holding family life as a high priority, she had delayed her career until both her children were school-aged" (p. 2), was considered relevant to the case study, neither Rick's experience with children nor his opinions of family life required any commentary. In addition, although Susan accepted the time-consuming position of Lead Teacher, supporting the training efforts of the state's ICT initiative, this contribution was diminished by pointing out that Susan did not volunteer for the position of Lead Teacher but only agreed because she had been 'bolstered by repeated reassurances from the state team that the associated stipend was intended to support teaching expertise, not to reward "technical savvy"' (Garthwait & Weller, 2005, p. 4). The fact that her voluntary involvement in the training program tapered off over time because of the increased workload drew many negative comments from the pre-service teachers, who criticised her lack of commitment. There was no criticism or questioning, however, of Rick's apparent lack of involvement with the voluntary program, even though he is perceived to be better qualified to assist other teachers than Susan.

In pre-service teachers' interpretations of Rick and Susan's use of ICT in the classroom there are many anomalies, contradictions and generalisations that require further investigation. The same can be said of pre-service teachers' observations during their school experiences. One pre-service teacher writes: *Males find it easier to play around with computers while females generally find computers too technical for their likings*. Gender, therefore, remains an important piece of the larger jigsaw that informs pre-service teachers' understandings of ICT practices in education. The comments of another pre-service teacher demonstrates how gender, age, race, location or dis/ability can inform understandings of the potential of individual bodies in terms of their ability to access the social domain of cyberspace:

There are many people in the community in which ICT can present a disadvantage to these include those from a low socio economic status, those from rural/remote areas where technological infrastructure is unavailable or expensive, students with disabilities

who may be unable to operate the equipment, those that find technology isolating & mechanical and females. Study shows that boys see computers as a toy, They experiment with its use developing a higher self-efficacy in its use. Females tend to find computers as a tool, & see perceived problems.

3. ICT increases productivity

The third discursive strategy of the discourse of Progressive Bodies is to focus on student productivity. ICT is presented as a means for enhancing productivity as it ensures more efficient information processing in terms of production speed, freedom of access, and a better quality product as a result of a concomitant increase in engagement and creativity.

Providing access to information is currently touted as the key to a socially productive life. The question as to what constitutes meaningful student productivity, however, is fraught with contradictory claims. The need to increase student productivity is informed by powerful economic and administrative discourses that measure productivity in terms of volume of input, time saved, speed of processing and volume of output. Knowledge is treated as a commodity and students are taught how to package and sell their product. To suggest that ICT increases student productivity is, therefore, to suggest that students or teachers are working faster and smarter to produce more. This rhetoric, or discursive technique, promotes a quantitative approach to knowledge that does not acknowledge the depth, complexity and creativity of a student's use of information, but rather the ability to standardise and measure student output in order to demonstrate high levels of accountability to stakeholders. This understanding of student productivity represents the perspective of "technologists ... whose avowed goal is to make schooling more efficient" (Hodas, 2006, p. 205). In this respect, for some at least, the role of ICT in education is to ensure efficient processes; this means the delivery, processing and storage of as much information as possible in the shortest space of time: "This fits well into the rationalist model of the school as factory and the technologists' goal of maximizing instructional delivery" (Hodas, 2006, p. 212). This vision of human progress is also congruent with a posthuman worldview as it serves to drive economies that have a heavy investment in the manipulation of information.

Pre-service teachers argue that students must be motivated to work more productively, and many pre-service teachers gauge the level of student motivation by their level of engagement in an activity. Consequently, the key arguments pre-service teachers use for justifying or making unproblematic claims of increased student productivity resulting from ICT use are constructed around two key terms: motivation and engagement. Terms used by pre-service teachers to back up their claims of increased student motivation and engagement include: fun, enjoyment, interactive,

creative, new, instant feedback and relevance. The following pre-service teachers' comments, however, provide a range of positions on student motivation and engagement:

Teachers would acknowledge world wide that computers engage students more artistically, academically and also personally; [Students are] engrossed in a manner similar to the way they would be at home watching TV; Is this [increased independence] by the improvement in teaching delivery or just because students have more to keep them entertained or distracted?; The students were not more motivated to do their music theory but simply to use the technology; ICT increases student motivation and engagement; Teachers can use the ICT to engage, tune in, the students; Students enjoy seeing their work being produced with better graphs, cool fonts etc; Computer engages student by giving instant feedback; ICT permits interactive engagement; One laptop per student would encourage them to enjoy learning and see the relevance of it once they have finished school; They enjoy learning new applications; ICT may give an impression of productivity but many students are still disengaged; ICT motivates and is more fun; ICT allows students with different learning styles to engage more adequately.

The positive dimension (identified through axial coding) of the category, 'ICT for Increased Productivity', promises increased student engagement and motivation, access to the information superhighway, and student empowerment through increased personal freedom. Pre-service teachers argue that ICT is an interactive, enjoyable, creative online learning environment that is highly relevant to students' personal lives. They point out that it saves time by enabling quick access to and efficient handling of information and this encourages increased student engagement, resulting in increased student productivity.

I noticed in an English class students would not put pen to paper, or struggled with writing, but these same students were able to produce a full page of well-written typed text. They used Word Art to create headings and implemented page borders, and imaginative fonts on their essays.

Increased classroom productivity resulting from ICT use is also linked closely to the need for speed and efficiency and these concepts are linked closely to the fast capitalist rhetoric (Gee & Lankshear, 1997) of constant change and the need for accelerated rates of production and consumption. The metaphor of the information superhighway, for example, represents the freedom to go further (surfing the Web) and faster (accessing the required information) with less effort:

Susan believed computers would be useful for speeding up activities; Students see research as easier because they don't have to go to the library; Rick found that students were more efficient, engaged and worked faster; Computers and Internet also save time when preparing for a lesson, there's less running around and writing up what needs to be done with a pen and paper.

The metaphor of the information superhighway promises fast access to information and represents, therefore, a highly efficient information network. For educators, this means up-to-date technology can open up new learning pathways and facilitate students' instant access to, and use

of, information: *Students are always keen to do a Google search and find out information; ICT allows students access to different sources of information.* The irony of the highway as a metaphor for freedom and efficiency, however, is that a highway can be both a means and an end in itself. For some, a highway is just a means of getting from point A to point B. For others, the information highway is not about the destination but about the experience of speed and freedom produced by a colourful, ever-changing visual spectacle: freedom from the limits of classroom spaces; freedom to be everywhere while the body appears, paradoxically, passive and inert. As an end in itself, the information superhighway becomes a liberating space because cyberspace offers an escape from the highly regulated, institutional space represented by the classroom: an escape from the inertia of physical bodies and from the demanding civic responsibilities such physical spaces and bodies represent:

Do students see the use of computers as a bludge lesson? ... this has been my experience ... I have observed many students off task when using computers or simply not doing a lot at all.

I saw projects in which information had been compiled from the internet. When students were questioned about their projects, they had very little insight into or understanding of the material they had presented, they had simply 'cut and pasted'. Because they had not used the information but simply presented it, they had, in fact, learned very little and their projects were a fine example of the triumph of style over substance.

Without clear structures, students can lose their sense of meaning and direction in learning. The end result experienced by pre-service teachers is that students enact freedom in learning through riding a wave of "information trivia, which has the effect of placing all information on an equal level" (Postman, 1992, p. 137).

4. *ICT aids behaviour management*

The fourth discursive strategy that supports the discourse of Progressive Bodies constructs ICT as an effective tool for classroom management, as pre-service teachers argue that learning with ICT represents authentic learning, resulting in increased student engagement and, therefore, fewer classroom management issues.

The issue of control in relation to ICT use is most explicitly discussed by pre-service teachers in terms of the aforementioned concepts of engagement, speed, freedom and motivation: *Boredom is one of the main reasons for behaviour problems so laptops should reduce such issues; Individual laptops ease boredom.* Pre-service teachers' positive and negative experiences with ICT use in the classroom, however, create an interesting tension. The argument for increased teacher control of the classroom through ICT use is, nevertheless a powerful one, which is demonstrated in

the comment: *Laptops would greatly increase students' motivation in and dedication to their work.* To maintain control over classroom behaviour, however, pre-service teachers discuss additional strategies using ICT. One strategy is to threaten to withdraw ICT access: *Mistreating the laptops could result in written work.* Another strategy is to use ICT as a reward or compromise: *First finish your work then you can play a game.*

Accompanying ICT's promise of freedom on the information superhighway, however, is the paradoxical demand for increased surveillance of students as they work and communicate online. This is due to the presence of pornography, racism, product marketing, pirating, plagiarism, and viruses which threaten to infiltrate and undermine the integrity of not only students' work but also their attitudes and activities.

Also antithetical to the notion of access and freedom is the need for greater control mechanisms, a negative outcome of which is decreased student engagement. This is manifested through either increased student passivity or subversive activity, ironically resulting in the need to further control and supervise students' online activities. Examples of off-task behaviours associated with ICT use and resulting in lost time include aimless Internet browsing, playing with fonts and colours, and abuse of email privileges. Some pre-service teachers question the nature of student motivation and engagement with ICT use by looking more closely at how ICT changes what students do: *The computer is actually doing some of the work for them ... cut and paste.*

The subversive potential of ICT can also be seen to be empowering for students. The role models provided by the cyberpunk genre of science fiction are often computer hackers admired for their technological prowess and their ability to beat the system. The researcher's observational journal (Budd, 2008) also confirms the subversive potential of ICT for those students whose ICT knowledge, due to their willingness to experiment with the system, is often far greater than that of their teachers. In addition, pre-service teachers complain about the difficulties of controlling students' ICT related behaviours, writing:

In my school experience I found that monitoring students was extremely difficult on computers; Behaviour management issues of students playing games, using email, accessing inappropriate sites or even mishandling each others' computers became a problem; Students play games and get off task; Monitoring students to ensure they are on the correct sites a problem; Keeping the students on task a problem; Some students view ICT use as a right not a privilege; Only one printer in room so students had to wait ... lost time, distractions; Ten computers for 22 students a management nightmare; Abuse of ICT; Hard to monitor what exactly student is viewing; Behaviour management issues is simply part of the job; Students clever at minimizing windows like game sites;

Subversive activities easily indulged by students; Students swap from work to games/emails while appearing to work.

5. ICT for innovation

Arguing the importance of being up-to-date emphasises the need for change and students communicate their contempt for anything deemed boring, slow, old-fashioned or obsolete through non-productive behaviours. This leads to the next discursive technique, which promotes innovation and encourages increased rates of change.

Change is a fundamental and positive aspect of our social realities as it encourages the development of resourceful, creative, flexible and adaptable social beings. However, the current rate of technological change creates a number of challenges for teachers. Postman (1992) explains that can be confused with novelty with the result that 'the idea of newness is closely linked with that of improvement' (p. 53). Consequently, an excessive desire for novelty and the urge to spend valuable resources on the latest hardware and software could mean that, instead of applying technology thoughtfully to liberate people from menial, repetitive or dangerous tasks, a fascination for technological change and innovation might actually enslave people by creating an increased desire for novelty and promote increased rates of consumption. Pre-service teachers also recognise this phenomenon:

Students are always excited by new technology; Glamour of computers; Laptops are a new innovation and not a household item therefore they have a degree of preciousness and appeal; There is also great potential for laptops to be used as a novelty or time filler.

To "delight in the machines for novelty rather than for what they can do" (Gerver, 1986, p. 15) can also result in superficial engagement: *Students about 50 percent of the time could only stay focused on the computer for a few minutes and soon resorted to playing games.* Any form of compulsive behaviour is not only disempowering, but can also result in disengagement when the technology cannot keep up with expectations. Furthermore, technical difficulties can be frustrating and old equipment and software can be boring for students, thereby exacerbating behaviour management issues:

I found student interest in the computers to diminish dramatically as soon as we began to have technological troubles; A boring screen is unappealing; After the initial novelty wore off these laptops were used with decreasing frequency within classes; It is counter productive to have students struggling with outmoded systems at the expense of their enthusiasm.

Staying up-to-date is a demanding and time consuming exercise for both teachers and students: *Costs of professional development would be enormous ... also be ongoing because continued use of computers is necessary to retain understanding but also because of the rapidly changing nature of IT in general.* Teachers in particular are burdened with the need to make time for additional professional development to keep them on top of the latest ICT developments: *Teachers and students alike must continually be learning how to use their computers in order to learn a topic of focus.* Furthermore, to give advice on service providers, buying a computer, setting up software or even recommending useful websites is a short term proposition as these products and services are continually changing. By this means, teachers are constantly placed under pressure to respond to the social impetus of innovative ICT practices through an approach which starts with identifying new ICTs and then trying to find uses for it" (Gerver, 1986).

For the embodied individual, perspective depends on the position and location of the body, and speed depends on the physical capacity of the body for movement. In cyberspace, however, perspective depends on the computer program that produces it so the physical body becomes peripheral to understandings of the world. The following advertisement for Virtual Communities (2005) provides an example of technological perspectives of learning being privileged over embodied perspectives of learning:

Is your old computer too slow and making it difficult for your children to do their homework? Imagine having a super fast PC that helps your children get their work done in half the time. (p. 8)

The question of how fast children can think is not an issue because the line of reasoning represented in the advertisement places technology before pedagogy. The need for speed supersedes the need to understand children's stages of development or the needs of individual learners.

The Internet does represent a wealth of resources for students and teachers, but students need to be purposeful and disciplined in their search and must be critical of the information they access: *My colleague teacher restricted the students to two websites possibly to prevent them from going off track; There are too many distractions on a computer; Internet is a distraction rather than a motivator.* Research is time consuming, it is very easy to get side-tracked, and information overload means a lot of time is required to sort through the information that is relevant to the research question:

Not all the websites are suitable for students; Teachers should spend lots of time on choosing them; It takes time to analyse web resources; Should consider the ability of

the students to sieve the relevant information from the overloading amount of information available on the World Wide Web.

While students need to learn these skills they can also be easily distracted or overwhelmed by the number of resources available, again taking the focus away from the key learning area and compounding the difficulties students face with limited time in the classroom and limited computer access.

Further undermining the case for increased student productivity through ICT use are pre-service teachers' experiences of lost time due to technical difficulties:

They are not always guaranteed to work properly and can sometimes just make the task more difficult and time consuming; It's a worry when things go wrong, when a computer crashes and you lose everything; I agree the computers can constantly cause technical issues; Technical problems can cause major problems ... speed of Internet connections ... the whole network crashed ... I have experienced this personally and it was very disruptive. Students couldn't access resources, teachers couldn't access planning, newsletters couldn't be printed; Wireless connections can be temperamental.

In the ICT case study (Garthwait & Weller, 2005), Susan acknowledges that optimal access to the server occurs at certain times of the day, that ink runs out, and students lose work when the server goes down. Not only Susan but also many pre-service teachers point out that ICT time does not always make teaching and learning easier: *I noticed that lessons involving computers took up more preparation time.* While technical issues were out of Susan's control, her willingness to question the reliability of the technology nevertheless leads many pre-service teachers to question her competence. Rick is notably silent on the matter.

The problematic nature of pre-service teachers' understandings and experiences of student engagement and motivation through ICT use is compounded with the unexplained connections made between increased productivity and higher order thinking skills:

Having such volume of information quickly available helps students become more independent and free thinking; Today, kids see pen and paper as old school materials (that have their place) but teachers would acknowledge world wide that computers engage students more – artistically, academically and also personally.

The application of ICT in a learning sequence, however, does not guarantee the emergence of higher order thinking, as one pre-service teacher complains that: *Students' rights on computers are almost becoming out of control as they constantly use instant messaging and look up irrelevant and unsuitable websites.*

Many pre-service teachers accept and promote ICT discourses while concurrently reflecting on the discrepancies between the promise ICT holds for improving student learning outcomes and their experiences of students' ICT use in the classroom. These discursive tensions are evident in the following pre-service teachers' comments: *ICT is used for final copies and quick research problem; Students see research as easier because they don't have to go to the library; Students don't even read their own work, they just pick out key words and cut and paste.*

Environmental and health issues are also acknowledged by pre-service teachers who place their understandings of efficiency and productivity into a broader social and physical context:

Computers also raise issues of consumption and the environment when I was on school experience, I saw a vast amount of accidental printing, paper and ink supplies causing waste.

Online teaching instruction would mean that the students attending Maine State School would be spending up to four hours a day connected to the school net work and Internet and in front of a computer screen. A recent study was completed by 24 year seven students in a Tasmanian government school ... it was concerning to discover that students home computer and Internet use varied from limited up to 32 hours use per week. This means if these students were implemented into a similar program as those students in Maine could be in front of a computer for up to 50 hours per week.

We would also hope that using computers in a one-to-one situation at school may encourage students to spend less time on computers at home – as they get their 'fix' at school and are tired of the machines when they arrive home.

Waste resulting from increased rates of obsolescence associated with the computer industry creates a range of environmental problems (Millar, 2000). Furthermore, ethical issues linked to computer industries, such as the exploitation of women and children in silicon sweatshops in Asian countries, represent the far reaching effects of the ICT industry. Corporate downsizing in western countries is enabled through ICT networks that facilitate the outsourcing of jobs to countries that can provide a cheaper and more compliant workforce. Hodas (2006) points out that "schools can never be independent of the values of society at large" (p. 217), so although many pre-service teachers point out that ICT is just an educational tool, its use and social effects are informed by broader discourses that are anything but neutral. Millar (2000) reminds us that "productivity must be measured in terms of a society's total input and output. This means the negative consequences of technology-induced unemployment as well as the social and environmental costs must be considered." (p. 155)

Nevertheless, certain aspects of embodied classroom experience that do not cohere with the ICT discourses can remain invisible when focussing on the online environment. This might explain the logic of the following pre-service teachers' comments:

A computer can be a great way to save on paper usage, which in turn can be more environmentally friendly – which would be great for modelling the values of the essential learning.

It is my opinion as students become more familiar with computer usage this need for printed material will be less dramatic.

The notion that students can increase their productivity without drawing on physical resources is counterintuitive. Such logic depends heavily on information economies which are able to control and commodify the information located in the 'non-space' of electronic networks and sell a more palatable simulacrum of the world to its online citizens:

The use of technology is and can be quite successful when considering all these approaches allowing students to explore the world as a smaller global environment which is not available through the use of hard copy materials.

The Discourse of Posthuman Pedagogy

By assigning agency to computers (Postman, 1992) and making little distinction between the quality of human-human interaction and human-computer interaction, the discourse of posthuman pedagogy signifies a blurring of the distinction between knowledge and information (Greenfield, 2003). Siegler, (as cited by Heffron, 2005) a cognitive psychologist, explains this phenomenon:

As researchers in the growing field of knowledge acquisition and engineering are quick to point out, in joint human-machine cognitive systems "the locus of control resides with the machine portion of the ensemble." Because the goal of interaction is to develop the human expert reflected in the machine. (p. 510)

The discourse of posthuman pedagogy is directly informed by the discourse of progressive bodies. It makes use of the cyborg metaphor to argue that computers can facilitate student potential by developing students' higher order thinking skills and increasing student creativity, productivity and engagement, thereby also reducing behaviour management issues. Many students explain this effect in terms of behaviourism:

The behaviourist approach also sees that ICTs serve to provide immediate reinforcement and feedback to students. The interactivity of ICTs allow students to engage in stimuli and responses and receive feedback for their behaviour, the computer acts as an intellectual partner.

The discourse of posthuman pedagogy constructs the progressive and competent teacher as one whose role is to facilitate student access to ICTs. This supports the view that close, human-machine relationships is a means of addressing the perceived deficiencies of the body.

Technology is not a neutral element in the practice of education. Teachers do not merely use technologies but are also used by them (Postman, 1992) as they feel restricted and dominated by the requirement to demonstrate their familiarity and competency with the latest technologies:

Perhaps this means that the way of the future is an all or nothing approach and that integration of new technology into old practices is doomed to fail; It would be compulsory in the future that every school, every classroom and every student uses computers to improve their learning.

Technology creates its own imperatives and, at the same time, creates cultural practices that perpetuate the need for constant technological innovation: *Implementing PC programs in classrooms is a must in this new century.* A posthuman pedagogy, therefore, changes teachers' classroom practices by redefining what teachers are, redirecting where they focus their attention, and re-informing how they can best develop a student's potential as a consumer and producer of information.

The discourse of posthuman pedagogy provides a new teleological framework for educators. It constructs a vision of a future in which the cybernetic entities make total connectivity a reality (Rifkin, 2000), and the role of education within this teleological frame, is to connect students to digital networks: *Teachers should fully understand [ICT's] capabilities to help a diverse range of students reach their full learning potential.* Kelly, (as cited in Rifkin, 2000) editor of *Wired* magazine, writes: "the act of the coming era is to connect everything to everything" (p. 19):

Students should no longer only sit in the classroom and do the rote learning, they should be informed and linked with the outer world every minute in their life. Computers are just a good way to incorporate the outer world into the classroom. It would be compulsory in the future that every school, every classroom and every student uses computer to improving their learning.

Total connectivity facilitates the individual's capacity for consuming, producing and circulating ever increasing amounts of information.

Although most pre-service teachers argue that ICTs are neutral tools that help teachers and students with their classroom activities, to disseminate or comply uncritically with posthuman discourses is to support the worldview that such discourses construct. Pre-service teachers'

pedagogies and their sense of self-efficacy are accordingly re-informed by this worldview as ICT metaphors and terminology appear natural in their professional discourses:

Students brains retain and reflect information differently than previous generation; Students brains are wired differently; Computers are becoming a requirement to survive; As generations progress more students will be suited to this learning style; Method of teaching has adapted to this new environment; More than ever, humans depend on technology... this dependence will increase exponentially over students' lifespan; The key is integration of the new, the old, the digital, the physical.

Pre-service teachers' use of terms such as productivity and efficiency frequently ascribe agency to the technology itself rather than to teachers or students who are, instead, constructed as conductors rather than producers of information: as non-resisting points through which information passes. Ascribing agency to technology is symptomatic of the posthuman condition in which the body is seen as deficient and, therefore, an unreliable element in the flow of information. As a result, ICT discourses disempower and marginalise those teachers who envisage a future in which the desire for sustainable, healthy and equitable communities guides the development of new technologies. This vision of human progress is inconsistent with the posthuman vision of human progress, which prioritises a seamless flow of information.

ICT discourses foreground the need for greater efficiency and productivity in education and this is facilitated by the use of ICT to integrate the curriculum and play a central role in students' learning experiences: *[ICT] have fast become not just a supplement to my pedagogical discourse but as an integral component.* Games, emails, simulation programs and web searches, are understood to be more authentic, that is, ICT better represents the world outside the classroom than old fashioned classroom games, face to face interactions and role plays: *ICT use makes learning authentic.* When pre-service teachers argue that learning experiences are more authentic in cyberspace, then agency is shifted away from teachers' and students' embodied realities to the hyperreality promoted by posthuman discourses:

But this is a new world and we need to be 'real', we need to prepare our students not only for today but for the future. The world is moving at a fast pace, students need to be ready to deal with constant change so they are able to cope in a world that moves technically forward second by second. If we were to deny technology to our students we would not be teachers.

Teacher efficacy is increased through compliance with a discourse that privileges the authenticity of experiences in cyberspace. Furthermore, teachers' 'authentic' classroom practices, which incorporate ICT use, can be endlessly replicated and validated in cyberspace with the click of a copy or replay key.

Hodas (2006) points out that the revolutionary potential of technological innovation is emphasised in ICT discourses, which promise to provide students with entirely new sets of skills and potentials. At the same time, however, teachers are paradoxically reassured that “their roles, positions, and relationships will remain by and large, as they were before” (p. 209). This contradiction creates an uncomfortable tension as pre-service teachers struggle to teach new literacies while at the same time being held accountable for the basic skills their students demonstrate in NAPLAN test results. Furthermore, educational discourses that focus on developing students’ skills and potentials around, and through, ICT use, signify a posthuman pedagogy based on behaviourist and transmission (Freire, 1972) models of education and this does not sit comfortably with the social constructivist models they claim to subscribe to.

The Discourse of Interactivity

The discourse of Interactivity works closely with the discourse of Posthuman Pedagogy by conflating human dialogue with machine data flows, and leaving unexamined the qualitative difference between knowledge and information, and human and machine interaction. This discourse also promotes a transmission or ‘banking’ model of education.

The interactivity of ICTs allow students to engage in stimuli and responses and receive feedback for their behaviour, the computer acts as an intellectual partner. Viewing ICTs in this way could account for increased student engagement.

Pre-service teachers are very much aware of the need to develop inclusive pedagogies and facilitate students’ abilities to access, relate to and understand a broader community beyond the classroom:

Authentic learning is interactive; Students are developing human beings and need real and meaningful social interaction; Susan overlooks that students are receiving authentic & rich tasks that are relevant and have real life context when using or learning how to use the technology; Computers is just a good way to incorporate the outer world into the classroom.

The school handbook (Department of Education, Tasmania, 2005) also points out that ICT can facilitate these needs by enabling access in a number of ways, for example:

Help available at any time; Isolated, rural or small schools, maintains learning pathways; Sick, disabled, home educators, isolated students, pregnancy, travellers, and itinerant workers.

These are valid points and ICT can certainly facilitate access to social resources.

A tension occurs, however, when access to and interaction with the technology supersedes the need for access to, and interaction with, other people, as this contradicts the principles of the

social constructivist pedagogy endorsed by the pre-service teachers. This perspective is implied through language practices that attribute agency to the machine:

The computer sets a challenge for the student, provides the resources to meet the challenge and modified the task through prompts to the student until they have progressed. This is similar to the behaviourist theory of rewarding positive behaviour & is demonstrated by the disinterested student's engagement. If we consider that his motivation for disinterest may be lack of feedback, positive reinforcement or skills to undertake the task, it would appear the computer meets these needs and supports his learning.

If pre-service teachers do not explicitly question to what extent they want machines to model real world relationships for their students, then the assumption can be made that if a computer can do what a human can do, then the computer will do it better and students would, therefore, do well to emulate the performance modelled by the machine: *Computers can assist in demonstrating how to process information regarding the social structure and lifestyles of contemporary society.*

The claim that computers can replace real world or embodied experiences is supported by a discursive technique that constructs the computer as an authentic and interactive partner:

Computers are socially interactive; The computer acts as an intellectual partner; The computer's interactive nature...; ... interaction between the computer and user, in which it is acting as a tutor and giving feedback; Laptops have become a great partner in problem-solving; Students to master certain concepts through ... having the computer as a partner or peer; ICT permits interactive engagement; ICT allows us to work in teams collaboratively; The computer takes the place of others interaction and assists learning firstly by interacting with the student by presenting tasks and information, secondly by reducing mental processing whilst encouraging higher order thinking.

The Discourse of Literacy

The discourse of literacy constructs information as a neutral signifier, which does not warrant ethical consideration. Posthuman discourses that focus on the need to speed up information processing de-emphasise the need to locate, or understand, or relate to, the source of textual production. Priority is given, instead, to the efficient production of information and its circulation. Postman (1992) voices a concern that this definition of information rejects “the necessity of interconnectedness, proceed[s] without context, argue[s] for instancy against historical continuity, and offer[s] fascination in place of complexity and coherence” (p. 69). In this context, literacy is not about developing critical understandings for the purpose of promoting ethical relationships between individuals and across community groups. In the information age, literacy is a commodity.

The majority of pre-service teachers are concerned with students' abilities to question and engage deeply with texts at an ethical level:

So much information; Searching irrelevant sites; When researching, students often cut and paste; URL information may be inaccurate; No way a student can ascertain the validity of website information; Students don't make personal meaning; There appears to be no real thought in retrieving information; How can a student verify information?; Almost 40% of students cut and paste without reference.

While pre-service teachers argue that ICT promotes independent learning and higher order thinking they also complain that: *Everyone's work looks the same.*

Furthermore, the speed with which hoaxes, rumours, viruses, and jokes (Burbules, 2001) can be disseminated online demonstrates how eagerly and uncritically texts are accepted and passed on as public information. Without critical literacy skills, having the freedom to create within an ICT environment can have the undesirable outcome of students abrogating responsibility for their texts the minute they become part of the public domain. Online texts may be taken up, reproduced, changed and used for a number of purposes for which they were never originally intended. The instability and shadowy origins of online texts undermines any sense of long-term responsibility. Most pre-service teachers point out that: *Plagiarism needs to be addressed.*

Conclusion: The Discourse of changing Education

The discourse of changing education is the last of the five discourses produced through analysis of the research data. In constituting the concluding section, the discourse of changing education is not assigned any greater or lesser importance than the other four discourses, but serves the purpose of re-examining how all the discourses work together to inform not only pre-service teachers' understandings of the role of ICT in education, but also the direction of educational change. Intentionally or unintentionally, pre-service teachers, in discussing the role of ICT in education, also validate particular ways of thinking about the aims and purposes of education in the digital age.

The posthuman worldview constructed by pre-service teachers' language practices promotes a shift in the way we talk about relationships and the nature of reality, and these shifts have profound implications for education. If minimising teacher interference, for example, means improving the flow of the information, then the future of education can reasonably be constructed as "technologically based learning environments and a paradigm of learning rather than teaching" (Hamilton et al., 2004, p. 844).

Rick found that whilst before computers he was limited to how he could capture a teachable moment, the WWW allows his students to extend their zone of proximal development by being able to continue their learning with little or no extra help from the teacher; The learning opportunities for these students have no boundaries when we allow them to access computer usage.

Informed by a paradigm of learning, the leaky interface of teachers' bodies that interfere with the smooth and accurate transmission of information can be replaced with computers that are "seen as prostheses" (Hamilton et al., 2004, p. 844) as they connect students directly to information sources and "deliver fast knowledge" (Hamilton et al., 2004, p. 844).

Tomorrow's students differ greatly and cannot be taught the same way as yesterday, they seem prepared to take the next steps required in the evolution of teaching; It's what they relate to, it's the technological age; Computer savvy students of a post MTV generation have different learning styles and requirements that requires teachers to keep up and look forward to a future full of integrated circuits.

These shifts in meaning, resulting from the discursive blurring of boundaries between human and machine processes, are promoted by ICT discourses, which promote a dangerous reductionism in the way teachers talk about and understand teaching and learning in the digital age.

References

- Baudrillard, J. (1994). *Simulacra and simulation* (S. F. Glaser, Trans.). Michigan: University of Michigan Press. (Original work published 1981).
- Bennett, H., & Larson, G. A. (Producers). (1974-1978). *The Six-Million Dollar Man* [Television series]. [With L. Majors, R. Anderson, & M. E. Brooks]. United States: Universal Studios.
- Bigum, C. (1997). Teachers and computers: In control or being controlled? *Australian Journal of Education*, 41(3), 247-261.
- Bigum, C., & Green, B. (1992). Technologizing literacy: The dark side of the dream. *Discourse: the Australian Journal of Educational Studies*, 1(2), 4-28.
- Boden, M. A. (1995). Could a robot be creative – and would we know? In K. M Ford, C. Glymour, & P. J. Hayes (Eds.), *Android epistemology* (pp. 51-72). Cambridge: The MIT Press.
- Carabine, J. (2001). Unmarried motherhood 1830-1990: A genealogical analysis. In M. Wetherall, S. Taylor, & S. J. Yates (Eds.), *Discourse as data: A guide for analysis* (pp.267-310). London: Sage Publications.
- Charmaz, K. (2000). Grounded theory: Objectivist and constructivist methods. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 509- 536). Thousand Oaks, CA: Sage Publications.
- Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. London: Sage Publications.

Paper Code: 00247

Deeley, M. (Producer) & Scott, R. (Director). (1982). *Blade Runner* [Motion picture]. [With H. Ford, R. Hauer, S. Young, E. J. Olmos, & D. Hannah]. United States: Warner Bros. Pictures.

Dick, P. (1968). *Do Androids dream of electric sheep?* New York: Ballantine Books.

Foucault, M. (1972). *The archaeology of knowledge* (A. M. Sheridan Smith, Trans.). London: Routledge.

Foucault, M. (1984). Nietzsche, genealogy, history. In P. Rabinow (Ed.), *The Foucault reader: An introduction to Foucault's thought* (pp. 76-100). London: Penguin Books.

Freire, P. (1972) *Pedagogy of the Oppressed*. Harmondsworth: Penguin

Garthwait, A., & Weller, H. G. (2005). A year in the life: Two seventh grade teachers implement one-to-one computing. *Journal of Research on Technology in Education*, 37(4), 361-371.

Gee, J. G. & Lankshear, C. (1997). Language, literacy and the new work order. In C. Lankshear (Ed.), *Changing literacies* (pp. 83-102). Buckingham, England: Open University Press.

Gerovitch, S. (2002). Love-hate for man-machine metaphors in Soviet physiology: From Pavlov to physiological cybernetics. *Science in Context*, 15(2), 339-374.

Gerver, E. (1986). *Humanizing technology: Computers in community use and adult education*. New York: Plenum Press.

Green, D. (2006). Understanding language and language learning. In R. Campbell & D. Green (Eds.), *Literacies and learners: Current perspectives* (pp. 1-22). Frenchs Forest, New South Wales, Australia: Pearson Education.

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory*. Chicago: Aldine Publishing Company.

Haraway, D. (1991). *Simians, cyborgs, and women: The reinvention of nature*. New York: Routledge.

Hayles, N. K. (1996). How cyberspace signifies: Taking immortality literally. In G. Slusser, G. Westfahl, & E. S Rabkin (Eds.), *Immortal engines: Life extension and immortality in science fiction and fantasy* (pp. 111-121). Athens: University of Georgia Press.

Hayles, N. K. (1999). *How we became posthuman: Virtual bodies in cybernetics, literature, and informatics*. Chicago: University of Chicago Press.

Heffron, J. (1995). Toward a cybernetic pedagogy: The cognitive revolution and the classroom. *Educational Theory*, 45(4), 487-518.

Heuser, S. (2003). *Virtual geographies: Cyberpunk at the intersection of the postmodern and science fiction*. Amsterdam: Rodopi.

Hodas, S. (2006). Technology refusal and the organizational culture of schools. In R. Kling (Ed.), *Computerization and controversy* (2nd ed., pp. 197-217). San Diego, CA: Academic Press.

- Hurd, G. A. (producer), & Cameron, J. (Director) (1984). *The Terminator* [Motion picture]. [With A. Schwarzenegger, M Biehn, & L. Hamilton]. United States: Orion Pictures.
- Kellner, D. M. (2002). Technological revolution, multiple literacies, and the restructuring of education. In I. Snyder (Ed.), *Silicon literacies: Communication, innovation and education in the electronic age* (pp. 154-169). London: Routledge.
- Knobel, M., & Lankshear, C. (1999). *Ways of knowing: Researching literacy*. Newtown, New South Wales, Australia: Primary English Teaching Association
- Lankshear, C. (1997). *Changing literacies*. Buckingham, England: Open University Press.
- Lather, P. (2001). Postmodernism, post-structuralism and post (critical) ethnography: Of ruins, aporias and angels. In P. A. Atkinson, A. Coffey, S. Delamont, J. Lofland, & L. Lofland (Eds.), *Handbook of ethnography* (pp. 477-492). London: Sage Publications.
- Lee, A. (1992). Poststructuralism and educational research: Some categories and issues. *Issues in Educational Research*, 2(1), 1-12. Retrieved October 10, 2008, from <http://education.curtin.edu.au/iier/iier2/lee.html>
- Leech, R. (2007, March). Geek chic: Getting girls into IT. *Teacher: The National Education Magazine*, 8(5), 4-10.
- Lyotard, J. (1984). *The postmodern condition: A report on knowledge*. Minneapolis, MN: University of Minnesota Press.
- Mark, L., Davis, J., Dow, T., & Wyck, G. (Producers), & Proyas, A. (Director). (2004). *I, Robot* [Motion picture]. [With W. Smith, B. Moynahan, B Greenwood & J. Cromwell]. United States: Twentieth Century Fox.
- Millar, M. S. (2000). *Cracking the gender code: Who rules the wired world?* Annandale, New South Wales, Australia: Pluto Press.
- Mills, S. (2003). *Michel Foucault*. London: Routledge.
- Phillips, L., & Jorgensen, M. (2002). *Discourse analysis as theory and method*. London: Sage Publications.
- Phillips, N., & Hardy, C. (2002). *Discourse analysis: Investigating processes of social construction*. Thousand Oaks, CA: Sage Publications.
- Postman, N. (1992). *Technopoly: The surrender of culture to technology*. New York: Vintage Books.
- Renshaw, P. D. (2003). Community and learning: Contradictions, dilemmas and prospects. *Discourse: Studies in the Cultural Politics of Education*, 24(3), 355-370.
- Rifkin, J. (2000). *The age of access: How the shift from ownership to access is transforming capitalism*. London: Penguin Books.

Paper Code: 00247

Snyder, I. (1999). *Literacy and technology studies: Past, present, future*. Paper presented at the Australian Council for Educational Research Conference on Improving Literacy Learning. Adelaide, South Australia October 18-19.

Tamboukou, M. (1999). Writing genealogies: An exploration of Foucault's strategies for doing research. *Discourse: Studies in the Cultural Politics of Education*, 20(2), 201-217.

Todd, S. (2001). Bringing more than I contain: Ethics, curriculum and the pedagogical demand for altered egos. *Journal of Curriculum Studies*, 33(4), 431-150.

Turkle, S. (1995). *Life on the screen: Identity in the age of the Internet*. New York: Simon & Schuster.

Virtual Communities. (2005). [Advertisement] *Australian Educator*, 47, 8.

Warschauer, M. (1998). Researching technology in TESOL: Determinist, instrumental, and critical approaches. *TESOL Quarterly*, 32(4), 757-761.

Wiener, N. (1961). *Cybernetics: Or control and communication in the animal and the machine*. Cambridge, MA: The M.I.T. Press.

Wiener, N. (1967). *The human use of human beings: Cybernetics and society*. New York: Avon Books.